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OFFICE WEST VIRGINIA
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NOTICE OF A COMMENT PERIOD ON A PROPOSED RULE

AGENCY: West Virginia Board of Education TITLE NUMBER: 126

RULE TYPE: Legislative ; CITE AUTHORITY: W. Va. Constitution, Article XII, §2, W.Va. Code §18-2-5 and §18-9A-22

AMENDMENT TO AN EXISTING RULE: YES X NO ____

IF YES, SERIES NUMBER OF RULE BEING AMENDED: 44B

TITLE OF RULE BEING AMENDED: 21st Century Mathematics Content Standards and Objectives for West Virginia Schools (2520.2)

IF NO, SERIES NUMBER OF NEW RULE BEING PROPOSED: _____

TITLE OF RULE BEING PROPOSED: _____

IN LIEU OF A PUBLIC HEARING, A COMMENT PERIOD HAS BEEN ESTABLISHED DURING WHICH ANY INTERESTED PERSON MAY SEND COMMENTS CONCERNING THESE PROPOSED RULES. THIS COMMENT PERIOD WILL END ON July 13, 2009 AT 4:00 p.m. . ONLY WRITTEN COMMENTS WILL BE ACCEPTED AND ARE TO BE MAILED TO THE FOLLOWING ADDRESS:

Lou Maynus
Office of Instruction
West Virginia Department of Education
Capitol Building 6, Room 608
1900 Kanawha Boulevard, East
Charleston, West Virginia 25305-0330

Comments to be considered are **limited to the PERFORMANCE DESCRIPTORS** of this proposed rule.

Steven L. Paine
State Superintendent of Schools

ATTACH A **BRIEF** SUMMARY OF YOUR PROPOSAL

EXECUTIVE SUMMARY
WEST VIRGINIA DEPARTMENT OF EDUCATION

Policy Number and Title: Policy 2520.2 - 21st Century Mathematics Content Standards and Objectives for West Virginia

Background: The West Virginia Content Standards and Objectives have performance descriptors for each Standard that describe in narrative format how students demonstrate achievement of the standards. West Virginia has designated five performance levels: distinguished, above mastery, mastery, partial mastery and novice which serve two functions. Instructionally, they give teachers detailed information about the levels of knowledge and skills students may demonstrate in a content area. Performance levels and descriptors are also used to categorize and explain student performance on statewide assessment. The existing performance descriptors need revision and reformatting to make them more succinct and usable for teachers, parents and students. The individuals involved with the changes of this policy are: Carla Williamson, Executive Director of the Office of Instruction; Marty Burke, Assistant Director of the Office of Instruction; Lou Maynus, Mathematics Coordinator in the Office of Instruction; Jane Sims, Coordinator in the Office of Assessment/Accountability; Lynn Baker, Math/Science Partnership Coordinator in the Office of Instruction, Joyce Evans, Teacher from Marion County; Susan Barrett, Teacher from Nicholas County; Joy Marino, Teacher from Taylor County; Diane Lemon, Teacher from Mineral County; Mary Ann Gaston, Teacher from Marion County; Pat Mick, Teacher from Summers County; Jeanie Brown, Teacher from Fayette County, Melissa Farley, Teacher from Monongalia County, Joy McCutcheon, Teacher from Kanawha County, Mike Mays, Higher Education West Virginia University and Mike Brown, Teacher from Nicholas County.

Proposals: Revisions to Policy 2520.2 are being recommended for:

- Revision of the performance descriptors to provide a narrative format that succinctly indicates levels of achievement and more accurately describes the conceptual understandings students should acquire at each grade level.
- Separation of the text to indicate clusters of concepts and the skills across the continuum.

Impact: The proposed revision of the Content Standards and Objectives for 21st Century Mathematics Standards and Objectives Performance Descriptors will provide teachers information about the levels of knowledge and skills the students must acquire and will provide parents an explanation of their child's knowledge and conceptual understanding that should be acquired at each grade level.

Response to Comments:

TITLE 126
LEGISLATIVE RULE
BOARD OF EDUCATION

SERIES 44B
21st Century Mathematics Content Standards and Objectives for West Virginia Schools (2520.2)

§126-44B-1. General.

1.1. Scope. – W. Va. 126CSR42, West Virginia Board of Education Policy 2510, Assuring the Quality of Education: Regulations for Education Programs (hereinafter Policy 2510) provides a definition of a delivery system for, and an assessment and accountability system for, a thorough and efficient education for West Virginia public school students. Policy 2520.2 defines the content standards objectives for mathematics as required by Policy 2510.

1.2. Authority. - W. Va. Constitution, Article XII, §2, W. Va. Code §18-2-5 and §18-9A-22.

1.3. Filing Date. - ~~November 26, 2007~~

1.4. Effective Date. – ~~July 1, 2008.~~

1.5. Repeal of former rule. - This legislative rule ~~repeals and replaces~~ amends W. Va. 126CSR44B West Virginia Board of Education Policy 2520.2 "21st Century Mathematics Content Standards and Objectives for West Virginia Schools (2520.2)" filed ~~November 15, 2006~~November 26, 2007 and effective July 1, 2008.

§126-44B-2. Purpose.

2.1. This policy defines the content standards and objectives for the program of study required by Policy 2510 in mathematics.

§126-44B-3. Incorporation by Reference.

3.1. A copy of the 21st Century Mathematics Content Standards and Objectives for West Virginia Schools is attached and incorporated by reference into this policy. Copies may be obtained in the Office of the Secretary of State and in the West Virginia Department of Education, Office of Instruction.

§126-44B-4. Summary of the Content Standards and Objectives.

4.1. The West Virginia Board of Education has the responsibility for establishing high quality standards pertaining to all educational standards pertaining to all education programs (W. Va. Code §18-9A-22). The content standards and objectives provide a focus for teachers to teach and students to learn those skills and competencies essential for future success in the workplace and further education. The document includes content standards for mathematics; an explanation of terms; objectives that reflect a rigorous and challenging curriculum; and performance descriptors.

West Virginia Department of Education

West Virginia Board of Education Policy 2520.2
21st Century Mathematics Content Standards and Objectives for West Virginia Schools

Steven L. Paine
State Superintendent of Schools

Foreword

A 21st century mathematics curriculum is an increasingly important aspect of developing learners prepared for success in the 21st century. Thus, the West Virginia Board of Education and the West Virginia Department of Education are pleased to present Policy 2520.2, 21st Century Mathematics Content Standards and Objectives for West Virginia Schools. The West Virginia Mathematics Standards for 21st Century Learning includes 21st century *content* standards and objectives as well as 21st century standards and objectives for *learning skills* and *technology tools*. This broadened scope of mathematics curriculum is built on the firm belief that quality engaging instruction must be built on a curriculum that triangulates rigorous 21st century content, 21st century learning skills and the use of 21st century technology tools.

Committees of educators from across the state convened to revise the content standards and objectives. The overarching goal was to build a rigorous, relevant and challenging mathematics curriculum that would prepare students for the 21st century. West Virginia educators, including regular classroom teachers, special education teachers, and teachers representing higher education institutions played a key role in shaping the content standards to align with national standards, rigorous national assessments and research and best practice in the field of mathematics education. The contribution of these professionals was critical in creating a policy that is meaningful to classroom teachers and appears in a format that can easily be used and understood.

Policy 2520.2 is organized around the three major components of a standards-based curriculum: learning standards, instructional objectives and performance descriptors. The learning standards are the *broad descriptions* of what *all* students must know and be able to do at the conclusion of the instructional sequence. The accompanying grade-level objectives are specific descriptors of knowledge, skills and attitudes that when mastered will enable the student to attain the standard. The instructional objectives guide instructional *planning* and provide a basis for determining appropriate *assessments, instructional strategies and resources*. The performance descriptors provide the basis for *assessing* overall student competence of grade level standards. The performance descriptors define the five student performance levels ranging from novice to distinguished. With the ultimate goal of "learning for all," these descriptors allow the teacher, students and parents to judge the *level* of student proficiency in each 21st century learning standard.

In combination, the use of learning standards, instructional objectives and performance descriptors become a comprehensive guide for delivering a rigorous and relevant mathematics curriculum to all West Virginia students. These elements, when used to guide the instructional process and when delivered with the creativity and instructional expertise of West Virginia teachers, will become a powerful resource for preparing students to meet the challenges of the 21st century.

Steven L. Paine
State Superintendent of Schools

Explanation of Terms

Content Standards are broad descriptions of what students should know and be able to do in a content area. Content standards describe what students' knowledge and skills should be at the end of a K-12 sequence of study.

Objectives are incremental steps toward accomplishment of content standards. Objectives are listed by grade level and are organized around the content standards. Objectives build across grade levels as students advance in their knowledge and skills.

Performance Descriptors describe in narrative format how students demonstrate achievement of the content standards. Line breaks within the narrative format indicate clusters of concepts and skills. —West Virginia has designed five performance levels: distinguished, above mastery, mastery, partial mastery and novice. Performance Descriptors serve two functions. Instructionally, they give teachers more information about the level of knowledge and skills students need to acquire. Performance levels and descriptors are also used to categorize and explain student performance on statewide assessment instruments.

Distinguished: A student at this level has demonstrated exemplary performance. The work shows a distinctive and sophisticated application of knowledge and skills in real world situations that go beyond course or grade level applications.

Above Mastery: A student at this level has demonstrated effective performance and exceeds the standard. The work shows a thorough and effective application of knowledge and skills in real world situations within the subject matter and grade level..

Mastery: A student at this level has demonstrated competency over challenging subject matter, including knowledge and skills that are appropriate to the subject matter and grade level. The work is accurate, complete and addresses real world applications. The work shows solid academic performance at the course or grade level.

Partial Mastery: A student at this level has demonstrated limited knowledge and skills toward meeting the standard. The work shows basic but inconsistent application of knowledge and skills characterized by errors and/or omissions. Performance needs further development.

Novice: A student at this level has demonstrated minimal fundamental knowledge and skills needed to meet the standard. Performance at this level is fragmented and/or incomplete and needs considerable development.

Numbering of Standards

The number for each content standard is composed of four parts, each part separated by a period:

- the content area code (M for Mathematics),
- the letter S, for Standard,

- the grade level (exceptions are grades 9-12 mathematics courses) and
- the standard number.

  Illustration: M.S.4.1 refers to fourth grade mathematics content standard #1.

Numbering of Objectives

The number of each objective is composed of five parts, each part separated by a period:

- the content area code (M for Mathematics),
- the letter O is for Objective,
- the grade level (exceptions are grades 9-12 mathematics, e.g. PS for Probability and Statistics),
- the number of the content standard addressed, and
- the objective number.

Illustration: M.O.6.2.3 refers to a mathematics sixth grade objective that addresses standard #2 in mathematics, the third objective listed under that standard.

Numbering of Performance Descriptors
The number for each group of three performance descriptors is composed of four parts, each part separated by a period:

- the content area,
- the letters PD, for Performance Descriptors,
- the grade level (See exceptions noted above for grade level under numbering of objectives), and
- the standard number.

Illustration: M.PD.9.2 refers to mathematics performance descriptors for ninth grade, content standard #2.

Unique Electronic Numbers (UENs)
Unique Electronic Numbers (or UENs) are numbers that help to electronically identify, categorize and link specific bits of information. Once Policy 2520.2 is available on the Web, each standard, each objective, and each group of five performance descriptors will have a Unique Electronic Number (UEN) that will always remain the same.

The codes printed in Policy 2520.2 form the basis of the UENs. The only additional set of numbers that will be added to each code to formulate its UEN will be a prefix that indicates the year and month that a particular version of Policy 2520.2 is approved by the State Board of Education.

The prefix for the UENs for each content area in Policy 2520.2 is noted at the top of each page containing standards, objectives and performance descriptors. As sections of 2520.2 are revised, UENs will be changed to reflect the new approval date.

UENs (Unique Electronic Numbers) are unique numbers that facilitate implementation of WV Standards into Electronic formats such as Databases and XML Files. The WV Department of Education encourages everyone who is going to use the WV Content Standards in any kind of electronic distribution, alignment, or software development to use the UENs so that all efforts can be cross-referenced and there is consistency across initiatives.

Illustration: The UEN for fifth grade mathematics standard #2 will be "200602.M.S.5.2".

Abbreviations

Content Area

M	Mathematics

High School Courses
Mathematics

A1	Algebra
A2	Algebra II
A3	Algebra III
C	Calculus
CM	Conceptual Mathematics
G	Geometry
PC	Pre-calculus
PS	Probability and Statistics
T	Trigonometry

Other Abbreviations

O	Objective
D	Performance Descriptors
S	Standard (Content Standard)

MATHEMATICS – POLICY 2520.2

These mathematics standards have been written in response to the need to better prepare students for post-secondary education and the 21st Century workplace. The five mathematics standards, Number and Operations, Algebra, Geometry, Measurement, and Data Analysis and Probability are aligned directly with the National Council of Teachers of Mathematics document, *Principles and Standards for School Mathematics,* released in 2000. Additionally, the authors of these standards used *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics: A Quest for Coherence,* released in 2006, to provide guidance as they developed an informed focus on areas of emphasis within the K-8 curriculum. See http://www.nctm.org to access both documents.

The six principles for school mathematics, as articulated in *Principles and Standards for School Mathematics,* address six overarching themes to be considered when focused on the continuous improvement of mathematics education:

1. **Equity.** High expectations and strong support for all students
2. **Curriculum.** Coherent focus on important mathematics that is well-articulated across the grades
3. **Teaching.** Understanding what students know and need to learn and then challenging and supporting them to learn it well
4. **Learning.** Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge
5. **Assessment.** Assessment should support the learning of important mathematics and provide useful information to both teachers and students.
6. **Technology.** Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.

The standards, objectives and performance descriptors presented in this policy are designed to provide clear, consistent priorities and focus, as well as depth of knowledge. The standards describe what each student of mathematics should be able to accomplish in grades K-12. The objectives spiral upward through the grade levels, eliminating repetition of content and increasing in rigor and depth of knowledge throughout the student's academic career. It is important that all students value mathematics and see themselves as mathematical problem solvers who can communicate mathematically and make connections to other content areas and the real-world application of mathematics.

The vision of the West Virginia Board of Education and the West Virginia Department of Education includes the triangulation of mathematics content, learning skills and technology tools standards within each classroom so that students will be able to think critically, analyze information, comprehend new ideas, communicate, collaborate, solve problems and make decisions. All West Virginia mathematics teachers are responsible for the integration of Policy 2520.14 21st Century Learning Skills and Technology Tools in their classroom instruction.

It is important that teachers of mathematics become familiar with the performance descriptors at each grade level. The Mastery level performance descriptor, supported by the accompanying standard and objectives, describes student proficiency at that grade level. An understanding of the performance descriptors, standards and objectives provides a clear picture of what every student should know, understand and be able to do at each grade level. Teachers are encouraged to become familiar with the performance descriptors and objectives at the previous and subsequent grade level to support a well-articulated curriculum. The abbreviation *e.g.* is used to indicate examples for teaching the objectives.

Policy 2510 states that "students in the professional pathway and college bound students in the skilled pathway, who do not achieve the State assessment college readiness benchmarks for mathematics, shall be required to take a college transition mathematics course during their senior year." In keeping with this policy, representatives from the West Virginia Department of Education and the Higher Education Policy commission assembled classroom teachers and professors of mathematics to establish the college readiness benchmarks for mathematics. An additional collaborative effort from classroom teachers and mathematics professors resulted in identification of a set of objectives from Policy 2520.2 courses in Algebra I, Geometry, Algebra II and Trigonometry that align to those benchmarks. The educational program for any student placed in a college transition mathematics course will be aligned to those objectives identified for Transition Mathematics. Therefore the college transition mathematics course is an individualized course relating to a student's identified skill deficiencies as related to previously approved objectives. Consequently, there is not an identified set of standards and objectives for the college transitions mathematics course required by Policy 2510.

Mathematics Content Standards K-12

Standard 1: Number and Operations
Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will demonstrate an understanding of numbers, ways of representing numbers, and relationships among numbers and number systems, demonstrate meanings of operations and how they relate to one another, and compute fluently and make reasonable estimates.

Standard 2: Algebra
Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will demonstrate understanding of patterns, relations and functions, represent and analyze mathematical situations and structures using algebraic symbols, use mathematical models to represent and understand quantitative relationships, and analyze change in various contexts.

Standard 3: Geometry
Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, specify locations and describe spatial relationships using coordinate geometry and other representational systems, apply transformations and use symmetry to analyze mathematical situations, and solve problems using visualization, spatial reasoning, and geometric modeling.

Standard 4: Measurement
Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will demonstrate understanding of measurable attributes of objects and the units, systems, and processes of measurement, and apply appropriate techniques, tools and formulas to determine measurements.

Standard 5: Data Analysis and Probability
Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, select and use appropriate statistical methods to analyze data, develop and evaluate inferences and predictions that are based on models, and apply and demonstrate an understanding of basic concepts of probability.

Kindergarten Mathematics Content Standards and Objectives

Kindergarten objectives emphasize the use of manipulatives, concrete materials, and appropriate technology so that students explore and develop ideas fundamental to the study of mathematics: number, counting, ordering, comparing, classifying, patterning, shape, size, position, numeration, measuring, and problem solving. Emphasis is on experience and growth in mathematics. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade K	Mathematics
Standard 1	Number and Operations
M.S.K.1	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of numbers, ways of representing numbers, and relationships among numbers and number systems, • demonstrate meanings of operations and how they relate to one another, and • compute fluently and make reasonable estimates.

Performance Descriptors (M.PD.K.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Kindergarten students at distinguished level in mathematics count forward to 100 with and without objects. They read, write, order, and compare numbers to 100 using multiple strategies. They group and count by 1's, 2's, 5's, 10's and 20's. They estimate numbers of objects to 100 and can model and identify place value through 99 using standard and expanded form. They model and write addition and subtraction sentences using whole numbers to 18. They interpret the meanings of operations and the~~	~~Kindergarten students at the above mastery level in mathematics count forward to 50 and backward from 20 with and without objects. They model and identify place value of each digit utilizing standard and expanded form through 50. They read, write, order, and compare numbers to 50. They estimate numbers of objects to 50. They group objects to 50 and can identify place value though 50. They model and identify place value using standard and expanded form through 50. They create addition and subtraction sentences~~	~~Kindergarten students at the mastery level in mathematics count to 20, compare numbers to 20 and group and count manipulatives by 1's, 5's and 10's. They model place value to 20 and use ordinal numbers to identify position. They estimate the number of objects in a group of 20 or less and evaluate the reasonableness of the estimation. They identify halves and wholes and use concrete objects to model addition and subtraction with whole numbers to 10. They model meanings of operations. They create~~	~~Kindergarten students at the partial mastery level in mathematics count forward to 20 and backward from 10. They read, write, and order numbers to 20. They model place value to 10 and estimate objects to 10. They recognize halves and wholes and ordinal positions to 5th. They group objects by ones and tens and identify place value using standard form through 20. They use concrete objects to model addition and subtraction sentences using whole numbers to 5. They solve one-step problems using numbers and pictures.~~	~~Kindergarten students at the novice level in mathematics count objects to 10. They match halves and wholes and recognize ordinal numbers to 5th. They copy place values of numbers using standard form. They use concrete objects to model addition and subtraction sentences using numbers to 5. They solve one-step problems using pictures.~~Kindergarten students at the novice level in mathematics: count objects to 10 and read, copy and order

~~relationship between addition and subtraction by creating picture and story problems that can be solved using a variety of strategies. They offer alternative solutions to two-step problems using pictures, numbers and words.~~Kindergarten students at the distinguished level in mathematics: count to 100 and backward from 30 and read, write, order and compare numbers to 100; group and count by 1's, 2's, 5's,10's, 20's, and estimate. model place value to 99,use standard and expanded form; model and write addition and subtraction sentences, sums of more than 20, interpret meanings of operations and relationship, create story problems, solve with a variety of strategies, offer alternative solutions to two-step problems; identify and name parts of wholes and use ordinal numbers.	~~using whole numbers to 15 and solve two-step problems using pictures. They present their results offering more than one solution.~~Kindergarten students at the above mastery level in mathematics: count to 50 and backward from 20 and read, write, order and compare numbers to 50; group and count by 1's, 2's, 5's, 10's and estimate to 50. model place value through 50 using standard and expanded form; model and write addition and subtraction sentences, sums of more than 10, interpret meanings of operations and relationship, create and solve two step story problems using pictures and offer solutions; identify wholes, halves, and fourths, and use ordinal numbers to identify position.	~~picture story problems and present and justify their solutions.~~Kindergarten students at the mastery level in mathematics: count to 20 and backward from 10 and read, write, order and compare numbers to 20; group and count by 1's, 5's, and 10's and estimate to 20; model and identify place value using standard and expanded form through 20; model and write addition and subtraction sentences, sums of 10, model operations and relationship between them, create story problems, use a variety of strategies, justify solutions; identify halves and wholes using models and use ordinal numbers to identify positions the 10th.	Kindergarten students at the partial mastery level in mathematics: count forward to 20 and backwards from 5 and read, write and order numbers to 20; group and count objects by 1's, 5', 10's and estimate; model place value to 20; use objects to model addition and subtraction to 10 and solve one-step problems using models and pictures; recognize halves and wholes using models and use ordinal numbers to identify positions to 5th.	numbers to 10; group and count by 1's and make sets of 5 and 10; model sets of ten and count by tens; use objects to model addition to 10 and solve problems using pictures and words; match halves and wholes and use ordinal numbers for 1st, 2nd and 3rd.

Objectives	Students will
M.O.K.1.1	count forward to 20 and backward from 10 with and without manipulatives.

M.O.K.1.2	read, write, order, and compare numbers to 20 using multiple strategies (e.g. manipulatives, number line).
M.O.K.1.3	group and count manipulatives by ones, fives, and tens.
M.O.K.1.4	model and identify place value of each digit utilizing standard and expanded form through 20.
M.O.K.1.5	Use ordinal numbers $1^{st} - 10^{th}$ to identify position in a sequence.
M.O.K.1.6	estimate the number of objects in a group of 20 or less and count to evaluate reasonableness of estimation.
M.O.K.1.7	identify and name halves and wholes using concrete models.
M.O.K.1.8	use concrete objects to model addition and subtraction of whole numbers related to sums of 10 or less and write corresponding number sentence.
M.O.K.1.9	model meanings of operations and the relationship between addition and subtraction (e.g., identity element of addition, commutative property) using manipulatives.
M.O.K.1.10	create grade-appropriate picture and story problems, solve using a variety of strategies, present solutions and justify results.

Grade K	**Mathematics**
Standard 2	Algebra
M.S.K.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD.K.2)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Kindergarten students at the distinguished level in mathematics justify classifications of objects by several attributes. They create, extend and describe repeating patterns. They count by 2's, 5's, 10's, and 20's to 100.~~Kindergarten students at the distinguished level in mathematics: justify classifications of objects by several attributes;	~~Kindergarten students at the above mastery level in mathematics justify the classification of self-selected objects by one attribute and then sort objects in another way and justify the new sort. They create and extend a repeating pattern. They count by 5's and 10's.~~Kindergarten students at the above mastery level in mathematics: justify the classification of objects by two attributes;	~~Kindergarten students at the mastery level in mathematics justify the classification of self-selected objects by one attribute. They create and extend a repeating pattern using common objects. They model and identify patterns by 5's and 10's.~~Kindergarten students at the mastery level in mathematics: justify the classification of objects by an attribute;	~~Kindergarten students at the partial mastery level in mathematics classify objects by one attribute. They repeat a pattern using common objects and model patterns of 5's and 10's.~~Kindergarten students at the partial mastery level in mathematics: classify objects by an attribute; extend a pattern using objects;	~~Kindergarten students at the novice level in mathematics sort objects and identify patterns of counting by 10's. They identify a repeating pattern.~~Kindergarten students at the novice level in mathematics: sort objects; copy a pattern using objects;

create, describe and analyze a growing pattern; model and identify counting in multiple ways.(e.g. 3's, 4's, and 6's)	use objects to create, describe and extend more complex repeating patterns; model and identify patterns of counting by 2's, 5's and 10's.	use objects to create, describe, and extend a repeating pattern; model and identify patterns of counting by 5's and 10's.	identify patterns of counting 5's and 10's.	identify patterns of counting by 10's.

Objectives	Students will
M.O.K.2.1	justify the classification of self-selected objects based on attributes.
M.O.K.2.2	create, describe, and extend a repeating pattern using common objects, sound, and movement.
M.O.K.2.3	model and identify patterns of counting by 5's and 10's.

Grade K	Mathematics
Standard 3	Geometry
M.S.K.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformations and use symmetry to analyze mathematical situations, and • solve problems using visualization, spatial reasoning, and geometric modeling.

Performance Descriptors (M.PD.K.3)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Kindergarten students at the distinguished level in mathematics construct representations of real-world shapes using multiple shapes together. They write about the shapes using numbers and/or words. They use physical models of separate parts to construct more than one whole object.~~Kindergarten students at the distinguished level in	~~Kindergarten students at the above mastery level in mathematics use physical materials to construct, identify and classify geometric plane shapes and connect these shapes to the environment. They use physical models of separate parts to construct a whole object.~~Kindergarten students at the above mastery level in mathematics:	~~Kindergarten students at the mastery level in mathematics, using physical materials, construct, identify and classify geometric plane shapes. They recognize and describe basic shapes in the environment and model and describe spatial relationships. They identify the separate parts used to make a whole object.~~Kindergarten	~~Kindergarten students at the partial mastery level in mathematics use physical materials to identify and classify geometric plane shapes. They recognize basic shapes in the environment and model spatial relationships.~~ Kindergarten students at the partial mastery level in mathematics: identify and classify	~~Kindergarten students at the novice level in mathematics identify geometric plane shapes. They identify basic shapes in the environment and recognize that separate parts are used to make a whole object.~~ Kindergarten students at the novice level in mathematics: identify geometric plane shapes;

mathematics: compare and contrast basic geometric plane shapes; analyze geometric shapes in the environment and creates models; analyze geometric constructions using spatial relationships; construct and deconstruct models identifying all parts of each whole object.	construct, identify, classify and describe basic geometric plane shapes; identify and construct geometric shapes in the environment; use spatial relationships in giving directions to others; construct models, identifying the separate parts to construct a whole object.	students at the mastery level in mathematics: use materials to construct, identify and classify basic geometric plane shapes; recognize and describe basic geometric shapes in the environment; model and describe spatial relationships; identify separate parts to make a whole object.	geometric plane shapes; recognize geometric shapes in the environment; model spatial relationships; identify some of the parts of a whole object.	recognize some geometric plane shapes in the environment; identify the location of an object; recognize the whole object.

Objectives	Students will
M.O.K.3.1	use physical materials to construct, identify, and classify basic geometric plane shapes: • circles • ellipses (oval) • rectangles including squares • triangles
M.O.K.3.2	recognize and describe basic geometric shapes in the environment.
M.O.K.3.3	model and describe spatial relationships: • inside/outside • top/bottom • before/after
M.O.K.3.4	identify the separate parts used to make a whole object.

Grade K	**Mathematics**
Standard 4	Measurement
M.S.K.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of measurable attributes of objects and the units, systems, and processes of measurement, and • apply appropriate techniques, tools and formulas to determine measurements.

Performance Descriptors (M.PD.K.4)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Kindergarten students at~~	~~Kindergarten students at the~~	~~Kindergarten students at~~	~~Kindergarten students at~~	~~Kindergarten students at~~

~~the distinguished level in mathematics compare and order objects in nonstandard units of measure according to length, height, and weight. They locate a day of the week on a calendar and identify what day is next in the week. They read time to half hour on an analog and digital clock. They determine the value of a set of coins, pennies, nickels and dimes, up to 20. They use the coins to make change from a dime to pennies, a dime to pennies and a nickel, and a nickel to pennies.~~Kindergarten students at the distinguished level in mathematics: estimate size of objects and describe how they compare and order objects by more than one attribute; use standard and nonstandard measurement to find length, height and weight; compare and describe the object by two or more attributes; use calendar to find dates, weeks, months and read hour and half hour on clocks;	~~above mastery level in mathematics compare objects in nonstandard units of measure according to length, height and weight. They locate a day of the week on a calendar. They read time to the half hour on an analog clock. They determine the value of a set of coins, pennies, nickels and dimes, up to 15. They justify the relationship between the coins through visual representations.~~Kindergarten students at the above mastery level in mathematics: estimate size of objects and describe how they compare and order objects by an attribute; use standard and nonstandard measurement to find length and height; compare and describe the object by two or more attributes; use calendar to locate date, days of week, months of year, and read time to hour on both clocks; identify name and value of coins and determine value of a set of coins up to 15 cents.	~~the mastery level in mathematics estimate size, compare and order objects by size with respect to a given attribute. They use standard and nonstandard units of measure to find length and compare two objects in non standard units of measure according to length, height and weight. They use the calendar to identify date and the sequence of the days of the week. They read time to the hour with analog and digital clocks. They identify and model the value of penny, nickel, and dime and determine the value of a set of pennies up to 20. They explain the relationship between the coins.~~Kindergarten students at the mastery level in mathematics: estimate size of object and compare and order objects by a given attribute; use standard and nonstandard measurement to find length; compare two objects by one or more attributes; use calendar to identify	~~the partial mastery in mathematics estimate size of an object and identify objects with respect to an attribute. They use standard and nonstandard units of measure to find length and order objects by length, height and weight. They name the days of the week and the seasons. They read time to the hour on an analog clock. They identify penny, nickel, and dime and determine a value of a set of pennies up to 10.~~Kindergarten students at the partial mastery level in mathematics: estimate the size of an object and compare objects by one attribute; use standard and nonstandard measurement to find length and height of an object; identify the calendar date, recite the days of the week, and use the analog clock to tell time to the hour; identify the name and value of each coin and explain relationship of penny and	~~the novice level in mathematics estimate size of an object and order objects with respect to an attribute. They use standard units of measure to find length. They repeat days of the week and repeat the seasons. They match penny, nickel, and dime and determine a set of pennies up to 5.~~Kindergarten students at the novice level in mathematics: estimate the size of an object and identify objects by one attribute; use standard and nonstandard measurement to find length of an object; identify the calendar and use the analog clock to tell time to the hour; identify the name of each coin.

identify coins including quarter and count sets of coins with values to 25 cents.		date, days of week and use both clocks to read time to the hour; identify name and value and explain relationship of penny, nickel and dime.	nickel.	

Objectives	Students will
M.O.K.4.1	estimate the size of an object and compare and order objects with respect to a given attribute.
M.O.K.4.2	use standard and nonstandard units of measure to find the length of an object.
M.O.K.4.3	compare two objects in nonstandard units of measure, according to one or more of the following attributes: • length • height • weight
M.O.K.4.4	use calendar to identify date and the sequence of days of the week.
M.O.K.4.5	read time to the hour using analog and digital clocks.
M.O.K.4.6	identify the name and value of coins and explain the relationships between: • penny • nickel • dime

Grade K	**Mathematics**
Standard 5	Data Analysis and Probability
M.S.K.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.

Performance Descriptors (M.PD.K.5)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Kindergarten students at the distinguished level in mathematics organize and analyze data on a graph. They create simple probability experiments, records results with tallies~~	~~Kindergarten students at the above mastery level in mathematics collect, sort, and organize data into a graph using objects and pictures. They analyze the data on a bar graph. They~~	~~Kindergarten students at the mastery level in mathematics collect, sort and organize data into a graph using objects and pictures. They interpret data represented on a bar graph.~~	~~Kindergarten students at the partial mastery level in mathematics collect and sort data in a graph with objects and pictures. They describe the data represented on a bar graph.~~	~~Kindergarten students at the novice level in mathematics collect and sort data in a graph using objects. They count the data represented on a bar graph. They label simple~~

~~and interpret results. They make predictions, present their findings and justify their solutions.~~ Kindergarten students at the distinguished level in mathematics: collect, organize, display, describe, interpret, and analyze the data from pictographs and bar graphs with and without technology; make predictions, create and conduct probability experiments, tally data, analyze results and compare to predictions.	~~create simple probability experiments and use tallies to record results in a table. They make predictions based on the results and present their findings.~~Kindergarten students at the above mastery level in mathematics: collect, organize, display, describe, interpret and analyze data using pictograph and bar graphs with and without technology; make predictions, create and conduct probability experiments, tally data and describe results.	~~They conduct simple probability experiments and use tallies to record results in a table. They make predictions based on results.~~Kindergarten students at the mastery level in mathematics: collect, organize, display, and interpret data using pictograph and bar graph with and without technology; conduct probability experiment and use tallies to record results and make predictions.	~~They conduct simple probability experiments.~~Kindergarten students at the partial mastery level in mathematics: collect, organize and display data in a pictograph and bar graph; conduct probability experiments and use tallies to record results.	~~probability experiments~~Kindergarten students at the novice level in mathematics: collect, organize and display data in a pictograph; participate in probability experiments.

Objectives	Students will
M.O.K.5.1	collect, organize, display, and interpret data using a pictograph and bar graph (with and without technology)
M.O.K.5.2	conduct a simple probability experiment and use tallies to record results in a table, make predictions based on results.

First Grade Mathematics Content Standards and Objectives

First grade objectives continue the emphasis on the use of manipulatives, concrete material, and appropriate technologies to give students the foundation needed to explore new mathematical concepts. Development of mathematical language allows students to explain such concepts as addition and subtraction of whole numbers; knowing the value of coins; the quick recall of addition and subtraction facts; identifying two- and three-dimensional figures; and gathering, organizing, and explaining data. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 1	**Mathematics**
Standard 1	Number and Operations
M.S.1.1	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of numbers, ways of representing numbers, and relationships among numbers and number systems, • demonstrate meanings of operations and how they relate to one another, and • compute fluently and make reasonable estimates.

Performance Descriptors (M.PD.1.1)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~First grade students at the distinguished level in mathematics read, write, order, compare and count numbers to 1000. They identify any number as odd/even. They model place value to 1000 in standard and expanded form. They create and model fractions of a whole and of a set (1/6, 1/8). They explain and justify the use of the relationship between addition and subtraction in solving problems. They create and present one-step problems and justify their results. They use concrete~~	~~First grade students at the above mastery level in mathematics read, write, order and compare numbers to 200. They identify any ordinal number. They model even/odd numbers to 100. They identify place value to 1000 in standard form and round numbers to the nearer 100. They create models for fractions of a whole and of a set (1/2, 1/3, 1/4). They demonstrate quick recall with basic addition and subtraction facts to 10 and use them to solve real-world problems. They use the~~	~~First grade students at the mastery level in mathematics read, write, order, compare, count and estimate numbers to 100 and identify ordinal numbers to 20th. They model even and odd numbers to 20. They model and identify place value to 100 using standard and expanded form and round to the nearer 10. They use models to represent fractions (halves, thirds, fourths) as part of a set and part of a whole. They model meanings of operations and relationship between~~	~~First grade students at the partial mastery level in mathematics read, write, and count numbers to 100 and recognize ordinal numbers to 10th. They identify odd and even numbers to 20, and identify place value to 100 using standard form. They identify fractions (halves, fourths) as part of a whole. They recognize the relationship between addition and subtraction of numbers to 18. They recall basic addition facts to 10. They model addition of three numbers with sums of 10 or~~	~~First grade students at the novice level in mathematics count to 100 and recite ordinal numbers to 10th. They identify odd and even numbers to 10 and read and write place value to 20 using standard form. They identify halves and wholes. They solve addition and subtraction facts to 10 with manipulatives.~~ First grade students at the novice level in mathematics: count to 100 and use ordinals to 10th, count back

~~objects to solve addition and subtraction of two-digit numbers requiring regrouping. They create real-world grade-appropriate one- and two-step problems using multiple strategies, present and justify results.~~First grade students at the distinguished level in mathematics: read, write, order, count and compare to 1000, identify any ordinal, identify any number as odd or even; group and count objects by 2's, 3's, 4's, 5's, and 10's; model place value to 1000 in standard and expanded form and round to the nearest 100; estimate, create and explain models for fractions of a whole and of a set, 1/6, 1/8; solve addition and subtraction of two-digits with regrouping and justify relationship;	~~relationship between addition and subtraction to solve problems. They use concrete models to solve addition problems of two-digit numbers with regrouping and present results. They create real-world grade-appropriate one-step problems using multiple strategies, and present and justify results.~~ First grade students at the above mastery level in mathematics: read, write, order, count and compare to 200 and identify any ordinal, model odd and even to 100; group and count objects by 1's, 2's, 5's, 10's; identify place value to 1000 in standard form and round to the nearest 100; estimate, create and explain models for fractions of a whole and a set, 1/2, 1/3, 1/4; model addition with multiple addends and two digit subtraction model and solve	~~addition and subtraction of numbers to 18. They demonstrate quick recall with basic addition and subtraction facts to 10, models and solve two-digit addition and subtraction without regrouping and addition of three numbers with sums less than 18. They create one-step grade-appropriate problems using multiple strategies and present and justify results.~~First grade students at the mastery level in mathematics: read, write, order, count and compare to 100, use ordinals to 20th, count back from 20, identify sets of odd and even to 20; group and count objects by 1's, 5's, and 10's to 100; model and identify place value using standard and expanded to 100 and round to nearest 10; estimate to 100, use models to explain 1/2, 1/3, 1/4, of whole or of set.; model 2 or 3 addends in	~~less and present their solutions.~~First grade students at the partial mastery level in mathematics: read, write, order, count to 100, use ordinals to 10th, count back from 20, identify sets of odd and even to 10; group objects by 1's, 5's and 10's to 100 and count objects by 1's, and 10's to 100.; model and identify place value using standard form to 100 and round to the nearest 10; estimate objects to 100 and use models to identify and name 1/2 and 1/4, as part of a whole; model addition and subtraction for sums to 12, write sentence; model addition and subtraction operations and the relationship between them; recall basic addition facts to 10 and some subtraction facts and solve story problems using models.	from 10 and identify odd and even to 10; group and count objects by 1's and 10's to 100; model and identify place value to 20 using standard form; estimate objects to 20 and use models to identify 1/2 of a whole; model addition and subtraction to 10; model addition and subtraction and show relationship with fact families; recall some addition and subtraction facts to 10 and retell a story problem.

create and present, one-step problems and justify results, construct real world one and two step problems using multiple strategies, present solutions and justify results.	2 digit addition with regrouping: use basic addition and subtraction facts and create real world story problems, present solutions and justify results with and without technology.	addition and subtraction to 18, write sentence, model addition and subtraction and their relationship, model 2-digit addition and subtraction without regrouping: recall basic addition and subtraction facts to 10 and create story problems using variety of strategies, present solutions, and justify results with and without technology		

Objectives	Students will
M.O.1.1.1	count forward to 100 and backward from 20 with and without manipulatives.
M.O.1.1.2	read, write, order, and compare numbers to 100 using multiple strategies (e.g. manipulatives, number line, symbols).
M.O.1.1.3	identify odd and even numbers to 20 and determine if a set of objects has an odd or even number of elements.
M.O.1.1.4	group and count manipulatives by ones, fives, and tens to 100.
M.O.1.1.5	model and identify place value of each digit utilizing standard and expanded form to 100.
M.O.1.1.6	round any two-digit number to the nearest 10.
M.O.1.1.7	use ordinal numbers 1^{st} - 20^{th} to identify position in a sequence.
M.O.1.1.8	estimate the number of objects in a group of 100 or less and count to evaluate reasonableness of estimate.
M.O.1.1.9	identify, name, and explain why a given part is a half, third or fourth of a whole or part of a group, using concrete models.
M.O.1.1.10	use concrete objects to model the addition of two or three addends and subtraction of whole numbers related to sums less than 18 and write the corresponding number sentence.
M.O.1.1.11	model operations, addition and subtraction, and the relationship between addition and subtraction (e.g., identity element of addition, commutative property, fact families, inverse operations) using concrete objects.
M.O.1.1.12	quick recall of basic addition facts with sums to 10 and corresponding subtraction facts.
M.O.1.1.13	model and solve 2-digit addition and subtraction without regrouping.
M.O.1.1.14	create grade-appropriate picture and story problems using a variety of strategies (with and without technology), present solutions and justify results.

Grade 1	**Mathematics**
Standard 2	Algebra

M.S.1.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD.1.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~First grade students at the distinguished level in mathematics identify the sorting rule used by another student. They identify non-examples of the rule. They create an input/output model. They create, analyze and modify number patterns to create new number patterns based on real-life situations. They prove equivalency of both sides of a number sentence and relate to a real-world situation.~~First grade students at the distinguished level in mathematics: interpret sorting rules for self and others using two or more attributes and various strategies; create an input/output model; create, write, and analyze number patterns;	~~First grade students at the above mastery level in mathematics provide a sorting rule and evaluate correctness of resulting sorting by another student. They determine the input when given the rule and function of an input/output model. They create, analyze and modify a number pattern to create new number patterns based on real-life situations. They prove equivalency of both sides of a number sentence.~~First grade students at the above mastery level in mathematics: determine sorting rules for more than one attribute using various strategies; determine the input when given the rule and function of an input/output model; create and write number	~~First grade students at the mastery level in mathematics sort and classify objects by more than one attribute using various strategies including Venn Diagrams. They determine the rule given an input/output model using addition or subtraction. They create and analyze number patterns based on real-life situations using word, AB form, and T-charts and present results. They demonstrate the equivalency of both sides of a number sentence.~~First grade students at the mastery level in mathematics: sort and classify objects by more than one attribute, using various strategies, including Venn Diagrams; determine the rule or give the output, given an input/output model using addition and subtraction;	~~First grade students at the partial mastery level in mathematics sort and classify objects by one attribute. They supply the output when given the input and function of an input/output model. They create number patterns based on real-life situations using word, AB form, and T-charts and present results. They recognize and describe the equivalency of both sides of a number sentence.~~First grade students at the partial mastery level in mathematics: sort and classify objects by one attribute using Venn Diagrams; give the output when input and function are given using the input/output model; identify and write number patterns by 5's and 10's;	~~First grade students at the novice level in mathematics sort objects by one attribute. They recognize and create number patterns. They recognize equivalency of both sides of a number sentence.~~First grade students at the novice level in mathematics: sort and classify objects by one attribute; give the output for addition using the input/output model; identify number patterns by 5's and 10's; recognize and create number patterns with AB form; recognize equivalency of

create, analyze and interpret number patterns based on real-life situations using words, AB form, T-charts and justify results; prove equivalency of both sides of a number sentence.	patterns; create, analyze and modify number patterns based on real-life situations, using words, AB form, T-charts and justify results; create and interpret number sentences that show equivalency.	identify and write number patterns by 2's,5's,and 10's; create and analyze number patterns based on real-life situations, using words, AB form, and T-charts and present results; use concrete materials to demonstrate that quantities on both sides of a number sentence are equivalent.	create number patterns based on real-life situations, using words, AB form, and T-chart and present results; identify equivalency of both sides of a simple number sentence.	both sides of a simple number sentence.

Objectives	Students will
M.O.1.2.1	sort and classify objects by more than one attribute, using various strategies, including Venn Diagrams.
M.O.1.2.2	determine the rule or give the output given an input/output model using addition or subtraction.
M.O.1.2.3	identify and write number patterns by 2's, 5's, and 10's.
M.O.1.2.4	create and analyze number patterns based on real-life situations using words, AB form, and T-charts and present results.
M.O.1.2.5	use concrete materials to demonstrate that the quantities on both sides of a grade-appropriate number sentence are equivalent.

Grade 1	**Mathematics**
Standard 3	Geometry
M.S.1.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformations and use symmetry to analyze mathematical situations, and • solve problems using visualization, spatial reasoning, and geometric modeling.

Performance Descriptors (M.PD.1.3)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Students at the distinguished level in first grade mathematics construct representations of real-world three-dimensional shapes. They write about the shapes~~	~~Students at the above mastery level in first grade mathematics draw, label, and analyze plane figures. They construct, identify and classify three-dimensional objects and connect these~~	~~Students at the mastery level in first grade mathematics draw, label and sort plane figures. They construct, identify and classify three-dimensional figures. They draw and~~	~~Students at the partial mastery level in first grade mathematics identify plane shapes. They identify three-dimensional figures. They identify open and closed figures and~~	~~Students at the novice level in first grade mathematics recognize plane shapes and three-dimensional figures. They recognize open, closed and congruent shapes. They identify~~

~~using numbers or words. They classify shapes as open and closed and congruent shapes, justifying their classification orally. They create symmetrical designs and justify designs are symmetrical. They recognize and describe three-dimensional shapes in the environment and describe spatial relationships. They describe spatial relationships. They create pictures with points on a first quadrant grid. They create new figures as the result of combining or decomposing two/three dimensional figures.~~First grade students at the distinguished level in mathematics: interpret the relationships between plane figures; construct, identify, analyze and write about three dimensional figures and relationship to real world; justify the classification of open and closed figures and congruent plane shapes; create, analyze, describe symmetrical designs;	~~shapes to the environment. They classify shapes as open, closed and congruent shapes. They create and analyze simple symmetrical designs. They recognize and describe three-dimensional shapes in the environment and describe spatial relationships. They describe spatial relationships. They find, name and describe locations on a first quadrant grid. They predict and draw the result of combining or decomposing two/three dimensional figures.~~First grade students at the above mastery level in mathematics: draw, label and analyze plane figures; construct, identify, classify and analyze three-dimensional figures, draw three dimensional shapes from the environment; classify open and closed figures and congruent plane shapes; create and analyze symmetrical designs; use spatial relationships;	~~identify open, closed, and congruent shapes. They create and describe simple symmetrical designs. They recognize and describe three-dimensional shapes in the environment and describe spatial relationships. They describe spatial relationships. They find and name locations on a first quadrant grid. They predict the result of combining or decomposing two/three dimensional figures.~~First grade students at the mastery level in mathematics: draw, label and sort plane figures by sides and vertices; construct, identify and classify three dimensional figures; recognize three-dimensional shapes in the environment; draw and identify open and closed figures and congruent plane shapes; create and describe simple symmetrical designs; describe spatial relationships; find and name locations on	~~congruent shapes. They describe simple symmetrical designs. They identify three-dimensional shapes in the environment.. They name locations on a first quadrant grid. They draw decomposing two/three dimensional figures.~~First grade students at the partial mastery level in mathematics: draw and sort plane shapes; identify three dimensional figures and match three dimensional shapes in the environment; identify open and closed figures and congruent shapes; describe simple symmetrical designs; identify spatial relationships; name locations on first-quadrant grid; combine and decompose two- and three-dimensional shapes.	~~simple symmetrical designs. They point to the location of a point on the first quadrant grid. They recognize three-dimensional shapes when given various shapes with which to choose.~~First grade students at the novice level in mathematics: sort plane shapes; sort three dimensional figures, recognize plane shapes in the environment; recognize open and closed figures, congruent shapes and simple symmetrical designs; recognize spatial relationships; touch a location on a first-quadrant grid; combine and decompose two-dimensional shapes.

create stories using spatial relationships; create and describe pictures with points on a first-quadrant grid; predict, describe, analyze results of combining and decomposing two- and three-dimensional shapes.	find, name and describe locations on a first-quadrant grid; predict and describe the result of combining and decomposing two- and three-dimensional shapes.	first-quadrant grid; predict result of combining or decomposing two or more two- and three-dimensional shapes.		

Objectives	Students will
M.O.1.3.1	draw, label, and sort • circle, • rectangles including squares, • triangles, and according to sides and vertices
M.O.1.3.2	use physical materials to construct, identify, and classify three-dimensional figures: • cube • cone • sphere • rectangular solid • pyramid • cylinder
M.O.1.3.3	recognize three-dimensional shapes in the environment.
M.O.1.3.4	draw and identify • open and closed figures • congruent plane shapes
M.O.1.3.5	create and describe simple symmetrical designs
M.O.1.3.6	describe spatial relationships: over/under, left/right.
M.O.1.3.7	find and name locations on a first-quadrant grid.
M.O.1.3.8	predict the result of combining or decomposing two or more two-dimensional/three-dimensional shapes.

Grade 1	Mathematics
Standard 4	Measurement
M.S.1.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will

	• demonstrate understanding of measurable attributes of objects and the units, systems, and processes of measurement, and • apply appropriate techniques, tools and formulas to determine measurements.

Performance Descriptors (M.PD.1.4)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Students at the distinguished level in first grade mathematics estimate, measure, compare, and order length of objects using customary, metric and nonstandard units justifying the comparison clearly in oral and written form. They use the calendar to identify important dates in the future. They demonstrate how to make change from a $1.00 and justify the procedures in oral and written form.~~First grade students at the distinguished level in mathematics: estimate, measure, compare and order using customary metric and nonstandard units to determine length to nearest unit and justify answers; select units and tools to measure and compare objects using two or more attributes, justify and record results;	~~Students at the above mastery level in first grade mathematics estimate, measure, compare, and order length of objects using customary, metric, and nonstandard units, justifying the comparison. They describe how to use a calendar to determine the date. They read an analog clock to the quarter hour. They justify the change given from $1.00.~~First grade students at the above mastery level in mathematics: estimate, measure, compare, and order using customary, metric, and nonstandard units to determine length to nearest whole unit and justify answers; select units and tools to measure and compare two or more objects using one or more attributes (length, height, weight, time and volume), justify and record results; use calendar to find yesterday, today, tomorrow	~~Students at the mastery level in first grade mathematics estimate, measure, compare, and order length of objects using customary, metric, and nonstandard units. They select the appropriate units and tools to measure length, height, weight, temperature, and volume. They use a calendar to identify the date, sequence of days of the week, and months of a year. They tell time to the half hour using an analog clock and a digital clock. They explain the relationship between coins and make change from a dollar.~~First grade students at the mastery level in mathematics: estimate, measure, compare and order using customary, metric, and nonstandard units to determine length to nearer whole unit; select units and tools to measure and compare two objects or events using one or more attributes (length,	~~Students at the partial mastery level in first grade estimate and measure objects using customary, metric and nonstandard units. Given the appropriate tool. They measure length, height, weight, temperature and volume. They use a calendar to identify the date and name the days of the week. They read time to the hour on an analog clock. They identify the penny, nickel, and dime and their value.~~First grade students at the partial mastery level in mathematics: estimate and measure using customary, metric, and nonstandard units to determine length to nearest whole unit; given the tool, measure length, height, weight, temperature, and volume; use calendar to identify	~~Students at the novice level in first grade use standard units to measure objects. They identify the tools used to measure length, height, weight, and temperature. They use calendar to identify the date. They read time on a digital clock. They recognize penny, nickel and dime.~~First grade students at the novice level in mathematics: estimate and measure using customary and nonstandard units to determine length; given the tool, measure length, height, weight and temperature; use the calendar and to identify the date; tell time to the hour on an

use the calendar to locate a specific day, date and identify one week later; use clocks to tell time to five minutes and relate to personal experiences; create stories with money and make change from a dollar using all coins and bills.	and birth date; use clocks to tell time to quarter hour and relate to personal experiences; identify all coins and dollar bill and make change from fifty cents.	height, weight, temperature, and volume) and justify results; use calendar to identify date, days, and months; tell time to half hour, use analog and digital clock, and relate time to personal experience; identify, count, trade and organize (penny, nickel, dime, quarter, and dollar bill); display real life price values to 100 cents.	date, and days of week; tell time to the hour on an analog and digital clock and relate time to personal experience; identify, count and trade pennies, nickels, dimes and quarters; display price values up to 25 cents.	analog clock and relate to personal experience; identify pennies, nickels, dimes and quarters; count and trade pennies, nickels and dimes.

Objectives	Students will
M.O.1.4.1	estimate, measure, compare and order using customary, metric, and nonstandard units to determine length to nearer whole unit.
M.O.1.4.2	select appropriate units and tools to measure and compare two objects or events according to one or more of the following attributes: length height weight temperature volume justify selection of units and tools used to measure the attributes and present results.
M.O.1.4.3	use calendar to identify date, sequence of days of the week, and months of the year.
M.O.1.4.4	explain time concept in context of personal experience.
M.O.1.4.5	read time to the half hour using an analog and digital clock.
M.O.1.4.6	identify, count, trade and organize the following coins and bill to display a variety of price values from real-life examples with a total value of 100 cents or less. • penny • nickel • dime • quarter • dollar bill

Grade 1	Mathematics
Standard 5	Data Analysis and Probability
M.S.1.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.

Performance Descriptors (M.PD.1.5)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Students at the distinguished level in first grade mathematics identify a real life situation to gather data over time; make a hypothesis as to the outcome; design and implement a method to collect, organize, and analyze the results to make a conclusion; evaluate the validity of the hypothesis based upon collected data; design a mode of presentation using a pictograph and a bar graph (with and without technology). They convey their findings in oral and written form. They create simple probability experiments and make predictions based on their results. They present their findings and justify their solutions.~~First grade students at the distinguished level in mathematics:	~~Students at the above mastery level in first grade mathematics identify a real life situation to gather data over time; make a hypothesis as to the outcome; design and implement a method to collect, organize, and analyze the results to make a conclusion; evaluate the validity of the hypothesis based upon collected data; design a mode of presentation using a pictograph and a bar graph (with and without technology). They create simple probability experiments and record data in charts. They make predictions based on the results and present their findings.~~First grade students at the above mastery level in mathematics: identify a real life situation, gather data over time, make a hypothesis as to the	~~Students at the mastery level in first grade mathematics identify a real life situation to gather data over time; make a hypothesis as to the outcome; design and implement a method to collect, organize, and analyze the results to make a conclusion; evaluate the validity of the hypothesis based upon collected data; design a mode of presentation using a pictograph and a bar graph (with and without technology).They conduct simple probability experiments, record data in a chart and use data to predict which of the events is more likely/less likely to occur.~~First grade students at the mastery level in mathematics: identify a real life situation, gather data over time, make a hypothesis as to the	~~Students at the partial mastery level in first grade mathematics identify a real life situation to gather data over time; make a hypothesis as to the outcome; design and implement a method to collect the results to make a conclusion (with and without technology).They conduct simple probability experiments and record data in a chart.~~First grade students at the partial mastery level in mathematics: identify a real life situation, gather data over time, organize and interpret data; conduct simple probability experiments and record	~~Students at the novice level in first grade mathematics identify a real life situation to gather data over time; make a hypothesis as to the outcome; design and implement a method to collect the results to make a conclusion They read pictographs. They conduct simple probability experiments.~~First grade students at the novice level in mathematics: identify a real life situation, gather data over time, and organize data; conduct simple probability experiments.

identify a real life situation, gather data over time, make a hypothesis as to the outcome, organize and analyze results, evaluate the validity of the hypothesis and communicate results using mathematical language; construct, interpret, and analyze probability experiments and explain how they relate to real life situations.	outcome, organize and analyze results, evaluate the validity of the hypothesis and communicate results; create and interpret probability experiments, record data, and use data to predict which events will be more or less likely to occur in repeated experiments	outcome, organize and analyze results, and evaluate the validity of the hypothesis; conduct simple probability experiments, record data, and use data to predict which events will be more or less likely to occur in repeated experiment.	data.	

Objectives	Students will
M.O.1.5.1	identify a real life situation to gather data over time; make a hypothesis as to the outcome; design and implement a method to collect, organize, and analyze the results to make a conclusion; evaluate the validity of the hypothesis based upon collected data; design a mode of presentation using a pictograph and a bar graph (with and without technology).
M.O.1.5.2	conduct simple experiments, record data on a tally chart or table and use the data to predict which of the events is more likely or less likely to occur if the experiment is repeated.

Second Grade Mathematics Content Standards and Objectives

Second grade objectives help a student to become a more independent problem solver through concrete and technology supported experiences which explore new problem solving strategies, everyday use of mathematical language, and reasonableness and interrelationships of mathematics. Concepts include place value through thousands, estimation, introduction of properties of mathematics, and measurement that including spatial perception. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 2	Mathematics
Standard 1	Number and Operations
M.S.2.1	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of numbers, ways of representing numbers, and relationships among numbers and number systems, • demonstrate meanings of operations and how they relate to one another, and • compute fluently and make reasonable estimates.

Performance Descriptors (M.PD.2.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Second grade students at the distinguished level in mathematics read, write, order, and compare numbers above 1000 and use ordinal numbers to identify position in a sequence. They justify any number as odd or even and determine if a set has an odd or even number of elements. They demonstrate quick recall of basic addition facts and related subtraction facts to 18. They use 2- and 3-digit numbers to solve problems, justifying their results. They create real-world grade-~~	~~Second grade students at the above mastery level in mathematics read, write, order and compares numbers above 1000 and use ordinal numbers to identify position in a sequence. They justify any number as odd or even and determine if a set has an odd or even number of elements. They demonstrate quick recall of basic addition facts and related subtraction facts to 18. They add and subtract two- and three-digit numbers with and without grouping. They create real-~~	~~Second grade students at the mastery level in mathematics read, write, order and compare numbers to 1000 and identify ordinal numbers to identify position in a sequence. They model and identify place value to 1000 and round numbers to the nearer 10 and 100. They justify any number as odd or even and determine if a set has an odd or even number of elements. They demonstrate quick recall of basic addition facts with sums to 18 and corresponding subtraction~~	~~Second grade students at the partial mastery level in mathematics read and write numbers to 1000 and identify ordinal numbers to the 20th position. They identify place value to 1000 and round numbers to the nearer 100. They label any number as odd or even and determine if a set has an odd or even number of elements. They demonstrate recall of basic addition facts with sums to 18 and corresponding subtraction facts. They model two- and three-digit addition and subtraction~~	~~Second grade students at the novice level in mathematics read numbers to 1000 and identify ordinal numbers to the 10th position. They model and solve problems involving addition and corresponding subtraction facts to 18. They round numbers less than 50 to the nearer 10. They identify any number as odd or even.They add and subtract 2-digit numbers without regroups. They recognize fractions as part of a whole. They solve one-step grade-level story problems using multiple~~

~~appropriate one and two student problems using multiple strategies, present and justifying procedures in a clear and concise manner.~~Second grade students at the distinguished level in mathematics: model, read, compare, order, write (standard and expanded form), identify place value with numbers beyond 1000; read and compare ordinal numbers to identify position in real world situations; round three-digit numbers and use rounding to estimate and evaluate sums and differences to solve real world problems; justify any number as odd or even and create sets with and even and odd set of members; show quick recall of addition and subtraction facts; justify number properties and the relationship between addition and subtraction using clear mathematical language;	~~world grade-appropriate one- and two-step problems using multiple strategies, present and justify results.~~Second grade students at the above mastery level in mathematics: model, read, compare, order, write (standard and expanded form), identify place value with numbers to 1000; read and compare ordinal numbers to identify position in real world situations; round three-digit numbers and use rounding to estimate and evaluate sums and differences; justify any number as odd or even; show quick recall of addition and subtraction facts; justify number properties and the relationship between addition and subtraction	~~facts. They model and justify the relationship between addition and subtraction facts. They model two- and three-digit addition and subtraction with regrouping. They identify, name, and explain fractions as part of whole and as part of a set using models. They create one and two-step grade-appropriate story problems using multiple strategies and present and justify results.~~Second grade students at the mastery level in mathematics: model, read, compare, order, write (standard and expanded form), identify place value with numbers to 1000; read and use ordinal numbers to identify position; round three-digit numbers and use rounding to estimate and evaluate sums and differences; justify any number as odd or even and determine if a set has an odd or even number;	~~without regrouping. They identify and name fractions as part of a whole and part of a set using models. They create one-step grade-appropriate story problems using multiple strategies.~~Second grade students at the partial mastery level in mathematics: model, read, compare, order, write (standard form), and identify place value with numbers to 1000; read and use ordinal numbers to identify position, 1^{st}-10^{th}; round three-digit numbers to the nearest 100 and use rounding to estimate and evaluate sums and differences; identify numbers as odd or even and determine if a set has an odd or even number; use strategies to recall of some addition and subtraction facts; model number properties and the relationship between addition and	~~strategies.~~Second grade students at the novice level in mathematics: model, read, write (standard form), and identify place value with numbers to 1000; use ordinal numbers to identify position, 1^{st}-5^{th}; round three-digit numbers to the nearest 100 to estimate sums and differences; determine if a set has an odd or even number; model of addition and subtraction facts; model the relationship between addition and subtraction add and subtract two-digit numbers without regrouping; model addition and subtraction of two-digit numbers without

add and subtract two- and three-digit numbers without and with regrouping and explain the procedures using clear mathematical language; identify, name, compare and explain fractions without models; create one and two-step story problems, solve using multiple strategies, present and justify results using clear mathematical language.	add and subtract two- and three- digit numbers without and with regrouping; identify, name, compare and explain fractions using models; create one and two-step story problems, solve using multiple strategies, present and justify results.	show quick recall of addition and subtraction facts; model and justify number properties and the relationship between addition and subtraction add and subtract two- and three-digit numbers without regrouping; model addition and subtraction of two- and three-digit numbers with regrouping; identify, name, and explain fractions using models; create one and two-step story problems, solve using multiple strategies, present and justify results.	subtraction add and subtract two- and three- digit numbers without regrouping; model addition and subtraction of two-digit numbers with regrouping; identify and name fractions using models; solve one and two-step story problems using multiple strategies and present results.	regrouping; identify fractions using models; solve one-step story problems and present results.

Objectives	Students will
M.O.2.1.1	read, write, order, and compare numbers to 1,000 using multiple strategies (e.g. symbols, manipulatives, number line).
M.O.2.1.2	justify any number as odd or even and determine if a set has an odd or even number of elements.
M.O.2.1.3	count and group concrete manipulatives by ones, tens, and hundreds to 1,000.
M.O.2.1.4	model and identify place value of each digit utilizing standard and expanded form through 1000.
M.O.2.1.5	identify and read any ordinal number to identify position in a sequence.
M.O.2.1.6	round any 3-digit number to both the nearer 10 and 100.
M.O.2.1.7	Identify and explain fractions as part of a whole and as part of a set/group using models.
M.O.2.1.8	model and justify the relationship between addition and subtraction (e.g., identity element of addition, associative property, commutative property, inverse operations, fact families).
M.O.2.1.9	demonstrate quick recall of basic addition facts with sums to 18 and corresponding subtraction facts.
M.O.2.1.10	model 2- and 3-digit addition and subtraction with regrouping using multiple strategies.
M.O.2.1.11	add and subtract 2- and 3-digit numbers without regrouping.
M.O.2.1.12	use rounding to analyze the reasonableness of a sum or a difference.
M.O.2.1.13	create story problems that require one or two-step procedures, using a variety of strategies explain the reasoning used , justify the

	procedures selected and present the results.

Grade 2	Mathematics
Standard 2	Algebra
M.S.2.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD.2.2)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Second grade students at the distinguished level in mathematics analyze, describe, extend and create a growing pattern, justifying their mathematical reasoning in a clear and concise manner. They create situations where one variable produces a change in another variable. They create a rule and then create a pattern to match the rule justifying their reasoning. They write equivalent numerical expressions and defend their reasoning.~~Second grade students at the distinguished level in mathematics: analyze, describe, extend and create growing patterns; explain how one variable produces a change in	~~Second grade students at the above mastery level in mathematics analyze, describe, extend and create a growing pattern, justifying their reasoning. They analyze and describe how one variable produces a change in another variable. They create a rule and then create a pattern to match the rule. They write equivalent numerical expressions.~~Second grade students at the above mastery level in mathematics: analyze, describe, extend and create growing patterns; explain how one variable produces a change in another variable (e.g., input/output table)in a real world situation;	~~Second grade students at the mastery level in mathematics analyze, describe, extend and create a growing pattern. They explain how one variable produces a change in another variable. They identify a rule for a pattern and use it to complete the pattern. They create equivalent numerical expressions.~~Second grade students at the mastery level in mathematics: analyze, describe, extend and create growing patterns; explain how one variable produces a change in another variable (e.g., input/output table); describe, complete, extend counting patterns when	~~Second grade students at the partial mastery level in mathematics describe, extend and create a growing pattern. They identify a variable that produces a change in another variable. They use a rule to complete a pattern. They describe equivalent numerical expressions.~~Second grade students at the partial mastery level in mathematics: analyze, describe, and extend growing patterns; determine input, output, or rule to show how one variable produces a change in another variable; extend counting patterns when given the rule;	~~Second grade students at the novice level in mathematics identify and extend a growing pattern. They choose which variable produces a change in another variable. They recognize a rule used to complete a pattern. They recognize equivalent numerical expressions.~~Second grade students at the novice level in mathematics: describe and extend growing patterns; determine output or rule to show how one variable produces a change in another variable; extend counting patterns when given the rule;

another variable (e.g., input/output table)in a real world situation; describe, complete, extend, and create counting patterns when given the rule; write the rule when given the pattern; create and analyze equivalent numerical expressions.	describe, complete, extend, and create counting patterns when given the rule; create, analyze, and demonstrate equivalent numerical expressions using models or manipulatives.	given the rule; create and demonstrate equivalent numerical expressions using models or manipulatives.	demonstrate equivalence of numerical expressions using models or manipulatives	model equivalent numerical expressions using manipulatives.

Objectives	Students will
M.O.2.2.1	analyze, describe, extend and create a growing pattern using objects or numbers.
M.O.2.2.2	explain how one variable produces a change in another variable
M.O.2.2.3	describe, complete and extend a variety of counting patterns, according to a given rule.
M.O.2.2.4	create physical models to demonstrate equivalency of two numerical expressions written as a grade-appropriate number sentence.

Grade 2	**Mathematics**
Standard 3	Geometry
M.S.2.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformations and use symmetry to analyze mathematical situations, and • solve problems using visualization, spatial reasoning, and geometric modeling.

Performance Descriptors (M.PD.2.3)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Second grade students at the distinguished level in mathematics identify, describe and analyze geometric solids. They communicate their reasoning in a clear and concise manner. They create shapes and the~~	~~Second grade students at the above mastery level in mathematics identify, describe and analyze geometric solids. They compare and contrast plane and solid geometric shapes communicating their reasoning orally. They~~	~~Second grade students at the mastery level in mathematics identify and describe geometric solids. They compare and contrast plane and solid geometric shapes. They identify and draw congruent shapes that have been rotated or~~	~~Second grade students at the partial mastery level in mathematics identify geometric solids. They compare plane and solid geometric shapes. They identify congruent shapes that have been rotated or reflected. They identify line~~	~~Second grade students at the novice level in mathematics recognize three-dimensional solids. They identify plane and solid geometric shapes. They recognize congruent shapes. They locate points on a grid. They recognize~~

~~reflected image. They create paths between locations on a grid. They create similar shapes and justify why they are similar in written form.~~Second grade students at the distinguished level in mathematics: identify, describe, compare, and contrast plane and solid shapes using clear mathematical language; draw, describe, and combine shapes that show reflections and rotations; draw or build similar shapes; model, draw, and describe line segments and angles; plot and describe the path between locations on a grid.	~~create shapes and the reflected image. They combine line segments and angles to form new shapes. They plot and describe multiple paths between locations on a grid. They create similar shapes and justify why they are similar.~~Second grade students at the above mastery level in mathematics: identify, describe, compare, and contrast plane and solid shapes using clear mathematical language; draw and describe shapes that show reflections and rotations; draw or build similar shapes; model, draw, and describe line segments and angles; plot and describe the path between locations on a grid.	~~reflected. They model and draw line segments and angles. They plot and describe the path between locations on a grid. They identify similar shapes.~~Second grade students at the mastery level in mathematics: identify, describe, compare, and contrast plane and solid shapes; identify and draw shapes that show reflections and rotations; identify similar shapes; model and draw line segments and angles; plot and describe the path between locations on a grid.	~~segments and angles. They describe the path between locations on a grid They recognize similar shapes.~~Second grade students at the partial mastery level in mathematics: identify and describe plane and solid geometric shapes; identify shapes that have been reflected or rotated; define similar shapes; model line segments and angles; plot locations on a grid.	~~line segments and angles.~~Second grade students at the novice level in mathematics: identify plane and solid geometric shapes; identify shapes that have been reflected or rotated; define similar shapes; model line segments and angles; identify locations on a grid.

Objectives	Students will
M.O.2.3.1	identify and describe the following geometric solids according to the number of faces and edges: • rectangular solid • cube • cylinder • cone • pyramid
M.O.2.3.2	compare and contrast plane and solid geometric shapes.

M.O.2.3.3	identify and draw congruent shapes that have been rotated or reflected
M.O.2.3.4	model and draw line segments and angles.
M.O.2.3.5	plot and describe the path between locations on a grid.
M.O.2.3.6	identify similar shapes.

Grade 2	Mathematics
Standard 4	Measurement
M.S.2.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of measurable attributes of objects and the units, systems, and processes of measurement, and • apply appropriate techniques, tools and formulas to determine measurements.

Performance Descriptors (M.PD.2.4)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Second grade students at the distinguished level in mathematics identify a real life situation to use appropriate measurement tools; over time make a hypothesis as to the change overtime using whole units: length in centimeters and inches, temperature in Celsius and Fahrenheit, weight/mass in pounds and kilograms, and design and implement a method to collect, organize, and analyze data; analyze the results to defend a conclusion evaluate the validity of the hypothesis based upon collected data; design a mode of presentation (with and without technology).They determine the perimeter and area of a given shape using manipulatives and justify~~	~~Second grade students at the above mastery level in mathematics identify a real life situation to use appropriate measurement tools; over time make a hypothesis as to the change overtime using whole units and design and implement a method to collect, organize, and analyze data; analyze the results to make a conclusion evaluate the validity of the hypothesis based upon collected data; design a mode of presentation (with and without technology). They determine the perimeter and area of a given shape using manipulatives and explain their reasoning. They read time to 5 minute intervals. They compare dates on a calendar. They explain the relationship between coins~~	~~Second grade students at the mastery level in mathematics identify a real life situation to use appropriate measurement tools; over time make a hypothesis as to the change overtime using whole units: length in centimeters and inches, temperature in Celsius and Fahrenheit, weight/mass in pounds and kilograms, and design and implement a method to collect, organize, and analyze data; analyze the results to make a conclusion evaluate the validity of the hypothesis based upon collected data; design a mode of presentation (with and without technology). They determine the perimeter and the area of a given shape using manipulatives. They~~	~~Second grade students at the partial mastery level in mathematics identify a real life situation to use appropriate measurement tools; over time make a hypothesis as to the change overtime using whole units: length in centimeters and inches, temperature in Celsius and Fahrenheit, weight/mass in pounds and kilograms, and design and implement a method to collect, organize, and analyze data; They determine the perimeter of a shape and recognize that a shape has area. They order events and read time to half hour on an analog and digital clock. They identify specific dates on a calendar. They count coins to $1.00.~~Second grade students at the partial	~~Second grade students at the novice level in mathematics, identify a real life situation to use appropriate measurement tools; over time make a hypothesis as to the change overtime using whole units: length in centimeters and inches, temperature in Celsius and Fahrenheit, weight/mass in pounds and kilograms, and implement a method to collect, organize, and analyze data; They read time to the nearest hour on an analog clock. They read dates on a calendar. They explain the relationship between coins.~~Second grade students at the novice level in mathematics: carry out a project to measure length, weight, or

~~their reasoning. They explain the relationship between coins and make change from $1.00 justifying their procedures.~~Second grade students at the distinguished level in mathematics: design a project to measure length, weight, or temperature; make and test a hypothesis; collect, organize, and analyze data; and present the results; estimate and measure to determine perimeter and find area by counting square units of regular and irregular shapes; order events, tell time to the nearest five minutes; use a calendar to find past and future dates of specific events; show multiple solutions to model given values and to make change to the next dollar.	~~and make change from $1.00 explaining their procedures.~~Second grade students at the above mastery level in mathematics: design a project to measure length, weight, or temperature; make and test a hypothesis; collect, organize, and analyze data; and present the results; estimate and measure to determine perimeter and find area by counting square units; order events and tell time to the nearest five minutes; use a calendar to find past and future dates; use coins to model given values and to make change up to the next dollar.	~~order events and read time to the nearest quarter hour using an analog and digital clock. They identify specific dates on a calendar and determine past and future dates. They explain the relationship between coins and make change from $1.00.~~Second grade students at the above mastery level in mathematics: design a project to measure length, weight, or temperature; make and test a hypothesis; collect, organize, and analyze data; and present the results; estimate and measure to determine perimeter and find area by counting square units; order events and tell time to the nearest five minutes; use a calendar to find past and future dates; use coins to model given values and to make change up to the next dollar.	mastery level in mathematics: carry out a project using tools to measure length, weight, temperature; test a hypothesis; collect, organize, and analyze data; and present the results; find perimeter and count square units to determine area; order events and tell time to the nearest half hour; use a calendar to find today's date and future dates; use coins to model given values and to make change up to a quarter.	temperature; collect, organize, and analyze data; and present the results; add to find perimeter and count square units to determine area; order events and tell time to the nearest hour; use a calendar to find today's date; use coins to model given values.
Objectives	Students will			

M.O.2.4.1	• identify a real life situation to use appropriate measurement tools; over time make a hypothesis as to the change overtime using whole units: • length in centimeters and inches, • temperature in Celsius and Fahrenheit, • weight/mass in pounds and kilograms, and design and implement a method to collect, organize, and analyze data; analyze the results to make a conclusion evaluate the validity of the hypothesis based upon collected data; design a mode of presentation (with and without technology).
M.O.2.4.2	estimate and determine the perimeter of squares, rectangles and triangles.
M.O.2.4.3	estimate and count the number of square units needed to cover a given area using manipulatives.
M.O.2.4.4	order events in relation to time.
M.O.2.4.5	determine past and future days of the week and identify specific dates, given a calendar.
M.O.2.4.6	read time to the quarter hour using an analog and digital clock.
M.O.2.4.7	identify, count and organize coins and bills to display a variety of price values from real-life examples with a total value of one dollar or less and model making change using manipulatives.

Grade 2	**Mathematics**			
Standard 5	Data Analysis and Probability			
M.S.2.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.			
Performance Descriptors (M.PD.2.5)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Second grade students at the distinguished level in mathematics create, read, and interpret a pictograph and justify their reasoning to the class. They plan and conduct simple probability experiments with more than two outcomes and use the data to predict which event is more, less, or equally~~	~~Second grade students at the above mastery level in mathematics create, read and interpret a pictograph and present their reasoning to the class. They plan and conduct simple probability experiments with more than two outcomes and use the data to predict which event is more, less, or equally~~	~~Second grade students at the mastery level in mathematics create, read, and interpret a pictograph. They conduct simple experiments with more than two outcomes and use the data to predict which event is more, less, or equally likely to occur if the experiment is repeated.~~	~~Second grade students at the partial mastery level in mathematics read and interpret a pictograph. They conduct simple probability experiments and describe the results. They collect and organize data into a chart, table or bar graph.~~Second grade students at the partial	~~Second grade students at the novice level in mathematics read a pictograph. They conduct simple probability experiments. They organize data into a table or bar graph.~~Second grade students at the novice level in mathematics:

~~likely to occur if the experiment is repeated, present and justify the results. They formulate questions, collect data, organize and display data in a chart, table, or bar graph and justify results to the class.~~Second grade students at the distinguished level in mathematics: create, read, and interpret pictographs with each picture representing greater than a single unit and present their findings; formulate questions, collect, organize, and display data as a chart, table, or bar graph and present their findings; analyze data represented on a graph and formulate questions that can be answered by the graph; conduct experiments with more than two outcomes, organize, display, and present the data, and use the data to predict outcomes if the experiment is repeated.	~~likely to occur if the experiment is repeated and present the results. They formulate questions, collect data, organize and display data in a chart, table, or bar graph and present the information to the class in oral form.~~Second grade students at the above mastery level in mathematics: create, read, and interpret pictographs with each picture representing greater than or equal to a single unit; formulate questions, collect, organize, and display data as a chart, table, or bar graph; analyze data represented on a graph and formulate questions that can be answered by the graph; conduct experiments with more than two outcomes, organize, display, and use the data to predict outcomes if the experiment is repeated.	~~They formulate questions, collect data, organize and display data in a chart, table or bar graph.~~Second grade students at the mastery level in mathematics: create, read, and interpret pictographs with each picture representing greater than or equal to a single unit; formulate questions, collect, organize, and display data as a chart, table, or bar graph and analyze data represented on a graph; conduct simple probability experiments with two or more outcomes and use the data to predict outcomes if the experiment is repeated.	mastery level in mathematics: create, read, and interpret pictographs with each picture representing a single unit; organize and display data as a chart, table, or bar graph and analyze data represented on a graph; conduct simple probability experiments with two or more outcomes and record the data.	read and interpret pictographs with each picture representing a single unit; display data as a chart, table, or bar graph and analyze data represented on a graph; conduct simple probability experiments with two outcomes and record the data.

Objectives	Students will
M.O.2.5.1	create, read, and interpret a pictograph with each picture representing greater than or equal to a single unit.
M.O.2.5.2	conduct simple experiments with more than two outcomes and use the data to predict which event is more, less, or equally likely to

	occur if the experiment is repeated.
M.O.2.5.3	analyze data represented on a graph using grade-appropriate questions.
M.O.2.5.4	formulate questions, collect data, organize and display as a chart, table or bar graph.

Third Grade Mathematics Content Standards and Objectives

Third grade objectives extend the students' mathematical skills and concepts through concrete experiences and appropriate technology. These concepts and operations include: whole number operations; comparing and ordering numbers to hundredths and ten thousands; fractions and decimals; recall of multiplication facts with corresponding division facts. Additional concepts include gathering and organizing data, estimating and performing measurements. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 3	Mathematics
Standard 1	Number and Operations
M.S.3.1	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of numbers, ways of representing numbers, and relationships among numbers and number systems, • demonstrate meanings of operations and how they relate to one another, and • compute fluently and make reasonable estimates.

Performance Descriptors (M.PD.3.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Third grade students at the distinguished level in mathematics read, write, order, and compare whole numbers and decimals using symbolic representations. They identify place value of each digit utilizing standard and expanded form to 1,000,000. They apply estimation skills (rounding, benchmarks, compatible numbers) to solve and evaluate reasonableness of an answer. They use symbolic representations to compare fractions as parts of a whole and part of a set,~~	~~Third grade students at the above mastery level in mathematics read, write, order, and compare whole numbers and decimals using manipulatives and number lines. They identify place value of each digit utilizing standard and expanded form to 100,000. They apply estimation skills (rounding, benchmarks, compatible numbers) to solve and evaluate reasonableness of an answer. They use pictorials and symbolic representations to compare fractions as parts of a whole~~	~~Third grade students at the mastery level in mathematics read, write, order and compare whole numbers and decimals using manipulatives. They identify place value of each digit utilizing standard and expanded form to 10,000. They apply estimation skills (rounding, benchmarks, compatible numbers) to solve and evaluate reasonableness of an answer. They use concrete models and pictorial representations to represent fractions as part of a whole and part of a set, to~~	~~Third grade students at the partial mastery level in mathematics identify whole numbers and decimals. They identify place value of each digit utilizing standard and expanded form to 1,000. They apply estimation skills (rounding, benchmarks, compatible numbers) to evaluate reasonableness of an answer. They identify fractions as part of a whole and parts of set, and add and subtract fractions with like denominators less than 10. They perform basic computation with 2-digit~~	~~Third grade students at the novice level in mathematics recognize whole numbers and decimals. They identify place value of each digit utilizing standard form to 1,000. They apply estimation skills (benchmarks, compatible numbers) evaluate reasonableness of an answer. They recognize fractions as parts of a whole and parts of a set. They recognize basic operations as they relate to whole numbers. They identify the operation necessary to solve grade-appropriate~~

~~to compare and order fractions, and to add and subtract fractions with like denominators. They justify procedures used to perform basic computation with addition, subtraction, multiplication and division. They create and analyze grade-appropriate real-world problems justifying the solution and processes in clear, concise manner.~~Third grade students at the distinguished level in mathematics: read, write (standard and expanded form), order, compare numbers beyond 10,000; model, read, write, order, compare decimals to hundredths; estimate to solve problems and to evaluate and justify reasonableness of answers; represent proper and improper fractions and mixed numbers, compare, order, and find equivalent fractions; add and subtract fractions with like denominators with or without models or pictures; add and subtract whole	~~and part of a set, to compare and order fractions and to add and subtract fractions with like denominators. They explain procedures used to perform basic computation with addition, subtraction, multiplication and division. They create grade-appropriate real-world problems justifying the reasoning and procedures.~~Third grade students at the above mastery level in mathematics: read, write (standard and expanded form), order, compare numbers to 10,000; model, read, write, order, compare decimals to hundredths; estimate to solve problems and to evaluate and justify reasonableness of answers; use models or pictures to represent proper and improper fractions and mixed numbers, to compare, order, and find equivalent fractions; add and subtract fractions with like denominators;	~~compare and order fractions, and to add and subtract fractions. They perform basic computation with addition, subtraction, multiplication of multi-digit numbers and division of a multi-digit number by a single digit number. They create grade-appropriate real-world problems, justifying the reasoning and procedures selected.~~Third grade students at the mastery level in mathematics: read, write (standard and expanded form), order, compare numbers to 10,000; model, read, write, order, compare decimals to hundredths; estimate to solve problems and to evaluate reasonableness of answers; use models and pictures to represent proper and improper fractions and mixed numbers, to compare, order, and find equivalent fractions; add and subtract fractions with like denominators; add and subtract two- and	~~addition, subtraction and multiplication and division of a 2-digit number by a 1-digit number. They solve grade-appropriate real-world problems.~~Third grade students at the partial mastery level in mathematics: read, write (standard form), order, compare numbers to 10,000; model, read, and write decimals to hundredths; estimate sums and differences; use models and pictures to represent fractions and mixed numbers, to compare fractions, to find equivalent fractions, and to add and subtract fractions with like denominators; add and subtract two-digit numbers with regrouping and three-digit numbers without regrouping and money; model multiplication and division of two-digit	~~real-world problems.~~Third grade students at the novice level in mathematics: read and write (standard form) numbers to 10,000; model, read, and write decimals to tenths; estimate sums and differences; use models to represent fractions and mixed numbers, to find equivalent fractions, and to add and subtract fractions with like denominators; add and subtract two- and three-digit numbers without regrouping; model multiplication and division of two-digit numbers by one-digit numbers; recall some multiplication

numbers and money and explain procedures used with and without regrouping; model and explain multiplication and division of three-digit numbers by one-digit numbers using clear mathematical language; demonstrate quick recall of multiplication/ division facts; use and explain number properties; model the distributive property; create and solve real-world problems, justify/present solutions.	add and subtract three-digit numbers and money and explain procedures used with and without regrouping model and explain multiplication and division of three-digit numbers by one-digit numbers; recall basic multiplication and division facts; use and explain number properties; model the distributive property; create and solve real-world problems, justify reasoning, present solutions.	three-digit numbers with and without regrouping and money; model multiplication and division of two- and three-digit numbers by one-digit numbers; recall basic multiplication and division facts; use and explain number properties; model the distributive property; create and solve real-world problems, justify reasoning when presenting solutions.	numbers by one-digit numbers; recall some multiplication and division facts; use number properties; model distributive property; solve real-world problems, justify reasoning when presenting solutions.	and division facts; use number properties; solve real-world problems and present solutions

Objectives	Students will
M.O.3.1.1	read, write, order, and compare numbers to 10,000 using a variety of strategies (e.g., symbols, manipulatives, number line).
M.O.3.1.2	read, write, order, and compare decimals to hundredths, with manipulatives.
M.O.3.1.3	identify place value of each digit utilizing standard and expanded form to 10,000.
M.O.3.1.4	apply estimation skills (rounding, benchmarks, compatible numbers) to solve and evaluate reasonableness of an answer.
M.O.3.1.5	demonstrate an understanding of fractions as part of a whole/one and as part of a set/group using models and pictorial representations.
M.O.3.1.6	create concrete models and pictorial representations to • compare and order fractions with like and unlike denominators, • add and subtract fractions with like denominators, and verify results.
M.O.3.1.7	use concrete models and pictorial representations to demonstrate an understanding of equivalent fractions, proper and improper fractions, and mixed numbers.
M.O.3.1.8	add and subtract 2- and 3-digit whole numbers and money with and without regrouping.
M.O.3.1.9	demonstrate and model multiplication (repeated addition, arrays) and division (repeated subtraction, partitioning).
M.O.3.1.10	use and explain the operations of multiplication and division including the properties (e.g., identity element of multiplication, commutative property, property of zero, associative property, inverse operations).

M.O.3.1.11	recall basic multiplication facts and the corresponding division facts.
M.O.3.1.12	model the distributive property in multiplication of 2- and 3-digit numbers by a 1-digit number.
M.O.3.1.13	use models to demonstrate division of 2- and 3-digit numbers by a 1-digit number.
M.O.3.1.14	create grade-appropriate real-world problems involving any of the four operations using multiple strategies, explain the reasoning used, and justify the procedures selected when presenting solutions.

Grade 3	**Mathematics**
Standard 2	Algebra
M.S.3.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD.3.2)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Third grade students at the distinguished level in mathematics analyze and extend geometric and numeric patterns, defending their mathematical reasoning in a clear and succinct manner. They use symbol and letter variables to represent an unknown quantity and determine the value of the variable and justify results.~~Third grade students at the distinguished level in mathematics: create, analyze, extend, and explain geometric and numeric patterns; create an input/output model using any operation;	~~Third grade students at the above mastery level in mathematics analyze and, extend geometric and numeric patterns, justifying their reasoning. They determine the rule which uses two operations when given the input/output. They solve equations and expressions with variables justifying their reasoning. They use symbol and letter variables to represent an unknown quantity and determine the value of the variable and verify the results.~~Third grade students at the above mastery level in mathematics: analyze, extend, and explain geometric and	~~Third grade students at the mastery level in mathematics analyze and extend geometric and numeric patterns. They create an input/output model using addition, subtraction, multiplication and division. They analyze patterns and write rules to represent the pattern. They write equivalent numerical expressions and justify equivalency. They use symbol and letter variables to represent an unknown quantity and determine the value of the variable.~~Third grade students at the mastery level in mathematics: analyze and extend	~~Third grade students at the partial mastery level in mathematics interpret and complete geometric and numeric patterns. They use simple input/output models with rules for addition, subtraction and multiplication. They identify equivalent numerical expressions and recognize that a variable represents an unknown quantity. They use symbol and letter variables to represent an unknown quantity.~~Third grade students at the partial mastery level in mathematics: extend geometric and numeric patterns;	~~Third grade students at the novice level in mathematics reproduce geometric and numeric patterns. They identify input/out models with rules for addition and subtraction. They recognize numerical expressions and variables. They recognize that variables represent an unknown quantity.~~Third grade students at the novice level in mathematics: extend simple geometric and numeric patterns; find the output when given the input using any operation;

analyze and create patterns and write the rule using a variable; write and justify equivalent numerical expressions in real world situations; use a variable to represent an unknown quantity; determine the value of the variable in a problem-solving situation.	numeric patterns; create an input/output model using any operation; analyze and create patterns and write the rule; write and justify equivalent numerical expressions; use a variable to represent an unknown quantity; determine the value of the variable.	geometric and numeric patterns; create an input/output model using any operation; analyze a given pattern and write the rule; write and justify equivalent numerical expressions; use a variable to represent an unknown quantity; determine the value of the variable.	complete an input/output model using any operation; write the rule for a given pattern; model and write equivalent numerical expressions; determine the value of a variable in a given number sentence.	determine the rule for a given pattern; model and write equivalent numerical expressions; determine the value of a variable in a given number sentence.

Objectives	Students will
M.O.3.2.1	analyze and extend geometric and numeric patterns.
M.O.3.2.2	create an input/output model using addition, subtraction, multiplication or division.
M.O.3.2.3	analyze a given pattern and write the rule.
M.O.3.2.4	write equivalent numerical expressions and justify equivalency.
M.O.3.2.5	use symbol and letter variables to represent an unknown quantity and determine the value of the variable.

Grade 3	**Mathematics**
Standard 3	Geometry
M.S.3.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformations and use symmetry to analyze mathematical situations, and • solve problems using visualization, spatial reasoning, and geometric modeling.

Performance Descriptors (M.PD.3.3)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Third grade students at the distinguished level in~~	~~Third grade students at the above mastery level in~~	~~Third grade students at the mastery level in~~	~~Third grade students at the partial mastery level in~~	~~Third grade students at the novice level in mathematics~~

~~mathematics identify, create, and analyze new polygons by transforming, combining and decomposing polygons. They communicate their understanding of polygons in a clear and concise manner. They construct and identify a solid figure from a plane drawing and communicate their understanding. They create a two-dimensional design with one line of symmetry. They model, describe, draw and analyze lines, rays and angles; they communicate their mathematical understanding in a clear and concise manner. They name the location of a point on a first-quadrant grid and compare its location to another point.~~Third grade students at the distinguished level in mathematics: identify, compare, contrast, combine, decompose, and draw transformations of polygons; identify, describe, compare, contrast, classify solids by faces, edges, and vertices; construct and identify a solid from a plane drawing;	~~mathematics identify, create, and analyze new polygons by transforming, combining and decomposing polygons. They construct, identify and analyze solid figures from a plane drawing. They identify, describe and draw lines of symmetry in two-dimensional shapes. They model, describe, draw and analyze lines, rays, and angles. They draw and describe examples of transformations. They name the location of a point on a first-quadrant grid using ordered pairs and describe how to determine ordered pairs.~~Third grade students at the above mastery level in mathematics: identify, compare, combine, decompose, and draw transformations of polygons; identify, describe, compare, and classify solids by faces, edges, and vertices; construct and identify a solid from a plane drawing; identify, describe, and draw lines of symmetry;	~~mathematics identify and create new polygons by transforming, combining and decomposing polygons. They classify geometric solids according to attributes. They construct and identify a solid figure from a plane drawing. They identify, describe and draw lines of symmetry in two-dimensional shapes. They model, describe, and draw lines, rays and angles. They draw an example of transformations. They name the location of a point on a first-quadrant grid using ordered pairs.~~Third grade students at the mastery level in mathematics: identify, combine, decompose, and draw transformations of polygons; identify, describe, and classify solids by faces, edges, and vertices; construct and identify a solid from a plane drawing; identify, describe, and draw lines of symmetry; model, describe, and draw lines, rays, and angles;	~~mathematics create new polygons by transforming and combining polygons. They describe geometric solids. They construct and identify a solid figure from a plane drawing. They identify and draw lines of symmetry in two-dimensional shapes. They identify and draw lines, rays, and angles. They identify the type of transformation. They identify points on the first-quadrant grid.~~Third grade students at the partial mastery level in mathematics: identify and draw transformations of polygons; identify and describe solids according to faces, edges, and vertices; construct a solid figure from a plane drawing; identify and draw lines of symmetry; model and draw lines, rays, and angles; match a point with the ordered pair describing its	~~recognize polygons. They recognize geometric solids. They construct and identify a solid figure from a plane drawing. They identify lines of symmetry in two-dimensional shapes. They identify lines, rays and angles. They recognize transformations. They recognize a point on the first-quadrant grid.~~Third grade students at the novice level in mathematics: identify polygons and model transformations; identify and describe solids according to faces; construct a solid figure from a plane drawing; identify lines of symmetry; model lines, rays, and angles; match a point with the ordered pair describing its location on a first-quadrant grid.

create designs with lines of symmetry; model, describe, draw, and classify lines, rays, and angles; name points using ordered pairs; plot points when given coordinates on a first-quadrant grid.	model, describe, draw, and classify lines, rays, and angles; name and write location of points using ordered pairs on a first-quadrant grid.	name the location of a point using ordered pairs on a first-quadrant grid.	location on a first-quadrant grid.	

Objectives	Students will
M.O.3.3.1	identify and create new polygons by transforming, combining and decomposing polygons.
M.O.3.3.2	identify, describe, and classify the following geometric solids according to the number of faces, edges, and vertices: • cube • rectangular solid • cylinder • cone • pyramid
M.O.3.3.3	construct and identify a solid figure from a plane drawing.
M.O.3.3.4	identify, describe and draw lines of symmetry in two-dimensional shapes.
M.O.3.3.5	model, describe, and draw • lines • rays • angles including right, obtuse, and acute angles.
M.O.3.3.6	draw an example of a flip, slide and turn (reflection, translation, and rotation) given a model.
M.O.3.3.7	name the location of a point on a first-quadrant grid, represent using ordered pairs.

Grade 3	Mathematics
Standard 4	Measurement
M.S.3.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of measurable attributes of objects and the units, systems, and processes of measurement, and • apply appropriate techniques, tools and formulas to determine measurements.

Performance Descriptors (M.PD.3.4)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Third grade students at the distinguished level in~~	~~Third grade students at the above mastery level in~~	~~Third grade students at the mastery level in~~	~~Third grade students at the partial mastery level in~~	~~Third grade students at the novice level in mathematics~~

~~mathematics within a project based investigation, identify a real life situation, consider a number of variables and use appropriate measurement tools, overtime, make a hypothesis as to the change overtime; with more precision than whole units; and design and implement a method to collect, organize, and analyze data; analyze results to defend a conclusion; evaluate the validity of the hypothesis upon collected data; design a mode of presentation (with and without technology) They communicate their understanding of perimeter and area in a clear and concise manner. They create real-world problems using time, including elapsed time (am and pm), and money. They identify, count, organize and solve real-world problems related to money up to $100 and communicate their understanding of money in a concise manner.~~Third grade students at the distinguished level in mathematics: design and implement a measurement project; make	~~mathematics within a project based investigation, identify a real life situation, consider a number of variables and use appropriate measurement tools, overtime, make a hypothesis as to the change overtime; with more precision than whole units; and design and implement a method to collect, organize, and analyze data; analyze results to make a conclusion; evaluate the validity of the hypothesis upon collected data; design a mode of presentation (with and without technology) They describe how to find the perimeter and area of familiar shapes. They describe how to use an analog clock to tell time in five-minute intervals (am and pm) and how to compute elapsed time to the quarter-hour using a clock. They identify, count, organize and solve real-world problems related to money up to $100.~~Third grade students at the above mastery level in mathematics: design and implement a measurement project; make and test a hypothesis;	~~mathematics within a project based investigation, identify a real life situation, consider a number of variables and use appropriate measurement tools, overtime, make a hypothesis as to the change overtime; with more precision than whole units; and design and implement a method to collect, organize, and analyze data; analyze results to make a conclusion; evaluate the validity of the hypothesis upon collected data; design a mode of presentation (with and without technology) They estimate and find the perimeter and area of familiar geometric shapes. They read time to five minute intervals (am and pm) and compute elapsed time to the quarter-hour using a clock. They identify, count and organize coins and bills to display a variety of price values to $100 and make change.~~Third grade students at the mastery level in mathematics: design and implement a measurement project; make and test a hypothesis; collect, organize, analyze data; present results;	~~mathematics within a project based investigation, identify a real life situation, consider a number of variables and use appropriate measurement tools, overtime, make a hypothesis as to the change overtime; with more precision than whole units; and design and implement a method to collect, organize, and analyze data; analyze results to make a conclusion. They use concrete models to determine the perimeter and area of a given rectangle. They read time to the quarter of an hour and compute elapsed time to the half-hour using a clock. They use concrete models to count money to $100 and make change to $10.~~Third grade students at the partial mastery level in mathematics: carry out a measurement project; make and test a hypothesis; collect, organize, analyze data; present results; find perimeter; use models to determine the formula for area of a	~~within a project based investigation, identify a real life situation, consider a number of variables and use appropriate measurement tools, overtime, make a hypothesis as to the change overtime; with more precision than whole units; and implement a method to collect, organize, and analyze data; They use a concrete model to find the perimeter of a given rectangle. They read time on a digital clock compute elapsed time to the hour using a clock. They use concrete models to count money to $10 and make change to $1.~~Third grade students at the novice level in mathematics: carry out a measurement project; collect, organize, and analyze data; present the results; find perimeter; use models to find the area of a rectangle; read time to 5-minute

and test a hypothesis; collect, organize, analyze data; present results ; estimate and find perimeter of real world objects; explain how the formula for area of rectangles relates to arrays; read time to the minute; compute elapsed time to the quarter hour; identify, count, and organize coins and bills to show prices up to $100; make change using the fewest possible coins and bills.	collect, organize, analyze data; present results; estimate and find perimeter; use models to determine and explain the formula for area of a rectangle; read time to 5-minute intervals; compute elapsed time to the quarter hour; identify, count, and organize coins and bills to show prices up to $100; model making change.	estimate and find perimeter; use models to determine and explain the formula for area of a rectangle; read time to 5-minute intervals; compute elapsed time to the quarter hour; identify, count, and organize coins and bills to show prices up to $100; model making change.	rectangle; read time to 5-minute intervals; compute elapsed time to the half hour; identify, count, and organize coins and bills to show prices up to $10; model making change.	intervals; identify, count, and organize coins and bills to show prices up to $10; model making change.

Objectives	Students will
M.O.3.4.1	Within a project based investigation, identify a real life situation, consider a number of variables and use appropriate measurement tools, overtime, make a hypothesis as to the change overtime; with more precision than whole units; • length in centimeters and inches, • temperature in Celsius and Fahrenheit • weight/mass in pounds and kilograms, and design and implement a method to collect, organize, and analyze data; analyze results to make a conclusion; evaluate the validity of the hypothesis upon collected data; design a mode of presentation (with and without technology)
M.O.3.4.2	estimate and find the perimeter and area of familiar geometric shapes, using manipulatives, grids, or appropriate measuring tools.
M.O.3.4.3	determine the formula the area of a rectangle and explain reasoning through modeling.
M.O.3.4.4	read time to 5-minute intervals (am and pm) using analog and digital clocks, compute elapsed time to the quarter-hour using a clock.
M.O.3.4.5	identify, count and organize coins and bills to display a variety of price values from real-life examples with a total value of $100 or less and model making change using manipulatives.

Standard 5	Data Analysis and Probability
M.S.3.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.

Performance Descriptors (M.PD.3.5)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Third grade students at the distinguished level in mathematics collect, organize, and analyze grade-appropriate real-world data. They communicate their findings in oral and written form. They compare and construct multiple representations of data. They make predictions based on the results of probability experiments and justify their predictions in a succinct manner. They develop grade-appropriate questions to analyze real-world data.~~Third grade students at the distinguished level in mathematics: collect and organize real-world data; identify and construct appropriate ways to display data; analyze data from graphs and communicate findings using concise mathematical language;	~~Third grade students at the above mastery level in mathematics collect, organize, and analyze grade-appropriate real-world data. They identify, construct, and interpret appropriate displays for data. They make predictions based on the results of probability experiments. They evaluate grade-appropriate questions used to analyze real-world data.~~Third grade students at the above mastery level in mathematics: collect and organize real-world data; identify and construct appropriate ways to display data; analyze data from graphs and communicate findings; develop and conduct experiments to determine the likeliness of events; list all outcomes.	~~Third grade students at the mastery level in mathematics collect and organize grade-appropriate real-world data. They identify and construct appropriate displays for the data. They develop and conduct experiments using concrete objects to determine the likeliness of events and list all outcomes. They analyze real-world data with appropriate grade-appropriate questions.~~Third grade students at the mastery level in mathematics: collect and organize real-world data; identify and construct appropriate ways to display data; analyze data from graphs; develop and conduct experiments to determine the likeliness of events; list	~~Third grade students at the partial mastery level in mathematics organize a given set of data. They use given data from a probability experiment to show likeliness of outcomes. They answer questions using a given graph.~~Third grade students at the partial mastery level in mathematics: collect, organize, and construct displays of real-world data; analyze data from graphs; conduct experiments to determine the likeliness of events; list all outcomes.	~~Third grade students at the novice level in mathematics use a given form to make a graph of given data. They list outcomes of a probability experiment. They identify important information on a given graph.~~Third grade students at the novice level in mathematics: collect, organize, and display real-world data; analyze data from graphs; conduct experiments to determine the likeliness of events; list outcomes.

develop, predict and conduct experiments to determine the likeliness of events; list all outcomes.		all outcomes.		

Objectives	Students will
M.O.3.5.1	collect and organize grade-appropriate real-world data from observation, surveys, and experiments, and identify and construct appropriate ways to display data.
M.O.3.5.2	develop and conduct grade-appropriate experiments using concrete objects (e.g. counters, number cubes, spinners) to determine the likeliness of events and list all outcomes.
M.O.3.5.3	analyze real-world data represented on a graph using grade-appropriate questions.

Fourth Grade Mathematics Content Standards and Objectives

Fourth grade objectives emphasize critical thinking skills to create independent problem solvers who possess a personalized set of skills and strategies to solve problems in everyday life. Concepts which are stressed include: quick recall of multiplication and corresponding division facts, multiplication and division of two-and three-digit numbers, construction and description of objects from different perspectives, plotting points in quadrant one of a coordinate plane, estimation, reading temperatures, description of possible outcomes in a given situation, use of calculators and computers, and describing mathematical relationships and patterns in other content areas and the real-world. Additional concepts targeted include adding and subtracting like fractions, and adding and subtracting decimals. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 4	**Mathematics**			
Standard 1	Number and Operations			
M.S.4.1	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of numbers, ways of representing numbers, and relationships among numbers and number systems, • demonstrate meanings of operations and how they relate to one another, and • compute fluently and make reasonable estimates.			
Performance Descriptors (M.PD.4.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Fourth grade students at the distinguished level in mathematics read, write, order, compare and contrast whole numbers to the millions place and decimals to the thousandths place using a variety of methods. They further analyze how this can be used in a contextual situation. They create and critique problems and demonstrate an understanding of place value of each digit utilizing standard and expanded form. They design~~	~~Fourth grade students at the above mastery level in mathematics read, write, order, and compare and contrast whole numbers to the millions place and decimals to the thousandths place using a variety of methods. They create problems and demonstrate an understanding of place value of each digit utilizing standard and expanded form. They estimate solutions and evaluate the reasonableness of the solution and then justify the~~	~~Fourth grade students at the mastery level in mathematics read, write, order, and compare whole numbers to the millions place and decimals to the thousandths place using a variety of methods. They demonstrate an understanding of place value of each digit utilizing standard and expanded form. They estimate solutions and evaluate the reasonableness of that solution and then justify the results. They use concrete~~	~~Fourth grade students at the partial mastery level in mathematics read, write, order, and compare whole numbers to the millions place and decimals to the thousandths place using any method. They identify an understanding of place value of each digit utilizing standard and expanded form. They examine solutions and identify the reasonableness of that solution and then explain the results. They use concrete models,~~	~~Fourth grade students at the novice level in mathematics read and write whole numbers to the millions place and decimals to the thousandths place using any method. They recognize place value of each digit utilizing standard and expanded form. They state solutions and describe the reasonableness of the solution and recite the results. They use concrete models, benchmark fractions and number lines to recognize fractions as~~

~~problems and then estimate the solutions and evaluate the reasonableness of that solution. They justify the results in a computational and real-world situation. They use concrete models, benchmark fractions and number lines to compare, order and model fractions as well as perform operations on fractions. They relate this to real-world situations. They analyze and summarize the relationship of fractions to decimals and communicate this relationship. They investigate various methods and justify the use of the standard algorithm to solve multi-digit whole number multiplication problems and then apply to a real-world problem. They demonstrate quick recall of basic multiplication facts and corresponding division facts and apply this recall to construct real-world problems. They create and critique grade-appropriate real-world story problems using multiple strategies, justify the reason for choosing a strategy and interpret and communicate results.~~Fourth grade students at the distinguished level in	~~results in a computational and real-world situation. They use concrete models, benchmark fractions and number lines to compare, order and model fractions as well as perform operations on fractions. They analyze the relationship of fractions to decimals and communicate this relationship. They investigate various strategies and justify the use of the standard algorithm to solve multi-digit whole number multiplication problems. They have quick recall of basic multiplication facts and corresponding division facts and apply this recall to real-world situations. They create and critique grade-appropriate real-world story problems using multiple strategies, justify the reason for choosing a strategy and communicate results.~~Fourth grade students at the above mastery level in mathematics: demonstrate an understanding of whole numbers, decimals, and fractions, place value, standard and expanded form using a variety of methods;	~~models, benchmark fractions and number lines to compare and order fractions as well as perform operations on fractions. They analyze the relationship of fractions to decimals. They justify various methods including the standard algorithm to solve multi-digit whole number multiplication problems. They have quick recall of basic multiplication facts and corresponding division facts. They create grade-appropriate real-world story problems using multiple strategies, justify the reason for choosing a strategy and communicate results.~~Fourth grade students at the mastery level in mathematics: demonstrate an understanding of whole numbers, decimals, and fractions, place value, standard and expanded form using a variety of methods; evaluate, estimate, and solve real world problems justifying the reasonableness of a solution;	~~benchmark fractions and number lines to identify fractions as well as perform operations on fractions. They identify the relationship of fractions to decimals. They use various methods including the standard algorithm to solve multi-digit whole number multiplication problems. They recall basic multiplication facts and corresponding division facts. They apply grade-appropriate real-world story problems using multiple strategies, recognize the reason for choosing a strategy and communicate results.~~Fourth grade students at the partial mastery level in mathematics: demonstrate an understanding of whole numbers, decimals, and fractions, identify place value, standard and expanded form using any method; examine solutions of real world problems and explain the results;	~~well as perform operations on fractions. They recognize the relationship of fractions to decimals. They recognize the standard algorithm to solve multi-digit whole number multiplication problems. They find basic multiplication facts and corresponding division facts using a hundreds chart. They identify grade-appropriate real-world story problems using any strategy, and communicate results.~~Fourth grade students at the novice level in mathematics: demonstrate an understanding of whole numbers, decimals, and fractions, recognize place value, standard, and expanded form using any method; state and solve real world problems and recite the results; identify real-world story problems and communicate results.

mathematics: demonstrate an understanding of whole numbers, decimals, and fractions, place value, standard and expanded form using a variety of methods, justify method used; design and critique real world problems justifying the reasonableness of a solution; create and critique real world story problems using multiple strategies and communicate the results using clear and concise mathematical language.	create and demonstrate real world problems justifying the reasonableness of a solution; create and critique real world story problems using multiple strategies and communicate the results.	create real-world story problems using multiple strategies and communicate the results.	apply multiple strategies to solve real-world story problems and communicate the results.	

Objectives	Students will
M.O.4.1.1	read, write, order, and compare whole numbers to the millions place and decimals to thousandths place using a variety of strategies (e.g. symbols, manipulatives, number line, pictorial representations).
M.O.4.1.2	demonstrate an understanding of the place value of each digit utilizing standard and expanded form through 1,000,000 with multiples of 10 [(5 X 10,000) + (3 X 1,000) + (4 X 10) + 2].
M.O.4.1.3	estimate solutions to problems including rounding, benchmarks, compatible numbers and evaluate the reasonableness of the solution, justify results.
M.O.4.1.4	using concrete models, benchmark fractions, number line • compare and order fractions with like and unlike denominators • add and subtract fractions with like and unlike denominators • model equivalent fractions • model addition and subtraction of mixed numbers with and without regrouping.
M.O.4.1.5	analyze the relationship of fractions to decimals using concrete objects and pictorial representations.
M.O.4.1.6	round decimals to the nearest whole, 10th, or 100th place.
M.O.4.1.7	add and subtract whole numbers(up to five –digit number) and decimals to the 1000th place, multiply (up to three digits by two-digits, and divide(up to a three digit number with a one and two-digit number) .

M.O.4.1.8	solve multi-digit whole number multiplication problems using a variety of strategies, including the standard algorithm, justify methods used.
M.O.4.1.9	quick recall of basic multiplication facts and corresponding division facts.
M.O.4.1.10	create grade-level real-world appropriate story problems using multiple strategies including simple ratios, justify the reason for choosing a particular strategy and present results.

Grade 4	Mathematics
Standard 2	Algebra
M.S.4.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD.4.2)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Fourth grade students at the distinguished level in mathematics determine and analyze the rule given an input-output model and explain how change in one variable relates to the change in the second variable. They construct input-output tables of their own and state the rule. They recognize, describe, and analyze relationships in which quantities change proportionally. They create relationships in which quantities change proportionally. They create real-world problems that contain variables. They represent the idea of a variable and write an expression using a variable~~	~~Fourth grade students at the above mastery level in mathematics determine and analyze the rule given an input-output model and explain how change in one variable relates to the change in the second variable. They find other values. They recognize, describe, and analyze relationships in which quantities change proportionally. They represent the idea of a variable and write an expression using a variable to describe a real-world situation and then evaluate that expression. They create and solve real-world problems involving order of operations.~~Fourth grade	~~Fourth grade students at the mastery level in mathematics determine the rule given an input-output model and explain how change in one variable relates to the change in the second variable. They recognize and describe relationships in which quantities change proportionally. They represent the idea of a variable and write an expression using a variable to describe a real-world situation. They solve real-world problems involving order of operations including grouping and the four operations.~~Fourth grade students at the mastery level in	~~Fourth grade students at the partial mastery level identify the rule given an input-output model and recognize how change in one variable relates to the change in the second variable. They recognize relationships in which quantities change proportionally. They identify the idea of a variable and apply an expression using a variable to solve a real-world situation. They describe real-world problems involving order of operations with no group symbols and the four operations.~~Fourth grade students at the partial mastery level in mathematics:	~~Fourth grade students at the novice level recite the rule given an input-output model. They recognize relationships in which quantities change proportionally. They identify the idea of a variable and apply an expression using a variable to describe a real-world situation. They describe real-world problems involving order of operations with two operations.~~Fourth grade students at the novice level in mathematics: recite the rule for one operation variables;

~~to describe that problem and then evaluate that expression. They create and solve real-world problems involving order of operations with variables.~~Fourth grade students at the distinguished level in mathematics: determine and analyze the rule for variables using two operations; write and evaluate an expression, using a variable to solve a real-world situation and justify the process; create and solve real-world problems involving order of operations with variables.	students at the above level mastery in mathematics: determine and analyze the rule for variables using two operations; write and evaluate an expression, using a variable to solve a real-world situation; create and solve real-world problems involving order of operations.	mathematics: determine the rule for variables using two operations; write an expression, using a variable, to describe a real-world situation; solve real-world problems involving order of operations.	identify the rule for two operation variables; apply an expression, using a variable, to describe a real-world situation; describe real-world problems involving order of operations.	select an expression, using a variable, to describe a situation; describe problems involving order of operations.

Objectives	Students will
M.O.4.2.1	determine the rule and explain how change in one variable relates to the change in the second variable, given an input/output model using two operations.
M.O.4.2.2	recognize and describe relationships in which quantities change proportionally.
M.O.4.2.3	represent the idea of a variable as an unknown quantity using a letter, write an expression using a variable to describe a real-world situation.
M.O.4.2.4	solve real-world problems involving order of operations including grouping symbols and the four operations,

Grade 4	**Mathematics**
Standard 3	Geometry
M.S.4.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformations and use symmetry to analyze mathematical situations, and

	• solve problems using visualization, spatial reasoning, and geometric modeling.

Performance Descriptors (M.PD.4.3)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Fourth grade students at the distinguished level in mathematics identify, classify, compare and contrast and construct two-dimensional and three-dimensional geometric figures and use these figures in real-world problems. They recognize, describe, draw and analyze three-dimensional objects from different perspectives. They construct figures with lines and angles and identify, draw, label, compare and contrast and classify the lines and angles. They explore the relationships between properties of angles and lines. They identify and create a two-dimensional design with one or more lines of symmetry and analyze the relationship between lines of symmetry and number of sides of polygons. They graph ordered pairs on a first-quadrant grid, use the coordinate system to investigate the relationship between ordered pairs on the coordinate plane. They draw, identify and explore~~	~~Fourth grade students at the above mastery level in mathematics identify, classify, compare and contrast two-dimensional and three-dimensional geometric figures and use these figures to in real-world problems. They recognize, describe, and draw three-dimensional objects from different perspectives. They construct figures with lines and angles and then identify, draw, label, compare and contrast and classify the lines and angles. They identify and create a two-dimensional design with one or more lines of symmetry. They graph ordered pairs on a first-quadrant grid, use the coordinate system. They investigate the relationship between ordered pairs on a one-quadrant grid. They draw, identify and recognize the relationship between the parts of a circle. They select, analyze, and justify appropriate use of transformations to solve geometry problems. They create transformations.~~Fourth	~~Fourth grade students at the mastery level in mathematics identify, classify and compare and contrast two-dimensional and three-dimensional geometric figures. They recognize and describe three-dimensional objects from different perspectives. They identify, draw, label, compare and contrast and classify lines and angles. They identify and create a two-dimensional design with one line of symmetry. They graph ordered pairs on a first-quadrant grid and use the coordinate system. They draw and identify parts of a circle. They select, analyze, and justify appropriate use of transformations to solve geometry problems.~~Fourth grade students at the mastery level in mathematics: identify, classify, compare/contrast, recognize and describe two- and three-dimensional geometric figures by attributes and different perspectives;	~~Fourth grade students at the partial mastery level in mathematics identify and classify two-dimensional and three-dimensional geometric figures. They recognize three-dimensional objects from different perspectives. They identify, draw, and label lines and angles. They identify a two-dimensional design with one line of symmetry. They graph ordered pairs on a first-quadrant grid and identify the coordinate system. They identify parts of a circle. They select and justify appropriate use of transformations to solve geometry problems.~~Fourth grade students at the partial mastery level in mathematics: identify, classify, and recognize two- and three-dimensional geometric figures by attributes and different perspectives; identify, draw, and label lines, angles, one line of symmetry, and parts of a	~~Fourth grade students at the novice level in mathematics identify two-dimensional and three-dimensional geometric figures. They recognize three-dimensional objects. They will identify and label lines and angles. They describe a two-dimensional design with one line of symmetry. They locate ordered pairs on a first-quadrant grid. They identify parts of a circle given terms. They select appropriate use of transformations to solve geometry problems.~~Fourth grade students at the novice level in mathematics: identify and recognize two and three-dimensional geometric figures by attributes; identify and label lines, angles, one line of symmetry, and parts of a circle when given terms;

~~the relationship between the parts of a circle. They select, analyze, and justify appropriate use of transformations to solve geometry problems. They use transformations to create tessellations.~~ Fourth grade students at the distinguished level in mathematics: identify, classify, compare/contrast, construct, and analyze two- and three-dimensional geometric figures by attributes and different perspectives; construct figures and identify, draw, label, compare/contrast, and classify lines, angles, parts of a circle, and analyze the relationship between lines of symmetry and number of side of a polygon; graph ordered pairs on a first-quadrant grid and investigate the relationship between ordered pairs and the coordinate plane; select, analyze, and justify transformations to solve problems and use transformations to create tessellations.	grade students at the above mastery level in mathematics: identify, classify, compare/contrast, recognize, describe, and draw two- and three-dimensional geometric figures by attributes and different perspectives; construct figures and identify, draw, label, compare/contrast, and classify lines, angles, one or more lines of symmetry, and parts of a circle; graph ordered pairs on a first-quadrant grid and use the coordinate system; select, analyze, and justify use of transformations to solve problems and create transformations.	identify, draw, label, compare/contrast lines, angles, one line of symmetry and parts of a circle; graph ordered pairs on first-quadrant grid and use the coordinate system; select, analyze, and justify use of transformations to solve problems.	circle; graph ordered pairs on a first-quadrant grid and identify the coordinate system; select and justify use of transformations to solve problems.	locate ordered pairs on a first-quadrant grid; select use of transformations to solve problems.

Objectives	Students will
M.O.4.3.1	identify, classify, compare and contrast two-dimensional (including quadrilateral shapes) and three-dimensional geometric figures according to attributes.
M.O.4.3.2	recognize and describe three-dimensional objects from different perspectives.
M.O.4.3.3	identify, draw, label, compare and contrast, and classify • lines (intersecting, parallel, and perpendicular) • angles (acute, right, obtuse, and straight)
M.O.4.3.4	identify and create a two-dimensional design with one line of symmetry.
M.O.4.3.5	graph/plot ordered pairs on a first-quadrant grid and use the coordinate system to specify location and describe path.
M.O.4.3.6	draw and identify parts of a circle: center point, diameter, and radius.
M.O.4.3.7	select, analyze and justify appropriate use of transformations (translations, rotations, flips) to solve geometric problems including congruency and tiling (tessellations).

Grade 4	Mathematics
Standard 4	Measurement
M.S.4.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of measurable attributes of objects and the unites, systems, and processes of measurement, and • apply appropriate techniques, tools and formulas to determine measurements.

Performance Descriptors (M.PD.4.4)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Fourth grade students at the distinguished level in mathematics select appropriate measuring tools and justify the selection. They apply, convert and recognize the relationship between standard units within a system to estimate, measure, compare and order real-world measurements. They analyze, justify and communicate results both orally and in writing. They construct real-world problems involving area.~~	~~Fourth grade students at the above mastery level in mathematics select appropriate measuring tools and justify the selection; apply and convert standard units within a system to estimate; measure, compare, and order real-world measurements; and analyze, justify and communicate results both orally and written. They quantify area by finding the total number of same sized units that cover a shape, develop a rule and justify~~	~~Fourth grade students at the mastery level in mathematics select appropriate measuring tools, apply and convert standard units within a system to estimate, measure, compare, and order real-world measurements, and justify and present results. They quantify area by finding the total number of same sized units that cover a shape, develop a rule and justify the formula for the area of a rectangle using the area~~	~~Fourth grade students at the partial mastery level in mathematics discover appropriate measuring tools, apply standard units within a system to estimate, measure, compare, and order real-world measurements and justify results. They quantify area by finding the total number of same sized units that cover a shape, and explain the formula for the area of a rectangle using the area model representing multiplication. They read~~	~~Fourth grade students at the novice level in mathematics name appropriate measuring tools, identify standard units within a system to estimate and measure real-world measurements and describe results. They determine area by finding the total number of same sized units that cover a shape, They read time to the quarter hour and calculate elapsed time in hours/minutes within a 24 hour period using either~~

~~They quantify area by finding the total number of same sized units that cover a shape, develop a rule and justify the formula for the area of a rectangle using the area model representing multiplication. They read time to the minute, calculate elapsed time in hours/minutes within any given period and construct real-world problems involving elapsed time. They create problems that involve counting coins and bills and determining correct change and communicate both orally and in writing.~~Fourth grade students at the distinguished level in mathematics: estimate, measure, compare, and order real-world measurements, analyze, justify and communicate results ; develop and justify the formula for area of a rectangle using a variety of strategies; read time to the minute and calculate elapsed time of real world events;	~~the formula for the area of a rectangle using the area model representing multiplication. They read time to the minute and calculate elapsed time in hours/minutes within any given period. They create problems that involve counting coins and bills and determining correct change.~~Fourth grade students at the above mastery level in mathematics: estimate, measure, compare, and order real-world measurements, analyze, justify and communicate results; develop and justify the formula for area of a rectangle; read time to the minute and calculate elapsed time; create problems counting coins and bills and determine correct change.	~~model representing multiplication. They read time to the minute and calculate elapsed time in hours/minutes within a 24 hour period. They count coins and bills and determine correct change.~~Fourth grade students at the mastery level in mathematics: estimate, measure, compare, and order real-world measurements, justify and present results; develop and justify the formula for area of a rectangle; read time to the minute and calculate elapsed time; count coins and bills and determine correct change.	~~time to the minute and calculate elapsed time in hours/minutes within a 24 hour period using either analog or digital clocks. They count coins and/or bills and determine correct change.~~Fourth grade students at the partial mastery level in mathematics: estimate, measure, compare, and order real-world measurements, and present results; explain the formula for area of a rectangle; read time to the minute and calculate elapsed time with analog or digital clocks; count coins determine correct change.	~~analog or digital clocks. They count coins and/or bills given real-world situations.~~Fourth grade students at the novice level in mathematics: estimate and measure real-world objects and describe results; determine area by finding the same sized units that cover a shape; read time to the quarter hour and calculate elapsed time with analog or digital clocks; count coins and bills.

create problems counting coins and bills and determine correct change and communicate the results.				

Objectives	Students will
M.O.4.4.1	select appropriate measuring tools, apply and convert standard units within a system to estimate, measure, compare and order real-world measurements including: • lengths using customary (to the nearest one-fourth inch) and metric units, • weight, • capacity, • temperature, and justify and present results.
M.O.4.4.2	Quantify area by finding the total number of same sized units that cover a shape, develop a rule and justify the formula for the area of a rectangle using the area model representing multiplication.
M.O.4.4.3	read time to the minute, calculate elapsed time in hours/minutes within a 24-hour period.
M.O.4.4.4	given real-world situations, count coins and bills and determine correct change.

Grade 4	Mathematics
Standard 5	Data Analysis and Probability
M.S.4.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will: • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.

Performance Descriptors (M.PD.4.5)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Fourth grade students at the distinguished level in mathematics create real-world problems that require them to read and interpret information represented on a circle graph and create problems that can be represented on a circle graph. They construct a real-world situation problem~~	~~Fourth grade students at the above mastery level in mathematics read and interpret information represented on a circle graph and apply problems that can be represented on a circle graph. They create and pose a grade-appropriate question that can be addressed with data.~~	~~Fourth grade students at the mastery level in mathematics read and interpret information represented on a circle graph. They pose a grade-appropriate question that can be addressed with data. They collect, organize, display and analyze data in order to answer the~~	~~Fourth grade students at the partial mastery level in mathematics read information represented on a circle graph. They solve a grade-appropriate question that can be addressed with data. They collect and display data in order to answer the question. They conduct a simple probability~~	~~Fourth grade students at the novice level in mathematics identify information represented on a circle graph. They recognize a grade-appropriate question that can be addressed with data. They display data in order to answer the question. They conduct a simple probability~~

~~that requires them to collect, organize, display and analyze data in order to answer the grade-appropriate question. They justify, interpret and analyze their results. They design and conduct a simple probability experiment in a real-world situation, list, examine and analyze all possible combinations using a tree diagram, represent the outcomes as a ratio, and analyze and present the results both orally and in writing. They create and solve real-world problems using mean, median and mode.~~Fourth grade students at the distinguished level in mathematics: pose a question, collect, organize, display, and analyze data to answer the question using statistical measures; design, conduct a probability experiment and present results using clear and concise mathematical language.	~~They collect, organize, display and analyze data in order to answer the question. They justify and interpret their results. They design and conduct a simple probability experiment, examine and list all possible combinations using a tree diagram, represent the outcomes as a ratio and analyze and present the results. They analyze and solve real-world problems using mean, median and mode.~~Fourth grade students at the above mastery level in mathematics: pose a question, collect, organize, display, and analyze data to answer the question using statistical measures; design, conduct a probability experiment and present results.	~~question. They design and conduct a simple probability experiment, examine and list all possible combinations using a tree diagram, represent the outcomes as a ratio and present the results. They solve real-world problems using mean, median and mode.~~Fourth grade students at the mastery level in mathematics: pose a question, collect, organize, display, and analyze data to answer the question using statistical measures; design, conduct a probability experiment and present results.	~~experiment, list possible combinations using a tree diagram, represent the outcomes and present the results. They solve problems using mean and median.~~Fourth grade students at the partial mastery level in mathematics: collect and display data to answer a question; identify the mode and median; conduct a probability experiment.	~~experiment, list some combinations using a tree diagram, and identify the outcomes. They solve real world problems using mean and mode.~~Fourth grade students at the novice level in mathematics: collect and display data to answer a question; identify the mode and median; conduct a probability experiment.

Objectives	Students will
M.O.4.5.1	read and interpret information represented on a circle graph.
M.O.4.5.2	pose a grade-appropriate question that can be addressed with data, collect, organize, display, and analyze data in order to answer the question.
M.O.4.5.3	design and conduct a simple probability experiment using concrete objects, examine and list all possible combinations using a tree diagram, represent the outcomes as a ratio and present the results.

M.O.4.5.4	solve real world problems using mean, median and mode.

Fifth Grade Mathematics Content Standards and Objectives

Fifth grade objectives place emphasis on developing proficiency in using whole numbers, fractions (primary focus on adding and subtracting fractions with like and unlike denominators and mixed numbers), and decimals to solve problems. Additional concepts include collecting, displaying and analyzing data in a variety of ways and solving probability problems. Other problems involve area and perimeter, classifying polygons, plotting points on a coordinate plane, and writing a number sentence using a variable to solve problems. The use of the standard algorithm to solve multi-digit whole number division should be preceded by work with understanding and justifying why the algorithm works. Continued work with concrete materials and appropriate technologies such as calculators and computers is emphasized. Problem solving should be integrated throughout all the strands. The development of a variety of problem-solving strategies should be a major goal of mathematics at this grade-level. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 5	Mathematics			
Standard 1	Number and Operations			
M.S.5.1	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of numbers, ways of representing numbers, and relationships among numbers and number systems, • demonstrate meanings of operations and how they relate to one another, and • compute fluently and make reasonable estimates.			
Performance Descriptors (M.PD.5.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Fifth grade students at the distinguished level in mathematics compare and contrast, analyze and summarize properties of whole numbers, fractions, mixed numbers and decimals. They understand place value and estimate, and critique solutions to real-world problems involving whole numbers, decimals, fractions, and percents. They examine, identify and develop the~~	~~Fifth grade students at the above mastery level in mathematics compare and contrast and analyze whole numbers, fractions, mixed numbers and decimals. They understand place value and estimate and formulate solutions to real-world problems involving whole numbers, decimals, fractions, and percents. They examine and identify the divisibility rules, greatest common factor and lowest~~	~~Fifth grade students at the mastery level in mathematics compare whole numbers, fractions, mixed numbers and decimals. They understand place value and estimate solutions to real-world problems involving whole numbers, decimals, fractions, and percents. They identify the divisibility rules, greatest common factor and lowest common multiple. They solve~~	~~Fifth grade students at the partial mastery level in mathematics identify whole numbers, fractions, mixed numbers and decimals. They identify place value and apply solutions to real-world problems involving whole numbers, decimals, fractions, and percents. They explain the divisibility rules, greatest common factor and lowest common multiple. They explain application problems with~~	~~Fifth grade students at the novice level in mathematics recognize whole numbers, fractions, mixed numbers and decimals. They confirm place value and recognize solutions to real-world problems involving whole numbers, decimals, fractions, and percents. They state the divisibility rules, greatest common factor and lowest common multiple. They confirm that application problems~~

~~divisibility rules, greatest common factor and lowest common multiple. They construct, design and solve application problems with fractions, mixed numbers and decimals. They select the most efficient strategy to solve multi-digit whole number division problems and justify the strategy used. They demonstrate fluency in addition, subtraction, multiplication and division of whole numbers and relate this fluency to the properties of whole numbers.~~ Fifth grade students at the distinguished level in mathematics: understand place value using multiple strategies to critique solutions to real-world problems; use real world problems to justify reasonableness of a solution or of estimation; demonstrate fluency in all of the four operations; demonstrate understanding of equivalencies by constructing, designing and solving application problems;	~~common multiple. They create and solve application problems with fractions, mixed numbers and decimals. They solve multi-digit whole number division problems using a variety of strategies, including the standard algorithm, make comparisons of strategies used. They demonstrate fluency in addition, subtraction, multiplication and division of whole numbers.~~ Fifth grade students at the above mastery level in mathematics: understand place value using multiple strategies within real-world problems; use real world problems to justify reasonableness of a solution or of estimation; demonstrate fluency in all of the four operations; demonstrate understanding of equivalencies; identify and develops divisibility rules and lowest	~~application problems with fractions, mixed numbers and decimals. They solve multi-digit whole number division problems using a variety of strategies, including the standard algorithm and justify the solutions They demonstrate fluency in addition, subtraction, multiplication and division of whole numbers.~~ Fifth grade students at the mastery level in mathematics: understand place value using multiple strategies; solve real-world problems to justify reasonableness of a solution or estimation; demonstrate fluency in all of the four operations; demonstrate understanding of equivalencies; identify the divisibility rules and lowest common multiple.	~~fractions, mixed numbers and decimals. They solve multi-digit whole number division problems using a variety of strategies, including the standard algorithm They solve addition, subtraction, multiplication and division of whole numbers with accuracy.~~ Fifth grade students at the partial mastery level in mathematics: identify place value using multiple strategies; solve or estimate real-world problems; solve problems in all of the four operations; identify equivalencies; use divisibility rules to solve division problems.	~~contain fractions, mixed numbers and decimals. They solve multi-digit whole number division problems They solve addition, subtraction, multiplication and division of whole numbers.~~ Fifth grade students at the novice level in mathematics: confirm place value using multiple strategies; solve or estimate a solution; solve problems in most of the four operations; confirm that application problems contain equivalencies; solve multi-digit division and find common multiples.

identify and develops divisibility rules and lowest common multiples.	common multiples.			

Objectives	Students will
M.O.5.1.1	read, write, order and compare all whole numbers, fractions, mixed numbers and decimals using multiple strategies (e.g., symbols, manipulatives, number line).
M.O.5.1.2	demonstrate an understanding of place value of each digit utilizing standard and expanded form in any whole number using powers of 10 $[(3 \times 10^5) + (4 \times 10^3) + 7 \times 10^2) + (1 \times 10^1) + 6]$.
M.O.5.1.3	estimate solutions to problems involving whole numbers, decimals, fractions, and percents to determine reasonableness using benchmarks.
M.O.5.1.4	use inductive reasoning to identify the divisibility rules of 2, 3, 5, 9 and 10 and apply the rules to solve application problems.
M.O.5.1.5	determine and apply greatest common factor and lowest common multiple to write equivalent fractions and to real-world problem situations.
M.O.5.1.6	model and write equivalencies of fractions decimals, percents, and ratios.
M.O.5.1.7	analyze and solve application problems and justify reasonableness of solution in problems involving addition and subtraction of: • fractions and mixed numbers • decimals.
M.O.5.1.8	apply the distributive property as it relates to multiplication over addition.
M.O.5.1.9	solve multi-digit whole number division problems using a variety of strategies, including the standard algorithm and justify the solutions.
M.O.5.1.10	demonstrate fluency in addition, subtraction, multiplication and division of whole numbers.
M.O.5.1.11	solve real-world problems involving whole numbers, decimals and fractions using multiple strategies and justify the reasonableness by estimation.

Grade 5	**Mathematics**
Standard 2	Algebra
M.S.5.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD.5.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Fifth grade students at the distinguished level in mathematics use inductive~~	~~Fifth grade students at the above mastery level in mathematics use inductive~~	~~Fifth grade students at the mastery level in mathematics use inductive~~	~~Fifth grade students at the partial mastery level in mathematics use inductive~~	~~Fifth grade students at the novice level in mathematics use inductive reasoning~~

~~reasoning to find missing elements in patterns, analyze results and construct their own patterns. They develop and determine rules from an input/output model as well as from an abstract model and identify and analyze square, prime and composite numbers. They solve simple equations and inequalities using patterns and models of real-world situations, create graphs on number lines of the equations and analyze and justify the results.~~Fifth grade students at the distinguished level in mathematics: use inductive reasoning to find missing elements in patterns, while analyzing and constructing their own patterns; develop and determine rules for input/output models moving to the abstract; identify and describe square, prime and composite numbers when solving problems; write an equation to match a number line using patterns	~~reasoning to find missing elements in patterns and analyze results. They develop and determine rules from an input/output model, identify, and describe square, prime and composite numbers. They solve simple equations and inequalities of real-world situations, create graphs on number lines of the equations and analyze the results.~~Fifth grade students at the above mastery level in mathematics: use inductive reasoning to find missing elements in patterns, and then construct their own patterns; develop and determine rules for an input/output model; identify and describe square, prime and composite numbers; solve simple equations and inequalities using patterns and models of real-world situations while interpreting results on a number line.	~~reasoning to find missing elements in patterns. They infer rules from an input/output model, identify, and describe square, prime and composite numbers. They solve simple equations and inequalities using patterns and models of real-world situations, create graphs on number lines of the equations and interpret the results.~~Fifth grade students at the mastery level in mathematics: use inductive reasoning to find missing elements in patterns; infer rules from an input/output model; identify and describe square, prime and composite numbers; solve simple equations and inequalities using patterns and models of real-world situations while interpreting results on a number line.	~~reasoning to confirm missing elements in patterns. They determine rules from an input/output model and recognize square, prime and composite numbers. They solve simple equations using patterns and models of real-world situations and label graphs on number lines of the equations.~~Fifth grade students at the partial mastery level in mathematics: find missing elements in a variety of patterns; find rules from an input/output model; describe prime and composite numbers; solve simple equations and inequalities using models of real-world situations.	~~models to label missing elements in patterns. They name rules from an input/output model and verify square, prime and composite numbers. They solve simple equations using patterns and models of real-world situations and identify graphs on number lines of the equations.~~Fifth grade students at the novice level in mathematics: find missing elements in simple patterns; name a rule and fill in an input/output model; identify prime and composite numbers; solve simple equations using models of real-world situations.

and real-world situations.					
Objectives	Students will				
M.O.5.2.1	use inductive reasoning to find missing elements in a variety of patterns (e.g., square numbers, arithmetic sequences).				
M.O.5.2.2	given an input/output model using two operations, determine the rule, output or input.				
M.O.5.2.3	solve simple equations and inequalities using patterns and models of real-world situations, create graphs on number lines of the equations and interpret the results.				
M.O.5.2.4	model identify and describe square, prime and composite numbers.				

Grade 5	Mathematics				
Standard 3	Geometry				
M.S.5.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformations and use symmetry to analyze mathematical situations, and • solve problems using visualization, spatial reasoning, and geometric modeling.				
Performance Descriptors (M.PD.5.3)					
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice	
~~Fifth grade students at the distinguished level in mathematics classify, compare, develop and critique the properties of triangles and construct and compare 3 dimensional shapes. They construct, analyze and compare designs with symmetry and construct circles. They draw and construct similar figures using a scale that involves reducing or enlarging by fractional units~~Fifth grade students at the distinguished level in mathematics: develop properties of	~~Fifth grade students at the above mastery level in mathematics classify, compare and determine the properties of triangles and construct 3 dimensional shapes. They create and analyze designs with symmetry and construct circles. They draw similar figures using a scale that involves reducing.~~ Fifth grade students at the above mastery level in mathematics: classify and compare triangles while discovering the properties of triangles and accurately use a	~~Fifth grade students at the mastery level in mathematics classify and compare triangles and construct 3 dimensional shapes. They create designs with symmetry and construct circles. They draw similar figures using a scale.~~ Fifth grade students at the mastery level in mathematics: classify and compare triangles and can accurately use a protractor;	~~Fifth grade students at the partial mastery level in mathematics model triangles and describe 3 dimensional shapes. They identify designs with symmetry and draw circles. They identify similar figures using a scale.~~Fifth grade students at the partial mastery level in mathematics: compare and model triangles and accurately use a protractor;	~~Fifth grade students at the novice level in mathematics recognize triangles and identify 3 dimensional shapes. They recognize designs with symmetry and circles. They recognize similar figures using a scale.~~Fifth grade students at the novice level in mathematics: rrecognize triangles and measure angles with a protractor;	

triangles through comparison and accurately use a protractor to construct a triangle to given measurements; analyze, classify, and construct three-dimensional shapes using properties; create and describe designs using more than one line of symmetry; construct a circle with a given radius or diameter; determine scale and draw a similar figure.~~,~~	protractor to construct a triangle to given measurements; construct and analyze three-dimensional shapes using properties; create and describe designs using more than one line of symmetry; construct a circle with a given radius or diameter; draw and describe a similar figure using scale.	construct and analyze three- dimensional shapes using properties; create designs using more than one line of symmetry; construct a circle with a given radius or diameter; draw a similar figure using scale.	construct and describe a three-dimensional shape; draw a line of symmetry; construct a circle with a given radius; identify a similar figure using scale.	construct and identify three-dimensional shapes; recognize a line of symmetry; identify a circle with a given radius; recognize similar figures using a scale.

Objectives	Students will
M.O.5.3.1	classify and compare triangles by sides and angles; measure the angles of a triangle using a protractor.
M.O.5.3.2	construct and analyze three-dimensional shapes using properties (i.e. edges, faces or vertices).
M.O.5.3.3	create a design with more than one line of symmetry.
M.O.5.3.4	construct a circle with a given radius or diameter.
M.O.5.3.5	draw a similar figure using a scale, given a real-world situation.

Grade 5	Mathematics
Standard 4	Measurement
M.S.5.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of measurable attributes of objects and the units, systems, and processes of measurement, and • apply appropriate techniques, tools and formulas to determine measurements.

Performance Descriptors (M.PD.5.4)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Fifth grade students at the distinguished level in mathematics estimate and measure, compare, order~~	~~Fifth grade students at the above mastery level in mathematics estimate and measure, compare, and~~	~~Fifth grade students at the mastery level in mathematics estimate and measure lengths up to 1/8~~	~~Fifth grade students at the partial mastery level in mathematics identify estimate and measure~~	~~Fifth grade students at the novice level in mathematics identify lengths up to 1/4 of an inch. They replicate how~~

~~and construct lengths up to 1/8 of an inch. They find, develop and analyze strategies to determine volume of a rectangular prism. They construct and solve real-world problems requiring conversion within a system of measurement and interpret the relationship between conversions. They estimate and measure weight/mass of real objects in ounces, pounds, grams and kilograms and compare properties of each unit. They estimate and calculate elapsed time from real-world settings, create real-world problems and analyze the solution. They design a scale drawing and determine the actual measurements of a figure from a scale drawing.~~ Fifth grade students at the distinguished level in mathematics: estimate, measure, compare, order and draw lengths of real objects up to 1/8 of an inch and millimeters; find, develop and analyze strategies to determine area of triangles and parallelograms using	~~order lengths up to 1/8 of an inch. They find and develop strategies to determine volume of a rectangular prism. They construct and solve real-world problems requiring conversion within a system of measurement. They estimate and measure weight/mass of real objects in ounces, pounds, grams and kilograms and compare properties of each unit. They estimate and calculate elapsed time from real-world settings and create in context problems. They create a scale drawing and determine the actual measurements of a figure from a scale drawing.~~ Fifth grade students at the above mastery level in mathematics: estimate, measure, compare, order and draw lengths of real objects up to 1/8 of an inch and millimeters; model, calculate and compare area of triangles and parallelograms using multiple strategies; estimate, measure, or solve real-world problems requiring weight/mass or	~~of an inch. They find strategies to determine volume of a rectangular prism. They solve real-world problems requiring conversion within a system of measurement. They estimate and measure weight/mass of real objects in ounces, pounds, grams and kilograms. They estimate and calculate elapsed time from real-world settings and determine the actual measurements of a figure from a scale drawing.~~ Fifth grade students at the mastery level in mathematics: estimate, measure, compare, order and draw lengths of real objects up to 1/8 of an inch and millimeters; model, calculate and compare area of triangles and parallelograms using multiple strategies; estimate, measure, or solves real-world problems requiring weight/mass or conversions within a system of measurement ;	~~lengths up to 1/8 of an inch. They determine volume of a rectangular prism, given a strategy. They identify real-world problems requiring conversion within a system of measurement. They measure weight/mass of real objects in ounces, pounds, grams and kilograms. They estimate elapsed time if given choices from real-world settings and determines the actual measurements of a figure from a scale drawing.~~ Fifth grade students at the partial mastery level in mathematics: estimate, measure, compare and draw lengths of real objects up to 1/8 of an inch and millimeters; determine area of triangles and parallelograms; identify, measure, or solve real-world problems requiring weight/mass or conversions within a system of measurement;	~~to find volume of a rectangular prism. They recognize real-world problems requiring conversion within a system of measurement. They recognize that weight/mass of real objects is in ounces, pounds, grams or kilograms. They recognize time has elapsed in real-world settings and recognizes measurements of a figure from a scale drawing are different.~~ Fifth grade students at the novice level in mathematics: measure, indentify and compare lengths up to 1/4 of an inch. replicate how to find area of triangles and parallelograms. identify real-world problems requiring conversion with a system of measurement. measure two-dimensional

multiple strategies; interpret the relationships of estimates, measurements, or solutions of real-world problems requiring weight /mass or conversions within a system of measurement; describe the effects on the measurement of a two-dimensional shape when the shape is changed; justify the changes in measurement; collect, record, estimate and calculate elapsed time while creating problems and analyzing the solution.	conversions within a system of measurement; describe the effects on the measurement of a two-dimensional shape when the shape is changed; justify the changes in measurement; collect, record, estimate and calculate elapsed time within context problems.	describe the effects on the measurement of a two-dimensional shape when the shape is changed; justify the changes in measurement; collect, record, estimate and calculate elapsed time from real-world situations.	measure two-dimensional shapes and identify the change in measurement when a dimension is changed; measure elapsed time in real-world situations with controlled choices.	shapes and identify the change in measurement when a dimension is changed; recognize time has elapsed in real-world settings.

Objectives	Students will
M.O.5.4.1	estimate, measure, compare, order and draw lengths of real objects in parts of an inch up to 1/8 of an inch and millimeters.
M.O.5.4.2	model, calculate and compare area of triangles and parallelograms using multiples strategies (including, but not limited to, formulas).
M.O.5.4.3	develop strategies (i.e. finding number of same sized units of volume)to determine the volume of a rectangular prism; solve application problems involving estimating or measuring volume of rectangular prisms.
M.O.5.4.4	describe the effects on the measurements of a two-dimensional shape (such as its perimeter and area) when the shape is changed in some way, justify changes.
M.O.5.4.5	solve real-world problems requiring conversions within a system of measurement.
M.O.5.4.6	estimate and/or measure the weight/mass of real objects in ounces, pounds, grams, and kilograms.
M.O.5.4.7	collect, record, estimate and calculate elapsed times from real-world situations (with and without technology)
M.O.5.4.8	determine the actual measurements of a figure from a scale drawing, using multiple strategies.

Grade 5	Mathematics
Standard 5	Data Analysis and Probability

M.S.5.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.

Performance Descriptors (M.PD.5.5)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Fifth grade students at the distinguished level in mathematics construct a sample space and make a hypothesis as to the probability of a real life situation overtime, test the prediction with experimentation, and defend conclusions (with and without technology). They collect and organize data into a circle graph, draw conclusions, interpret results and summarize findings from similar data sets. They collect and analyze real world data using mean, median and mode to determine the best statistical measure, and defend their solutions.~~Fifth grade student at the distinguished level in mathematics: construct a sample space and make a hypothesis in a real life situation over time and test the prediction with experimentation and defend conclusions:	~~Fifth grade students at the above mastery level in mathematics construct a sample space and make a hypothesis as to the probability of a real life situation overtime, test the prediction with experimentation, and defend conclusions in a presentation (with and without technology).They collect and organize data into a circle graph, draw conclusions and interpret results. They collect and analyze data using mean, median and mode to determine the best statistical measure and defend their solutions.~~Fifth grade student at the above mastery level in mathematics: construct a sample space and make a hypothesis in a real life situation over time and test the prediction with experimentation and present conclusions;	~~Fifth grade students at the mastery level in mathematics construct a sample space and make a hypothesis as to the probability of a real life situation overtime, test the prediction with experimentation, and present conclusions (with and without technology). They organize data into a circle graph and draw conclusions. They collect and analyze data using mean, median and mode to determine the best statistical measure.~~Fifth grade student at the mastery level in mathematics: construct a sample space and make a hypothesis in a real life situation over time and test the prediction with experimentation and present conclusions; collect, organize, construct, present the data and draw conclusions using a circle	~~Fifth grade students at the partial mastery level in mathematics construct a sample space and make a hypothesis as to the probability of a real life situation overtime, present conclusions (with and without technology).They organize data into a circle graph. They analyze data using mean, median and mode to determine the best statistical measure.~~Fifth grade student at the partial mastery level in mathematics: construct a sample space and make a hypothesis as to the probability of a real life situation overtime, present conclusions; organize data into a circle graph; read and interpret tables,	~~Fifth grade students at the novice level in mathematics construct a sample space (with and without technology).They identify data. They solve problems using mean, median and mode.~~Fifth grade student at the novice level in mathematics: construct a sample space. identify data on a circle graph; locate information on tables and graphs which include stem and leaf plots; solve real-world problems

collect, organize data into a circle graph while drawing conclusions, interpreting results, and summarize findings; construct, interpret tables, charts, and graphs including stem and leaf plots to draw reasonable inferences and justify conclusions; collect and analyze data using mean, median and mode to determine the best statistical measure and defend their solutions.	collect, organize, construct, present the data and draw conclusions using a circle graph; construct, interpret tables, charts and graphs including stem and leaf plots to draw reasonable inferences; collect and analyze data using mean, median and mode to determine the best statistical measure and defend their solutions.	graph; construct, interpret tables, charts, and graphs including stem and leaf plots to draw reasonable inferences; collect and analyze data using mean, median and mode to determine the best statistical measure.	charts and graphs including stem and leaf plots to draw reasonable inferences; collect data and calculate the mean, median, and mode.	using mean, median, and mode.

Objectives	Students will
M.O.5.5.1	construct a sample space and make a hypothesis as to the probability of a real life situation overtime, test the prediction with experimentation, and present conclusions (with and without technology).
M.O.5.5.2	construct, read, and interpret tables, charts, and graphs including stem and leaf plots to draw reasonable inferences or verify predictions.
M.O.5.5.3	collect and organize real-world data to construct a circle graph (with and without technology), present data and draw conclusions.
M.O.5.5.4	collect and analyze data using mean, median and mode to determine the best statistical measure.

Sixth Grade Mathematics Content Standards and Objectives

Sixth grade objectives place continued emphasis on the study of whole numbers, decimals and fractions (primary focus on multiplication and division of fractions and mixed numbers). Introductory work with integers includes understanding why the rules for adding, subtracting, multiplying and dividing integers work. Opportunities to apply these skills to real world situations help to make sense of the mathematics. Calculators, computers and manipulatives may be used to solve problems. Probability, Statistics, Geometry, and Pre-Algebra will be stressed. Concepts of using ratios to compare data sets, making geometric constructions of three-dimensional figures and solving problems involving circles, volume and surface area are emphasized. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 6	**Mathematics**			
Standard 1	Number and Operations			
M.S.6.1	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of numbers, ways of representing numbers, and relationships among numbers and number systems, • demonstrate meanings of operations and how they relate to one another, and • compute fluently and make reasonable estimates.			
Performance Descriptors (M.PD.6.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Sixth grade students at the distinguished level in mathematics use prime factorization to determine GCF and LCM of more than two numbers for use in problem solving. They create problems and expressions using the distributive, commutative, associative, and identity properties. They state equivalencies among fractions, decimals and percents; between numbers written in scientific and standard notation justifying~~	~~Sixth grade students at the above mastery level in mathematics use prime factorization to determine GCF and LCM for use in problem solving. They use the distributive, commutative, associative, identity properties to solve problems. They state equivalencies among fractions, decimals and percents; between numbers written in scientific and standard notation explaining methods used. They solve problems involving whole~~	~~Sixth grade students at the mastery level in mathematics determine GCF and LCM to solve problems; finds prime factorization of a number. They apply distributive, commutative, associative and identity properties of addition and multiplication. They state equivalencies among fractions, decimals, and percents; between numbers written in scientific and standard notation. They solve problems involving whole numbers,~~	~~Sixth grade students at the partial mastery level in mathematics find GCF and LCM; give prime factorization of a number. They identify examples of distributive, commutative, associative, and identity properties of addition and multiplication. They identify equivalencies among fractions, decimals, and percents. They convert a number from scientific notation to standard notation. They solve problems involving whole~~	~~Sixth grade students at the novice level in mathematics find GCF and LCM; give prime factorization of numbers less than 100. They identify examples of commutative and associative properties of addition and multiplication. They determine equivalent fractions, decimals and benchmark percents. They recognize a number written in scientific notation. They solve problems involving whole numbers, fractions, decimals, addition and~~

~~the methods used. They create and solve problems involving whole numbers, fractions, decimals, integer operations and comparison, and percent of a number; they justify method used and reasonableness of solution. They write and explain in a clear, concise manner, the effect of multiplying and dividing a number by a number between 0 and 1 inclusive.~~Sixth grade students at the distinguished level in mathematics: demonstrate an understanding of large numbers using standard and scientific notation; create, analyze and solve real-world problems involving whole numbers, fractions, mixed numbers, decimals, percents and integers justifying the method used, process and the reasonableness of the solutions.; develop, test and justify hypotheses to derive the rules of operations with integers; create problems from	~~numbers, fractions, decimals, integer operations and comparison, and percent of a number. They justify method used and reasonableness of solution. They explain the effects of multiplying and dividing numbers by numbers 0 and 1 inclusive.~~Sixth grade students at the above mastery level in mathematics: demonstrate an understanding of large numbers using standard and scientific notation; create, analyze and solve real-world problems involving whole numbers, fractions, mixed numbers, decimals, percents and integers justifying the method used and the reasonableness of the solutions; develop, test and justify hypotheses to derive the rules of operations with integers; create problems from numeric expressions.	~~fractions, decimals, integer operations and comparison, and percent of a number and justify reasonableness of solution by estimation. They interpret the effect of multiplying and dividing whole numbers, fractions, and decimals by numbers between zero and one, inclusive.~~Sixth grade students at the mastery level in mathematics: demonstrate an understanding of large numbers using standard and scientific notation; analyze and solve real-world problems involving whole numbers, fractions, mixed numbers, decimals, percents and integers justifying the reasonableness of the solutions; develop, test and justify hypotheses to derive the rules of operations with integers; apply number properties to numeric expressions.	~~numbers, fractions, decimals; addition, multiplication, division, and comparison of integers. They calculate benchmark percents (10%, 25%, 50%, and 75%) of a number. They interpret the effect of multiplying whole numbers, fractions and decimals by numbers between 0 and 1, inclusive.~~Sixth grade students at the partial mastery level in mathematics: convert a number from scientific notation to standard notation; solve real-world problems involving whole numbers, fractions, mixed numbers, decimals, percents and integers; develop and test hypotheses to derive rules of operations with integers; identify examples of number properties in numeric expressions.	~~comparison of integers. They calculate benchmark percents 25% and 50% of numbers less than 100. They interpret the effect of multiplying whole numbers by numbers between 0 and 1, inclusive.~~Sixth grade students at the novice level in mathematics: identify large numbers using standard and scientific notation; solve problems involving whole numbers, fractions, mixed numbers, decimals, percents and integers; use rules of operations with integers; identify examples of number properties in numeric expressions.

expressions and justify using number properties.				

Objectives	Students will
M.O.6.1.1	demonstrate an understanding of large numbers by converting and comparing numbers in scientific notation and standard notation (with and without technology).
M.O.6.1.2	determine the greatest common factor and least common multiple using multiple strategies to solve real-world problems; find prime factorization of a number.
M.O.6.1.3	compare and order integers using multiple strategies (e.g., symbols, manipulatives, number line).
M.O.6.1.4	analyze and solve real-world problems involving addition, subtraction , multiplication and division of • whole numbers, • fractions, mixed numbers, • decimals, • integers, and justify the reasonableness by estimation.
M.O.6.1.5	apply the distributive, commutative, associative and identity properties to numeric expressions and use to prove equivalency.
M.O.6.1.6	convert between fractions/ratios, mixed numbers, decimals and percents in appropriate real-world problems.
M.O.6.1.7	compute the percent of a number to solve application problems and justify the reasonableness by estimation.
M.O.6.1.8	demonstrate an understanding of the effect of multiplying and dividing, whole numbers, fractions and decimals by numbers including 0, 1 and values between 0 and 1 .
M.O.6.1.9	develop and test hypotheses to derive the rules for addition, subtraction, multiplication and division of integers, justify by using real-world examples and use them to solve problems.

Grade 6	Mathematics
Standard 2	Algebra
M.S.6.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD.6.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Sixth grade students at the distinguished level in mathematics write algebraic expressions for word phrases, simplify numeric and evaluate algebraic expressions using order of~~	~~Sixth grade students at the above mastery level in mathematics write algebraic expressions for word phrases, simplify numeric and evaluate algebraic expressions using order of~~	~~Sixth grade students at the mastery level in mathematics write algebraic expressions for word phrases, simplify numeric and evaluate algebraic expressions using order of~~	~~Sixth grade students at the partial mastery level in mathematics write algebraic expressions for word phrases and simplify numeric expressions using order of operations. They~~	~~Sixth grade students at the novice level in mathematics write algebraic expressions for word phrases involving one operation and simplify numeric expressions using order of operations. They~~

~~operations; they use the expressions to solve real-world problems. They present their method and justify solution in a clear, concise manner. They create a rule, express it algebraically, find values by making an input /output table, test it to determine if it is a function, and explain their thinking in a clear, concise manner. They create a geometric or arithmetic sequence, determine any term in the sequence, and express the rule they used algebraically. They solve problems involving real-world proportional situations, explaining the method they used, and by writing a proportion; they relate their method to the proportion. They write and solve one-step equations to solve real-world problems. They present the justification of the use of the equation and their solution, using clear, concise language.~~Sixth grade students at the distinguished level in mathematics: create algebraic expressions corresponding to real-world situations and use the expressions to	~~operations; they use the expressions to solve real-world problems, and explain their thinking. They determine the rule, output or input, given an input/output table; write the rule as an algebraic expression, identify other values, and explain their thinking in a clear, concise manner. They create a geometric or arithmetic sequence and determine any term in a sequence and explain their rule. They solve problems involving real-world proportional situations and explain the method they used. They write and solve one-step equations to solve real-world problems. They justify the use of the equation and the solution.~~Sixth grade students at the above mastery level in mathematics: create algebraic expressions corresponding to real-world situations and use the expressions to solve problems and justify the solution; complete, describe, and extend patterns and express the rule as an	~~operations. They use the expressions to solve real-world problems. They determine the rule, output or input, given an input/output table; write the rule as an algebraic expression; and identify other values. They predict the nth term of a pattern. They solve problems involving real-world proportional situations. They write and solve one-step equations to solve real-world problems.~~Sixth grade students at the mastery level in mathematics: create algebraic expressions corresponding to real-world situations and use the expressions to solve problems; complete, describe, and extend patterns and express the rule as an algebraic expression to predict the nth term; solve problems involving real-world proportional situations justifying the strategy; write and use one-step equations to solve real-	~~find a rule, output or input, given an input/output table; They identify the next three terms of a pattern. They solve a proportion problem involving measurement. They solve one-step equations.~~Sixth grade students at the partial mastery level in mathematics: create algebraic expressions for word phrases and use the expressions to solve problems; complete, describe, and extend patterns; solve proportion problems between equivalent fractions; translate word problems to one-step equations.	~~determine the output, given the rule and the input. They identify the next three terms of a pattern of one operation. They solve a proportion between equivalent fractions. They solve one-step equations with the use of manipulatives.~~Sixth grade students at the novice level in mathematics: create algebraic expressions for word phrases involving one operation and use the expressions to solve problems; complete and/or extend patterns; recognize equivalent fractions; solve one-step equations.

solve problems justifying the process and solution in a clear and concise manner; complete, describe, and extend patterns and express the rule as an algebraic expression to predict the nth term; solve problems involving real-world proportional situations justifying the strategy; create a real world problem which can be solved using a one-step equation justifying the process and solution.	algebraic expression to predict the nth term; solve problems involving real-world proportional situations justifying the strategy; write and use one-step equations to solve real-world problems justifying the reasonableness of the solution.	world problems.		

Objectives	Students will
M.O.6.2.1	simplify numerical expressions and evaluate algebraic expressions using order of operations.
M.O.6.2.2	use inductive reasoning to extend patterns to predict the nth term (e.g., powers and triangular numbers).
M.O.6.2.3	create algebraic expressions that correspond to real-world situations; use the expressions to solve problems.
M.O.6.2.4	determine the rule, output or input; given an input/output model using one operation, write an algebraic expression for the rule and use to identify other input/output values.
M.O.6.2.5	solve real-world proportion problems involving rates, probability and measurements using multiple strategies, justify selection of strategies.
M.O.6.2.6	write and solve one-step equations using number sense, properties of operations and the idea of maintaining equality to represent and solve real-world problems.

Grade 6	Mathematics
Standard 3	Geometry
M.S.6.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformations and use symmetry to analyze mathematical situations, and • solve problems using visualization, spatial reasoning, and geometric modeling.

Performance Descriptors (M.PD.6.3)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Sixth grade students at the distinguished level in mathematics analyze the characteristics of geometric figures to compare and contrast the figures. They compare it to the original figures, given a new figure. They derive the formula to determine the sum of the measures of the interior angles of a polygon and express it algebraically; use the formula to find the sum of the measures of an n-gon; and extend the formula to find the measure of each angle in a regular n-gon. They use geometric representations to solve real-world problems; they apply the concepts of parallel, perpendicular, intersecting, and skew lines to real-world situations and to the edges of polyhedrons; they make conjectures regarding lines and planes. They create designs with rotational and/or line symmetry; they apply transformations to polygons in a coordinate plane, including rotating a quadrilateral or triangle in a coordinate plane about a~~	~~Sixth grade students at the above mastery level in mathematics analyze the characteristics of geometric figures to compare and contrast the figures. They derive the formula to determine the sum of the measures of the interior angles of a polygon and use the formula to find the sum of the measures of an n-gon. They use geometric representations to solve real-world problems; they apply the concepts of parallel, perpendicular, intersecting, and skew lines to real-world situations and to the edges of polyhedrons. They create designs with rotational symmetry and/or line symmetry; they apply transformations to polygons in a coordinate plane and describe the method they used. They create a polygon on a coordinate plane with a given area; they determine the length of the sides; they name coordinates so the polygon can be reproduced.~~Sixth grade students at the above mastery level in mathematics: represent real world	~~Sixth grade students at the mastery level in mathematics analyze the characteristics of geometric figures to compare the figures. They derive the formula to determine the sum of the measures of the interior angles of a polygon. They use geometric representations to solve real-world problems; they apply the concepts of parallel, perpendicular, intersecting, and skew lines to real-world situations. They create designs using line and rotational symmetry; they predict, describe, and perform transformations on two-dimensional shapes. They plot polygons on a coordinate grid and determine lengths and areas from the graphs.~~Sixth grade students at the mastery level in mathematics: analyze geometric figures; derive the formula to determine the sum of the measures of the interior angles of a polygon;	~~Sixth grade students at the partial mastery level in mathematics identify the characteristics of geometric figures. They find the sum of the measures of the interior angles of a polygon by partitioning the polygon into triangles. They identify geometric figures; they find examples of parallel, perpendicular, intersecting, and skew lines in the classroom and identify them. They identify line and rotational symmetry. They plot polygons on a coordinate plane.~~Sixth grade students at the partial mastery level in mathematics: identify characteristics of geometric figures; find the sum of the measures of the interior angles of a polygon by partitioning the polygon into triangles; identify designs using line and rotational symmetry and transformations of two-dimensional figures;	~~Sixth grade students at the novice level in mathematics identify sides and angles of polygons. They determine the sum of the measures of the angles of a polygon, given a formula. They identify geometric figures; shown two lines in the classroom, they identify them as parallel, perpendicular, or intersecting. They identify lines of symmetry. They plot points on a coordinate plane.~~Sixth grade students at the novice level in mathematics: recognize geometric figures; find the sum of the measures of the interior angles of a polygon given a formula; identify lines of symmetry and transformations of two-dimensional figures; plot points on a coordinate

~~point not on the polygon; and they describe the method they used, including mathematical notation. They create a non-rectangular polygon on a coordinate plane with a given area; they determine the length of the sides; they name coordinates so the polygon can be reproduced.~~Sixth grade students at the distinguished level in mathematics: use geometric figures to solve real world problems; use the concept of the sum of the measures of interior angles of a polygon to solve a real world situation; determine the name of the geometric figure given the sum of the measures of the interior angles; create a design for a real world situation using the plotting of polygons on a coordinate plane.	situations using geometric figures; derive the formula to determine the sum of the measures of the interior angles of a polygon and use the formula to find the sum of the measure of an n-gon; create designs using line and rotational symmetry; apply transformations to polygons in a coordinate plane and describe method used; create polygons on a coordinate plane with a given area and determine length of the sides.	create designs using line and rotational symmetry; predict, describe, and perform transformations on two-dimensional figures; plot polygons on coordinate planes and determine lengths and areas from the graph.	plot polygons on coordinate plane.	plane.

Objectives	Students will
M.O.6.3.1	analyze characteristics using defining properties of

	• lines, • angles, • polygons, • triangles, and compare these geometric figures.
M.O.6.3.2	use inductive reasoning with the measures of interior angles in polygons and derive the formula to determine the sum of the measures of the interior angles.
M.O.6.3.3	apply the concepts of parallel, perpendicular, intersecting, and skew lines to real-world situations (i.e. roads and routes).
M.O.6.3.4	create designs using line and rotational symmetry.
M.O.6.3.5	predict, describe, and perform transformations on two-dimensional shapes • translations • rotations • reflections
M.O.6.3.6	use geometric representations to solve real-world problems.
M.O.6.3.7	plot polygons on coordinate grids, determine lengths and areas from the graph.

Grade 6	**Mathematics**			
Standard 4	Measurement			
M.S.6.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of measurable attributes of objects and the units, systems, and processes of measurement, and • apply appropriate techniques, tools and formulas to determine measurements.			
Performance Descriptors (M.PD.6.4)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Sixth grade students at the distinguished level in mathematics collect data by examination and by graphing, determine an approximation for pi. They develop a formula for the circumference of a circle from this information. They determine formulas for perimeter of polygons, area of parallelograms and triangles, circumference and area of circles, volume of rectangular prisms, and~~	~~Sixth grade students at the above mastery level in mathematics collect data, by examination, determine an approximation for pi. They develop a formula for the circumference of a circle from this information. They determine formulas for perimeter of polygons, area of parallelograms and triangles, circumference and area of circles, volume of rectangular prisms, and perimeter and area of~~	~~Sixth grade students at the mastery level in mathematics determine an approximation for pi using actual measurements. They determine formulas for perimeter of polygons, area of parallelograms and triangles, circumference and area of circles, volume of rectangular prisms, and perimeter and area of composite figures. They describe surface area of rectangular prisms and~~	~~Sixth grade students at the partial mastery level in mathematics measure and state that the distance around a circle is about three times the diameter. They calculate the area of rectangles and identify through modeling the formula for the area of a triangle and the volume of a rectangular prism. They identify and find the area of the surfaces of a rectangular prism. They~~	~~Sixth grade students at the novice level in mathematics states that the distance around a circle is about three times the diameter. They identify the formula for area of a rectangle and model the formula for volume of a rectangular prism. They identify the surfaces of a rectangular prism. They identify similar polygons.~~Sixth grade students at the novice level in mathematics:

~~perimeter and area of composite figures; they justify the formulas; they use these formulas in problem solving situations. They describe surface area of rectangular prisms and cylinders; they find the surface area of rectangular prisms; they find the volume of cylinders, including those in real-world situations; they justify the methods and their answers; they express formulas algebraically. They construct scale drawings, and describe mathematically in writing the method they used.~~Sixth grade students at the distinguished level in mathematics: collect data by examination and by graphing, determine an approximation for pi; develop and test hypothesis for formulas for perimeter, area and volume of geometric figures and solids to solve real world problems justifying the process and solution; solve real world problems related to surface area justifying the process and solution justifying the	~~composite figures; they use these formulas in problem solving situations. They describe surface area of rectangular prisms and cylinders; they find the surface area of rectangular prisms; they find the volume of cylinders, including those in real-world situations; they justify the methods and their answers. They construct scale drawings of regular polygons, and explain the method they used. They demonstrate and compare the relationship between area and perimeter of plane figures. They apply the formulas for area of rectangles and the volume of a rectangular prism.~~ Sixth grade students at the above mastery level in mathematics: collect data, by examination, determine an approximation for pi; develop and test hypothesis for formulas for perimeter, area and volume of geometric figures and solids used to solve real world problems; solve real world problems	~~cylinders; they find the surface area of rectangular prisms; they find the volume of cylinders, including those in real-world situations. They construct scale drawings of regular polygons.~~Sixth grade students at the mastery level in mathematics: determine an approximation for pi using actual measurements; develop and test hypothesis to determine formulas for perimeter, area, and volume of geometric figures and solids; investigate, model, and describe surface area of rectangular prisms and cylinders; construct scale drawings of regular polygons.	~~identify similar polygons and construct scale drawings of rectangles.~~Sixth grade students at the partial mastery level in mathematics : measure and state that the distance around a circle is about three times the diameter; develop formulas to determine the perimeter, area and volume of geometric figures and solids; identify and find the area of the surfaces of a rectangular prism; construct scale drawings of rectangles.	state that the distance around a circle is about three times the diameter; use formulas to determine the perimeter and area geometric figures; identify the surfaces of a rectangular prism; identify similar polygons.

process and solution; construct scale drawings to solve real world problems justifying the process and solution.	related to surface area justifying the solution; construct scale drawings of regular polygons and describe the method used.			

Objectives	Students will
M.O.6.4.1	determine an approximation for pi using actual measurements.
M.O.6.4.2	develop and test hypotheses to determine formulas for • perimeter of polygons, including composite figures • area of parallelograms • area of triangles • area of composite figures made of parallelograms and triangles • circumference of a circle • area of a circle • volume of a rectangular prism
M.O.6.4.3	investigate, model and describe surface area of rectangular prisms and cylinders; develop strategies to determine the surface area of rectangular prisms
M.O.6.4.4	develop strategies to determine volume of cylinders; solve real-world problems involving volume of cylinders, justify the results.
M.O.6.4.5	given a two-dimensional polygon, construct a scale drawing given the scale factor.

Grade 6	**Mathematics**
Standard 5	Data Analysis and Probability
M.S.6.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.

Performance Descriptors (M.PD.6.5)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Sixth grade students at the distinguished level in mathematics design an experiment from a problem-solving situation in order to collect, organize, display,~~	~~Sixth grade students at the above mastery level in mathematics design an experiment from a problem-solving situation in order to collect, organize, display,~~	~~Sixth grade students at the mastery level in mathematics collect, organize, display, and interprets data in bar, line and circle graphs, stem and~~	~~Sixth grade students at the partial mastery level in mathematics organize and display data in bar, line, and circle graphs, stem and leaf plots, and frequency tables.~~	~~Sixth grade students at the novice level in mathematics display data in bar and line graphs. They identify a real life situation using statistical measures (mean, median,~~

and interpret data in bar, line, and circle graphs, stem and leaf plots, and/or frequency tables. They draw conclusions from the data and justify the use of the graphical representation they used. They identify a real life situation using statistical measures (mean, median, mode, range, outliers) overtime, make a hypothesis as to the outcome; design and implement a method to collect, organize and analyze data; analyze the results to make a conclusion; evaluate the validity of the hypothesis based upon collected data, design a mode of presentation using words, graphs, models, and/or tables (with and without technology). They create a data set for a specific mean, median, mode and range. They design an experiment involving either fair or unfair probability, determine the theoretical probability, make a prediction based on it, experiment and draw conclusions from their findings. They compare and contrast combinations and permutation; they find and explain ways to determine the number of	and interpret data in bar, line, and circle graphs, stem and leaf plots, and/or frequency tables. They justify the use of the graphical representation they used. identify a real life situation using statistical measures (mean, median, mode, range, outliers) overtime, make a hypothesis as to the outcome; design and implement a method to collect, organize and analyze data; analyze the results to make a conclusion; evaluate the validity of the hypothesis based upon collected data, design a mode of presentation using words, graphs, models, and/or tables (with and without technology). They recognize and explain how additional data in a set would affect the measures of central tendency. They create a probability experiment, determine the theoretical probability, make a prediction, experiment and draw conclusions from their findings. They list permutations and combinations; they explore ways to determine the number of combinations and permutations.Sixth	leaf plots, and frequency tables. They identify a real life situation using statistical measures (mean, median, mode, range, outliers) overtime, make a hypothesis as to the outcome; design and implement a method to collect, organize and analyze data; analyze the results to make a conclusion; evaluate the validity of the hypothesis based upon collected data, design a mode of presentation using words, graphs, models, and/or tables (with and without technology). They determine the effect of outliers. They predict outcomes of events and express probability as a ratio, decimal, or percent. They determine permutations and combinations.Sixth grade students at the mastery level in mathematics: identify a real life situation, use statistical measures to make and check the validity of a hypothesis and communicate the results; perform simple probability experiments and use experimental and theoretical	They identify a real life situation using statistical measures (mean, median, mode, range, outliers) overtime, make a hypothesis as to the outcome; design and implement a method to collect, organize and analyze data; They determine mean, median, mode, median and range. They determine probability of an event and express it as a fraction. They list combinations of simple data.Sixth grade students at the partial mastery level in mathematics: collect, organize, display, read, and analyze data; compare and contrast experimental and theoretical probability; determine the combination and permutation of a given situation.	mode, range, outliers) overtime, make a hypothesis as to the outcome; implement a method to collect, organize and analyze data; They determine median, mode and range from a set of data. They identify probability of an event using a coin or a cube. They name combinations from simple real-world situations.Sixth grade students at the novice level in mathematics: collect, organize, display and read data; express probability as a ratio, decimal or percent; determine the combination of a given situation.

~~combinations and permutations; they find and describe ways that this information is useful in real-world situations.~~Sixth grade students at the distinguished level in mathematics: identify a real life situation, use statistical measures to make and check the validity of a hypothesis and communicate the results; design a probability experiment to investigate the probability of a real life situation and communicate likeliness of the event; determine whether to use a combination or permutation to analyze a real world situation and communicate their findings.	grade students at the above mastery level in mathematics: identify a real life situation, use statistical measures to make and check the validity of a hypothesis and communicate the results; design a probability experiment to investigate the probability of a real life situation; determine whether to use a combination or permutation to analyze a real world situation.	probability to predict the outcome of the event; determine combinations and permutations of a given real-world situations.		

Objectives	Students will
M.O.6.5.1	collect, organize, display, read, interpret and analyze real-world data using appropriate graphs and tables (with and without technology).
M.O.6.5.2	identify a real life situation using statistical measures (mean, median, mode, range, outliers) overtime, make a hypothesis as to the outcome; design and implement a method to collect, organize and analyze data; analyze the results to make a conclusion; evaluate the validity of the hypothesis based upon collected data, design a mode of presentation using words, graphs, models, and/or tables (with and without technology).
M.O.6.5.3	perform simple probability events using manipulatives; predict the outcome given events using experimental and theoretical probability; express experimental and theoretical probability as a ratio, decimal or percent.
M.O.6.5.4	determine combinations and permutations of given real-world situations by multiple strategies, including creating lists.

Seventh Grade Mathematics Content Standards and Objectives

Seventh grade objectives place emphasis on preparing students to take Algebra I in the eighth grade year. With less emphasis on paper/pencil computation, calculators are emphasized in all facets of the mathematics daily work as well as test situations. Review of all basic mathematics skills occurs in a relevant context. Problem solving is embedded in the curriculum, a variety of new concepts are utilized, and cooperative learning promotes communication skills. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 7	Mathematics
Standard 1	Number and Operations
M.S.7.1	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of numbers, ways of representing numbers, and relationships among numbers and number systems, • demonstrate meanings of operations and how they relate to one another, and • compute fluently and make reasonable estimates.

Performance Descriptors (M.PD.7.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Seventh grade students at the distinguished level in mathematics compare, order, differentiate among and between rational and irrational numbers; and convert between decimal and fraction representations of rationals (including repeating decimals). They identify a number between any two given numbers and justify their thinking. They model the relationship between perfect squares and square roots and estimate and evaluate square root by estimation and calculation and justify~~	~~Seventh grade students at the above mastery level in mathematics compare, order, differentiate among and between rational and irrational numbers; and convert between decimal and fraction representations of rationals (including repeating decimals). They model the relationship between perfect squares and square roots and estimate and evaluate square root by estimation and calculation. They justify the use of the commutative, associative, distributive, identity, and inverse~~	~~Seventh grade students at the mastery level in mathematics compare, order, and differentiate among and between rational and irrational numbers. They model the relationship between perfect squares and square roots and estimate and evaluate square root. They justify the use of the commutative, associative, distributive, identity, and inverse properties to simplify numeric expressions. They analyze and solve real-world problems, demonstrate fluency in~~	~~Seventh grade students at the partial mastery level in mathematics compare, order, and differentiate among rational numbers. They evaluate square root of perfect squares and identify between which whole numbers the square root of a number from 1-144 is found. They use and identify the commutative, associative, distributive, identity, and inverse properties when appropriate to simplify numeric expressions involving whole numbers. They analyze and solve real-world~~	~~Seventh grade students at the novice level in mathematics compare and order integers, terminating decimals, and fractions. They evaluate square root of perfect squares. They use the commutative, associative, distributive, identity, and inverse properties to simplify numeric expressions involving whole numbers. They analyze and solve real-world problems with calculator assistance, and demonstrate fluency in performing the whole number operations required~~

~~the use of this method. They justify the use of the commutative, associative, distributive, identity, and inverse properties to simplify numeric and algebraic expressions; they explain the connection between simplifying numeric and algebraic expressions. They analyze and solve real-world problems, demonstrate fluency in performing the operations required to solve them; in a clear, concise manner, justify solutions and explain the process used in solving. Using the laws of exponents for expressions with numeric and variable bases, they generalize by expressing the rules algebraically; they solve problems using numbers in scientific notation.~~ Seventh grade students at the distinguished level in mathematics: compare, order, differentiate, and convert between decimals/fraction representations of rational numbers and identify/justify a number between any two given numbers; model, estimate and evaluate the relationship	~~properties to simplify numeric and algebraic expressions. They analyze and solve real-world problems, demonstrate fluency in performing the operations required to solve them, justify solutions, and explain the process used in solving. They extend the laws of exponents for expressions with numeric bases to expressions with variable bases; they solve problems using numbers in scientific notation.~~Seventh grade students at the above mastery level in mathematics: compare, order, differentiate, and convert between decimal/fraction representations of rational numbers; model, estimate and evaluate the relationship between perfect squares/square roots and calculate the square root; justify the use of the properties to simplify numeric/algebraic expressions;	~~performing the operations required to solve them, and justify solutions. They find and justify laws of exponents for expressions with numeric bases; they solve problems using numbers in scientific notation.~~Seventh grade students at the mastery level in mathematics: compare, order, and differentiate between rational/irrational numbers; model, estimate and evaluate the relationship between perfect squares/ square roots; justify the use of the properties to simplify numeric expressions; analyze, demonstrate fluency in performing operations required and solve real world problems; find/justify laws of	~~problems with calculator assistance, but demonstrate fluency in performing the whole number operations required to solve them; justify solutions. They apply laws of positive exponents to expressions with numeric bases. They solve problems using numbers in scientific notation with positive exponents.~~Seventh grade students at the partial mastery level in mathematics: compare, order, and differentiate among rational numbers; evaluate and identify square root of perfect squares; use/identify properties to simplify numeric/whole number expressions; analyze/solve with calculator assistance, and demonstrate/justify fluency	~~to solve them. They evaluate powers with positive exponents and convert between numbers in scientific notation with positive exponents and standard form.~~Seventh grade students at the novice level in mathematics: compare/order integers, terminating decimals, and fractions; evaluate square root of perfect squares; use properties to simplify numeric expressions/whole number expressions; analyze/solve with calculator assistance and demonstrate fluency in whole number operations; evaluate powers with positive exponents and convert between numbers in

between perfect squares/square roots and calculate/justify the square root; justify the use of the properties to simply numeric/algebraic expressions and explain the connections; analyze, demonstrate fluency in performing operations required, justify, explain the process to solve real world problems; use laws of exponents for expressions with numeric/algebraic bases to generalize the rules algebraically and solve problems using scientific notations.	analyze, demonstrate fluency in performing operations required, justify, explain and solve real world problems; extend the laws of exponents for expressions with variable bases to numeric bases and solve problems using scientific notation.	exponents for expressions with numeric bases and solve problems using scientific notation.	in whole number operations; apply laws of positive exponents to expressions with numeric bases and solve problems using scientific notation with positive exponents.	scientific notation/positive exponents/standard form.

Objectives	Students will
M.O.7.1.1	compare, order, and differentiate among integers, decimals, fractions, and irrational numbers using multiple representations (e.g., symbols, manipulatives, graphing on a number line).
M.O.7.1.2	model the relationship between perfect squares and square roots using physical representations; estimate square root and evaluate using technology.
M.O.7.1.3	using simple computation and problem-solving situations, demonstrate fluency and justify solutions in performing operations with rational numbers including negative numbers for • adding • subtracting • multiplying • dividing
M.O.7.1.4	justify the use of the commutative, associative, distributive, identity and inverse properties to simplify numeric expressions.
M.O.7.1.5	analyze and solve grade-appropriate real-world problems with whole numbers, integers, decimals, fractions and percents including problems involving • discounts,

	• interest, • taxes, • tips, • percent increase or decrease, and justify solutions including using estimation and reasonableness.
M.O.7.1.6	use inductive reasoning to find and justify the laws of exponents with numeric bases
M.O.7.1.7	solve problems using numbers in scientific notation (positive and negative exponents) with and without technology, and interpret from real life contexts.

Grade 7	Mathematics
Standard 2	Algebra
M.S.7.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contents.

Performance Descriptors (M.PD.7.2)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Seventh grade students at the distinguished level in mathematics express a rule algebraically and extend the sequence in arithmetic and geometric sequence. They plot lines on a coordinate plane, determine the slope, and solve problems algebraically, in a clear, concise manner, justify solution, and explain the process used in solving. They simplify and evaluate algebraic expressions with whole numbers, fractions, integers, absolute value, and exponents, using order of operations. They create input/output function tables~~	~~Seventh grade students at the above mastery level in mathematics create a rule and extend the sequence in arithmetic and geometric sequences. They plot lines on a coordinate plane, determine the slope, and solve problems algebraically, justifying solutions, and explain the process used in solving. They evaluate algebraic expressions with whole numbers, fractions, integers, absolute value, and exponents, using order of operations. They create input/output function tables to predict values in problem~~	~~Seventh grade students at the mastery level in mathematics find missing elements in arithmetic and geometric sequences. They plot lines on a coordinate plane, determine the slope, and solve problems algebraically justifying solutions. They evaluate algebraic expressions with whole numbers, integers, absolute value, and exponents, using order of operations. They create input/output function tables to predict values in problem solving situations. They solve problems involving proportional situations.~~	~~Seventh grade students at the partial mastery level in mathematics identify which operation is used to create a sequence and identify it as an arithmetic or geometric sequence. They plot lines on a coordinate plane, determine the slope, and solve problems algebraically. They evaluate algebraic expressions with whole numbers, and integers using order of operations. They solve one-step linear equations involving integers. They complete input/output function tables to predict values in problem~~	~~Seventh grade students at the novice level in mathematics identify which operation is used to create a sequence. They plot lines on a coordinate plane and identify the slope as being positive or negative. They evaluate algebraic expressions using whole numbers and the order of operations. They solve one-step linear equations involving whole numbers. They complete input/output function tables. They solve proportions. They solve one-step equations involving whole numbers.~~Seventh grade

~~to predict values in problem solving situations and express the rule algebraically. They distinguish between proportional and non-proportional situations, write and solve a proportion for a proportional situation, and justify the solution. They solve multi-step linear equations containing rational numbers and solve and graph multi-step inequalities.~~Seventh grade students at the distinguished level in mathematics: express a rule algebraically and extend in arithmetic and geometric sequences; simplify/evaluate algebraic expressions with whole numbers, fractions, integers, absolute value, and exponents using the order of operations; create input/output tables to predict values and state the rule algebraically in problem solving situations; solve multi-step linear equations and inequalities containing rational numbers and graph;	~~solving situations and state the rule. They write and solve a proportion for a proportional situation and justify the solution. They solve one-step linear equations containing rational numbers and solve and graphs basic inequalities.~~Seventh grade students at the above mastery level mathematics: create/extend a rule in arithmetic and geometric sequences; evaluate algebraic expressions with whole numbers, fractions, integers, absolute value, and exponents using the order of operations; create input/output tables to predict values and state the rule in problem solving situations; solve one-step linear equations and inequalities containing rational numbers and graph; plot lines in a coordinate plane, determine slope, and solve problem algebraically and justify/explain the process;	~~They solve one-step linear equations containing rational numbers and solve basic inequalities.~~Seventh grade students at the mastery level in mathematics: find missing elements in arithmetic/geometric sequences; evaluate algebraic expressions with whole numbers, integers, absolute value and exponents using the order of operations; create input/output function tables to predict values in problem solving situations; solve one-step linear equations and inequalities containing rational numbers; plot lines in a coordinate plane, determine slope, and solve/justify problems algebraically; solve problems involving proportional situations.	~~solving situations. They recognize that two equal ratios form a proportion and solve one-step equations and inequalities involving whole numbers.~~Seventh grade students at the partial mastery level in mathematics: identify operation used in sequence and identify as arithmetic or geometric; evaluate algebraic expressions using whole numbers/integers and the order of operations; complete input/output functions tables to make predictions; solve one-step linear equations and inequalities involving integers; plot lines in a coordinate plane, determine slope, and solve algebraically; recognize two equal ratios form a proportion.	students a the novice level in mathematics: identify operation used to create a sequence; evaluate algebraic expressions using whole numbers and the order of operations; complete input/output function tables; solve one-step equations involving whole numbers; plot lines on a coordinate plane and identify slope as positive or negative; solve proportions.

plot lines in a coordinate plane, determine slope, and solve problem algebraically and justify/explain the process in a clear, concise manner; distinguish between proportional/non-proportional situations and write, solve, and justify the solution.	write and solve proportion for a proportional situation and justify.			

Objectives	Students will
M.O.7.2.1	use inductive reasoning to find missing elements in a variety of arithmetic and geometric patterns including algebraic sequences and series.
M.O.7.2.2	evaluate algebraic expressions with whole numbers, integers, absolute value and exponents using the order of operations.
M.O.7.2.3	solve problems by creating an input/output function table(including, but not limited to, spreadsheets) to predict future values, given a real-world situation involving rational numbers.
M.O.7.2.4	analyze proportional relationships in real-world situations, select an appropriate method to determine the solution and justify reasoning for choice of method to solve.
M.O.7.2.5	solve one-step linear equations and inequalities using a variety of strategies containing rational numbers with integer solutions; graph solutions, and justify the selection of the strategy and the reasonableness of the solution.
M.O.7.2.6	plot lines within the Cartesian coordinate plane from a table of values to solve mathematical real-world problems.
M.O.7.2.7	determine the slope of a line from its graphical representation.
M.O.7.2.8	represent algebraically and solve real-world application problems and justify solutions.
M.O.7.2.9	identify a real life problem involving proportionality; make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project using words, graphs, drawings, models, or tables.

Grade 7	Mathematics
Standard 3	Geometry
M.S.7.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will: • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformations and use symmetry to analyze mathematical situations, and • solve problems using visualization, spatial reasoning, and geometric modeling.

Performance Descriptors (M.PD.7.3)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Seventh grade students at the distinguished level in mathematics identify and construct angle pairs, congruent segments and angles, perpendicular bisectors of segments, and angle bisectors. They find the missing measure in an angle pair, identify corresponding, alternate interior and alternate exterior angles given a measure. They apply line, rotational symmetry and transformations. They solve real world problems involving scale by writing proportions and creating scale models and use compound geometric figures.~~Seventh grade students at the distinguished level in mathematics: identify/construct angle pairs, congruent segments/angles, perpendicular bisectors of segments and angle-bisector. Find missing measure in angle pair and identify corresponding, alternate interior/exterior angles; apply line/rotational	~~Seventh grade students at the above mastery level in mathematics identify and construct angle pairs, congruent segments and angles, perpendicular bisectors of segments, and angle bisectors. They find the missing measure in an angle pair given a measure. They apply line symmetry and transformations and recognize rotational symmetry. They solve real world problems involving scale by writing proportion and use compound geometric figures.~~Seventh grade students at the above mastery level in mathematics: identify/construct angle pairs, congruent segments/ angles, perpendicular bisectors of segments and angle-bisector. Find missing measure in an angle pair; apply line symmetry/ transformations and recognize rotational symmetry;	~~Seventh grade students at the mastery level in mathematics identify and construct angle pairs, congruent segments and angles, perpendicular bisectors of segments, and angle bisectors. They apply line symmetry and transformations. They solve real world problems involving scale and use compound geometric figures.~~Seventh grade students at the mastery level in mathematics: identify/construct angle pairs, congruent segments/ angles, perpendicular bisectors of segments and angle-bisectors; apply line symmetry and transformations; solve real world problems with compound geometric figures involving scale.	~~Seventh grade students at the partial mastery level in mathematics identify and construct angle pairs, angles, congruent segments and bisectors of segments. They identify line symmetry and transformations. They solve ratio and proportion and real world problems involving geometric figures.~~Seventh grade students at the partial mastery level in mathematics: identify/construct angle pairs, angles, congruent segments and bisectors of segments; identify line symmetry and transformations; solve ratio/proportion and real world problems involving geometric figures.	~~Seventh grade students at the novice level in mathematics identify angle pairs, congruent segments and angles. They recognize line symmetry and transformations. They solve simple ratio and proportion problems with simple geometric figures.~~Seventh grade students at the novice level in mathematics: identify angle pairs, congruent segments and angles; recognize line symmetry and transformations; solve simple ratio and proportion problems with simple geometric figures.

symmetry and transformations; solve real world problems with compound geometric figures involving scale by writing proportions and creating scale model.	solve real world problems with compound geometric figures involving scale by writing a proportion.			

Objectives	Students will
M.O.7.3.1	identify and construct • angle-pairs adjacent, complementary, supplementary, vertical • congruent segments and angles • perpendicular bisectors of segments • angle-bisectors
M.O.7.3.2	apply line symmetry to classify plane figures.
M.O.7.3.3	apply rotations, reflections, translations to plane figures and determine the coordinates of its transformation and compare and contrast the new figure with the original.
M.O.7.3.4	pose and solve ratio and proportion problems including scale drawings and similar polygons.
M.O.7.3.5	solve problems and explain the relationships among scale factor and area and volume including • square of a scale factor • cube of a scale factor
M.O.7.3.6	solve mathematical real-world problems using compound geometric figures.

Grade 7	**Mathematics**
Standard 4	**Measurement**
M.S.7.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will: • demonstrate understanding of measurable attributes of objects and the units, systems, and processes of measurements, and • apply appropriate techniques, tools and formulas to determine measurements.

Performance Descriptors (M.PD.7.4)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Seventh grade students at the distinguished level in mathematics solve real-world problems (including those that have missing measures) involving~~	~~Seventh grade students at the above mastery level in mathematics solve real-world problems involving perimeter, circumference, area, surface area, distance~~	~~Seventh grade students at the mastery level in mathematics solve real-world problems involving perimeter, circumference, area, surface area, distance~~	~~Seventh grade students at the below mastery level in mathematics solve problems involving perimeter, circumference, area, surface area, distance~~	~~Seventh grade students at the novice level in mathematics solve problems involving perimeter, circumference, area and, surface area; they~~

~~perimeter, circumference, area, surface area, distance and temperature and volume of prisms and cylinders and develop formulas; they convert units of measure. They create and solve problems involving the Pythagorean Theorem and indirect measurement in right triangles.~~Seventh grade students at the distinguished level in mathematics: solve real world problems (including missing measures) involving perimeter, circumference, area, surface area, distance, temperature, volume of prisms/cylinders and develop formulas and convert units; create/ solve problems involving Pythagorean Theorem and indirect measurement in right triangles.	~~and temperature and volume of prisms and cylinders and develop formulas; they convert units of measure. They use the Pythagorean Theorem, indirect measure, and definitions to solve right-triangle application problems.~~Seventh grade students at the above mastery level in mathematics: solve real world problems involving perimeter, circumference, area, surface area, distance, temperature, volume of prisms/cylinders and develop formulas and convert units; use Pythagorean Theorem, indirect measurement and definitions to solve right triangles problems	~~and temperature and volume of prisms and cylinders they convert units of measure. They use the Pythagorean Theorem to find the length of any side of a right triangle.~~Seventh grade students at the mastery level in mathematics: solve real world problems involving perimeter, circumference, area, surface area, distance, temperature, volume of prisms/cylinders and convert units of measure; use Pythagorean Theorem to find the length of any side of a triangle.	~~and temperature; they convert units of measure. They use the Pythagorean Theorem to find the length of the hypotenuse of a right triangle.~~Seventh grade students at the partial mastery level in mathematics: solve problems involving perimeter, circumference, area, surface area, distance temperature and convert units of measure; use Pythagorean Theorem to find the length of the hypotenuse of a right triangle.	~~convert units of measure. They state the Pythagorean Theorem.~~Seventh grade students at the novice level in mathematics: solve problems involving perimeter, circumference, area, surface area and convert units of measure; state the Pythagorean Theorem.

Objectives	Students will
M.O.7.4.1	select and apply an appropriate method to solve (including, but not limited to, formulas) justify the method and the reasonableness of the solution, given a real-world problem solving situation involving • perimeter • circumference • area • surface area of prisms (rectangular and triangular) • volume of prisms and cylinders

	• distance and temperature (Celsius, Fahrenheit)
M.O.7.4.2	use the Pythagorean Theorem to find the length of any side of a right triangle and apply to problem solving situations.
M.O.7.4.3	convert units of measurement, linear, area and volume, within customary and metric systems.

Grade 7	**Mathematics**
Standard 5	**Data Analysis and Probability**
M.S.7.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will: • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability

Performance Descriptors (M.PD.7.5)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Seventh grade students at the distinguished level in mathematics determine theoretical probability of compound, independent events, make and test predictions, and explain their thinking. They create and solve problems involving combinations and permutations. They collect, organize, graphically represent, analyze, and interpret data displays; solve problems using measures of central tendency to interpret the data; and solve problems using measures of central tendency that involve missing data.~~Seventh grade students at the distinguished level in mathematics:	~~Seventh grade students at the above mastery level in mathematics determine theoretical probability of compound, independent events, and make and test predictions. They use appropriate technology to solve application problems involving combinations and permutations. They collect, organize, graphically represent, analyze, and interpret data displays; and solve problems using measures of central tendency to interpret the data.~~Seventh grade students at the above mastery level in mathematics: determine theoretical probability of compound, independent events to	~~Seventh grade students at the mastery level in mathematics determine theoretical probability to make, test predictions. They determine combinations and permutations by constructing sample spaces. They collect, organize, graphically represent, analyze, and interpret data displays and solve problems using measures of central tendency.~~Seventh grade students at the mastery level in mathematics: determine theoretical probability to make and test predictions;	~~Seventh grade students at the partial mastery level in mathematics predict the outcome of an event given its probability and test their prediction and identify the theoretical and experimental probability. They list combinations and permutations of three items. They collect, organize, graphically represent data displays and solve problems using measures of central tendency.~~Seventh grade students at the partial mastery level in mathematics: predict and test the outcome of an event and identify the theoretical/ experimental probability;	~~Seventh grade students at the novice level in mathematics predict the outcome of an event given its probability and test their prediction. They recognize a situation involving a combination and a permutation. They collect and organize data and determine measures of central tendency.~~Seventh graded students at the novice level in mathematics: predict/test outcomes of an event given its probability; recognize a situation involving combinations/ permutations;

determine theoretical probability of compound, independent events to make/test predictions and explain their thinking; create and solve problems involving combinations/ permutations; collect, organize, graph, analyze, interpret data and solve problems using measures of central tendency to interpret data with/without missing data.	make/test predictions; use appropriate technology to solve application problems involving combinations/permutations; collect, organize, graph, analyze, interpret data and solve problems using measures of central tendency to interpret data.	determine combinations/ permutations by constructing sample spaces; collect, organize, graph, analyze, interpret data and solve problems using measures of central tendency.	list combinations/ permutations of three items; collect, organize, graph and solve problems using measures of central tendency.	collect/organize data and determine measures of central tendency.

Objectives	Students will
M.O.7.5.1	determine theoretical probability of an event, make and test predictions through experimentation.
M.O.7.5.2	determine combinations and permutations by constructing sample spaces (e.g., listing, tree diagrams, frequency distribution tables).
M.O.7.5.3	collect, organize, graphically represent, and interpret data displays including frequency distributions, line-plots, scatter plots, box and whiskers, and multiple-line graphs.
M.O.7.5.4	analyze and solve application problems involving measures of central tendency (mean, median, mode) and dispersion (range) from data, graphs, tables, and experiments using appropriate technology to compare two sets of data.

Eighth Grade Mathematics Content Standards and Objectives

Eighth grade objectives provide an alternative course for students who do not take Algebra I in the eighth grade. In addition to reinforcing the concepts presented in seventh grade, this course extends problem solving to a more sophisticated level. Linear equations, systems of linear equations, proportional reasoning and rate of change are emphasized in the Algebra strand in preparation for the formal Algebra I course. Lessons involving cooperative learning, manipulatives, or technology strengthen understanding of concepts while fostering communication and reasoning skills. Calculator use is emphasized for all mathematical tasks including assessment. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 8	Mathematics
Standard 1	Number and Operations
M.S.8.1	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of numbers, ways of representing numbers, and relationships among numbers and number systems, • demonstrate meanings of operations and how they relate to one another, and • compute fluently and make reasonable estimates.

Performance Descriptors (M.PD.8.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Eighth grade students at the distinguished level in mathematics analyze, describe and compare the characteristics of rational and irrational numbers and use rational and irrational numbers to create and solve problems. They create and solve problems involving powers and radicals; they solve problems using numbers in scientific notation. They analyze and solve application problems involving properties of rational and irrational~~	~~Eighth grade students at the above mastery level in mathematics analyze, describe and compare the characteristics of rational and irrational numbers ; and use rational and irrational numbers; they add, subtract, multiply and divide with rational and irrational numbers. They solve problems involving powers and radicals; they solve problems using numbers in scientific notation. They analyze and solve application problems involving rational and~~	~~Eighth grade students at the mastery level in mathematics analyze, describe and compare the characteristics of rational and irrational numbers They solve problems using powers and square roots; they solve problems using numbers in scientific notation They analyze and solve application problems involving any rational numbers (e.g. rates, tips, discounts, sales tax, and interest) and verify solutions using estimation techniques.~~Eight grade	~~Eighth grade students at the partial mastery level in mathematics describe, order and compare rational and irrational numbers. They evaluate powers of integers; they solve problems using numbers in scientific notation. They analyze and solve application problems involving no more than two operations with whole numbers, integers, decimals, fractions, and percents (e.g. rates, tips, discounts, sales tax, and interest) and verify solutions~~	~~Eighth grade students at the novice level in mathematics compare and order rational and irrational numbers by converting to and comparing their decimal forms. They evaluate powers of integers; they convert between numbers in scientific notation and standard form. They solve application problems involving one operation with whole numbers, integers, decimals, fractions, and percents (e.g. rates, tips, discounts, sales tax, and interest) and verify solutions~~

~~number, radicals, and powers and, in a clear, concise manner, justify solutions and explain the process used in solving.~~Eight grade students at the distinguished level in mathematics: analyze, describe and compare characteristics of rational/irrational numbers and use to create/solve problems; create/solve problems using powers, radicals and numbers in scientific notation; analyze and solve application problems involving rational/irrational numbers, verify solutions using estimation and explain process in a clear, concise manner.	~~irrational numbers, verify solutions using estimation techniques, and explain the process used in solving.~~Eight grade students at the above mastery level in mathematics: analyze, describe and compare characteristics of rational/irrational numbers and add, subtract, multiply and divide rational/irrational numbers; solve problems using powers, radicals and numbers in scientific notation; analyze and solve application problems involving rational/irrational numbers, verify solutions using estimation and explain process.	students at the mastery level in mathematics: analyze, describe and compare characteristics of rational/irrational numbers; solve problems using powers, square roots and numbers in scientific notation; analyze and solve application problems involving rational numbers and verify solutions using estimation.	~~using estimation techniques.~~Eight grade students at the partial mastery level in mathematics: describe and compare characteristics of rational/irrational numbers; evaluate powers of integers and solve problems using numbers in scientific notation; analyze and solve application problems involving no more than two operations evaluate powers of integers and solve problems using numbers in scientific notation. with whole numbers, integers, decimals, fractions, percents and verify solutions using estimation.	~~using estimation techniques.~~Eight grade students at the novice level in mathematics: compare and order rational/ irrational numbers by converting/comparing their decimal form; evaluate powers of integers and convert between numbers in scientific notation and standard form; solve application problems involving one operation evaluate powers of integers and solve problems using numbers in scientific notation with whole numbers, integers, decimals, fractions, percents and verify solutions using estimation.

Objectives	Students will
M.O.8.1.1	analyze, describe and compare the characteristics of rational and irrational numbers.
M.O.8.1.2	analyze and solve application problems with • powers, • squares, • square roots, • scientific notation, and verify solutions using estimation techniques.
M.O.8.1.3	analyze and solve grade-appropriate real-world problems with

	• whole numbers, • decimals, • fractions, • percents, percent increase and decrease, • integers, and including, but not limited to, rates, tips, discounts, sales tax and interest and verify solutions using estimation techniques.

Grade 8	**Mathematics**
Standard 2	**Algebra**
M.S.8.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD.8.2)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Eighth grade students at the distinguished level in mathematics formulate an algebraic expression from data in a table arithmetic, geometric, or algebraic pattern; they analyze the table and rule to determine and explain whether or not there exists a functional relationship. They identify a real life problem involving change over time; make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the results of the investigation; present~~	~~Eighth grade students at the above mastery level in mathematics formulate an algebraic expression from data in a table arithmetic, geometric, or algebraic pattern; they analyze the table and rule to determine if a function relationship exists. They identify a real life problem involving change over time; make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the results of the investigation; present the project using words,~~	~~Eighth grade students at the mastery level in mathematics formulate a rule from data in a table to generate an arithmetic, geometric, or algebraic pattern; they analyze tables and rules to determine if a functional relationship exists. They identify a real life problem involving change over time; make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the results of the investigation; present the project using words,~~	~~Eighth grade students at the partial mastery level in mathematics complete a table to predict values in a problem solving situation involving an arithmetic, geometric, or algebraic pattern; they analyze the table and rule to determine if a function relationship exists. They identify a real life problem involving change over time; make a hypothesis as to the outcome; develop, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the results of the investigation; present~~	~~Eighth grade students at the novice level in mathematics create a table of values for and graph linear equations; they identify the slope of a line from its graph as being positive or negative. They identify a real life problem involving change over time; make a hypothesis as to the outcome; implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the results of the investigation; They solve one and two-step linear equations and solve and graph one and two-step inequalities involving whole~~

~~the project using words in a clear and concise manner, with graphs, drawings, models, They solve multi-step linear equations and literal equations and solve and graph multi-step inequalities in one variable with variables on both sides. They graph linear equations and inequalities; they determine the slope of a line given the graph of the line, two points, or the slope/intercept equation; they determine the equation of a line, given the graph or a table of values. They solve problems by creating and simplifying polynomial expressions; they justify their process and solution.~~ Eight grade students at the distinguished level in mathematics: solve multi-step linear/literal equations and solve/graph multi-step inequalities in one variable with variable on both sides; solve problems by creating/ simplifying/justifying polynomials to solve problems; formulate an algebraic expression from data in a table arithmetic, geometric	~~graphs, drawings, models, They solve multi-step linear equations and solve and graph multi-step inequalities in one variable with variables on both sides. They graph linear equations and inequalities; they determine the slope of a line given the graph of the line, two points, or the slope/intercept equation; they determine the equation of a line, given the graph. They generate and apply expressions and equations, including proportions, to solve problems and justify solutions; they add and subtract polynomials to solve problems.~~ Eight grade students at the above mastery level in mathematics: solve multi-step linear equations and solve/graph multi-step inequalities in one variable with variable on both sides; add and subtract polynomials to solve problems; formulate an algebraic expression from data to generate an arithmetic, geometric or algebraic	~~graphs, drawings, models, or tables. They solve two-step linear equations and solve and graph two-step inequalities with rational solutions. They graph linear equations and inequalities; they determine the slope of a line given the graph of the line, two points, or the slope/intercept equation. They generate and apply expressions and equations, including proportions, to solve real-world problems; they add and subtract polynomials limited to two variables and positive exponents.~~ Eight grade students at the mastery level in mathematics: solve two-step linear equations and solve/graph two-step inequalities with rational solutions; add and subtract polynomials to two variables and positive exponents; formulate a rule from data to generate an arithmetic, geometric or algebraic pattern and analyze to determine if a functional relationship exists;	~~the project using words, graphs, drawings, models, They solve one and two-step linear equations and solve and graph one and two-step inequalities involving integers. They create a table of values for and graph linear equations; they determine the slope of a line from its graph. They write and simplify algebraic expressions with whole numbers, integers, rational numbers, absolute value, and exponents using order of operations; they add and subtract polynomials limited to two variables and no exponents~~ Eight grade students at the partial mastery level in mathematics: solve one/two-step linear equations and solve/graph one/two-step inequalities involving integers; add and subtract polynomials to two variables and no exponents; complete a table from data involving an arithmetic, geometric or algebraic pattern and analyze to determine if a functional	~~numbers. They complete a table to generate an arithmetic, geometric, or algebraic pattern; they analyze the table and rule to determine if a function relationship exists. They write algebraic expressions for word phrases, solve proportions, and identify like terms in monomials; they add and subtract polynomials limited to two variables and no exponents.~~ Eight grade students at the novice level in mathematics: solve one/two-step linear equations and solve/graph one/two-step inequalities involving whole numbers; add and subtract polynomials to two variables and no exponents; complete a table to generate an arithmetic, geometric or algebraic pattern and analyze to determine if a functional relationship exists; complete a table of values and graph linear equations;

or algebraic pattern and analyze to determine/ explain if a functional relationship exists; graph linear equations and inequalities, determine the slope given graph of line, two points or slope-intercept form and determine the equation of a line given a graph or table of values; identify a real-life problem involving change over time, make a hypothesis, develop/implement/justify a method to analyze data, generalize/ compare the results and present in a project.	pattern and analyze to determine if a functional relationship exists; graph linear equations and inequalities, determine the slope given graph of line, two points or slope-intercept form and determine the equation of a line given a graph; identify a real-life problem involving change over time, make a hypothesis, develop/implement/justify a method to analyze data, generalize/ compare the results and present in a project	graph linear equations and inequalities, determine the slope given graph of line, two points or slope-intercept form; identify a real-life problem involving change over time, make a hypothesis, develop/implement/justify a method to analyze data, generalize/ compare the results and present in a project.	relationship exists; create a table of values and graph linear equations and determine the slope of a line from a graph; identify a real-life problem involving change over time, make a hypothesis, develop/ implement a method to analyze data, generalize/compare the results and present in a project.	identify a real-life problem involving change over time, make a hypothesis, implement a method to analyze data, and compare the results

Objectives	Students will
M.O.8.2.1	use a variety of strategies to solve one and two-step linear equations and inequalities with rational solutions; defend the selection of the strategy; graph the solutions and justify the reasonableness of the solution.
M.O.8.2.2	identify proportional relationships in real-world situations, then find and select an appropriate method to determine the solution; justify the reasonableness of the solution.
M.O.8.2.3	add and subtract polynomials limited to two variables and positive exponents.
M.O.8.2.4	use systems of linear equations to analyze situations and solve problems.
M.O.8.2.5	apply inductive and deductive reasoning to write a rule from data in an input/output table, analyze the table and the rule to determine if a functional relationship exists.
M.O.8.2.6	graph linear equations and inequalities within the Cartesian coordinate plane by generating a table of values (with and without technology).
M.O.8.2.7	formulate and apply a rule to generate an arithmetic, geometric and algebraic pattern.
M.O.8.2.8	determine the slope of a line using a variety of methods including • graphing • change in y over change in x • equation
M.O.8.2.9	represent and solve real-world grade-appropriate problems using multiple strategies and justify solutions.

M.O.8.2.10	identify a real life problem involving change over time; make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the results of the investigation; present the project using words, graphs, drawings, models, or tables.

Grade 8	Mathematics
Standard 3	Geometry
M.S.8.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will: • analyze characteristics and properties of two- and three- dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformation and use symmetry to analyze mathematical situations, and • solve problems using visualization, spatial reasoning, and geometric modeling.

Performance Descriptors (M.PD.8.3)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Eighth grade students at the distinguished level in mathematics apply relationships among angles formed by parallel lines cut by a transversal to determine missing measures and justify their solution; they construct perpendicular and angle bisectors. They use transformations to create Escher-like tessellations. They create scale models of three-dimensional prisms; they use ratio, proportion to determine scale factor in similar figures. They solve problems involving intersections and unions of plane and solid figures. They make and test conjectures concerning relationships between the dimensions of geometric~~	~~Eighth grade students at the above mastery level in mathematics apply relationships among angles formed by parallel lines cut by a transversal to determine missing measures; they construct perpendicular and angle bisectors. They use transformations to create tessellations. They create scale models of three-dimensional rectangular prisms; they use ratio, proportion to determine scale factor in similar figures. They prove conjectures involving regular polygons and uses coordinate geometry to solve problems involving similar figures and transformations. They make and test conjectures~~	~~Eighth grade students at the mastery level in mathematics recognize relationships among angles formed by parallel lines cut by a transversal; they construct perpendicular and angle bisectors. They create geometric patterns and transformations to predict results of combining, subdividing and changing shapes of plane figures and solids. They create scale models; they use ratio, proportion to determine scale factor in similar figures. They make and test conjectures concerning regular polygons, cross section of a solid such as a cylinder, cone and pyramid, or the intersection of two or more geometric figures in the plan; justify the results.~~	~~Eighth grade students at the partial mastery level in mathematics identify the classifications of angles formed by parallel lines cut by a transversal (alternate interior angles, alternate exterior angles, corresponding angles) and recognize congruent angles pairs formed by parallel lines cut by a transversal; they recognize perpendicular and angle bisectors. They identify geometric patterns and transformations to predict results of combining, subdividing and changing shapes of plane figures and solids. They create scale models of rectangles and right triangles; they use ratio, proportion to determine scale factor in~~	~~Eighth grade students at the novice level in mathematics identify the classifications of angles formed by parallel lines cut by a transversal (alternate interior angles, alternate exterior angles, and corresponding angles); they recognize perpendicular and angle bisectors. They recognize geometric patterns, transformations and results of combining, subdividing and changing shapes of plane figures and solids. They create scale models of rectangles; they use ratio, proportion to determine scale factor in similar figures. They test conjectures concerning regular polygons, cross section of a solid such as a cylinder, cone and pyramid,~~

~~figures; state and justify the results and refine the conjecture. They classify polyhedrons according to the number and shape of faces; and use inductive reasoning to determine and algebraically state the relationship between vertices, faces and edges.~~Eight grade students at the distinguished level in mathematics: apply/justify the relationship among angles formed by parallel lines cut by a transversal; construct perpendicular and angle bisectors; use transformations to create Escher-like tessellations; create scale models of prisms and use ratio/proportions to determine scale factor in similar figures; make/test/justify/refine conjectures concerning relationship between the dimensions of geometric figures;	~~concerning regular polygons, cross section of a solid such as a cylinder, cone and pyramid, or the intersection of two or more geometric figures in the plan; refine the conjecture. They classify polyhedrons according to the number and shape of faces; use inductive reasoning to determine and state the relationship between vertices, faces and edges.~~Eight grade students at the above mastery level in mathematics: apply the relationship among angles formed by parallel lines cut by a transversal; construct perpendicular and angle bisectors; use transformations to create tessellations; create scale models of rectangular prisms and use ratio/proportions to determine scale factor in similar figures; make/test/justify/refine conjectures concerning	~~They classify polyhedrons according to the number and shape of faces and use inductive reasoning to determine the relationship between vertices, faces and edges.~~Eight grade students at the mastery level in mathematics: recognize the relationship among angles formed by parallel lines cut by a transversal; construct perpendicular and angle bisectors; create geometric patterns/ transformations to predict results changing plane figures/solids; create scale models and use ratio/proportions to determine scale factor in similar figures; make/test/justify conjectures concerning regular polygons, cross sections of a solid or intersection of two or more geometric figures; classify polyhedrons according number/shape of faces and use reasoning to	~~similar figures. They make and test conjectures concerning regular polygons, cross section of a solid such as a cylinder, cone and pyramid, or the intersection of two or more geometric figures in the plan; state the results. They classify polyhedrons according to the number and shape of faces and determine the number of vertices, faces and edges.~~Eight grade students at the partial mastery level in mathematics: identify the classifications of angles formed by parallel lines cut by a transversal and recognize congruent angles formed; recognize perpendicular and angle bisectors; identify geometric patterns/ transformations to predict results changing plane figures/solids; create scale models of rectangles/right triangles and use ratio/proportions to determine scale factor in similar figures; make/test conjectures concerning regular	~~or the intersection of two or more geometric figures in the plan; state the results. They determine the number of vertices, faces and edges and distinguish between prisms and pyramids~~Eight grade students at the novice level in mathematics: identify the classifications of angles formed by parallel lines cut by a transversal; recognize perpendicular or angle bisectors; identify geometric patterns/ transformations and results changing plane figures/ solids; create scale models of rectangles and use ratio/proportions to determine scale factor in similar figures; test conjectures concerning regular polygons, cross sections of a solid or intersection of two or more geometric figures; determine the number of vertices/faces/edges and

classify polyhedrons according number/shape of faces and use inductive reasoning to determine/ algebraically state the relationship between vertices, faces and edges.	regular polygons, cross sections of a solid or intersection of two or more geometric figures; classify polyhedrons according number/shape of faces and use reasoning to determine/state the relationship between vertices, faces and edges.	determine the relationship between vertices, faces and edges.	polygons, cross sections of a solid or intersection of two or more geometric figures; classify polyhedrons according number/shape of faces and determine the number of vertices, faces and edges.	distinguish between prisms/pyramids.

Objectives	Students will
M.O.8.3.1	justify the relationships among corresponding, alternate interior, alternate exterior and vertical angles when parallel lines are cut by a transversal using models, pencil/paper, graphing calculator, and technology.
M.O.8.3.2	classify polyhedrons according to the number and shape of faces; use inductive reasoning to determine the relationship between vertices, faces and edges (edges + 2 = faces + vertices).
M.O.8.3.3	identify, apply, and construct perpendicular and angle bisectors with and without technology) given a real-world situation,.
M.O.8.3.4	create geometric patterns including tiling, art design, tessellations and scaling using transformations (rotations, reflections, translations) and predict results of combining, subdividing, and changing shapes of plane figures and solids.
M.O.8.3.5	create scale models of similar figures using ratio, proportion with pencil/paper and technology and determine scale factor
M.O.8.3.6	make and test a conjecture concerning • regular polygons, • the cross section of a solid such as a cylinder, cone, and pyramid, • the intersection of two or more geometric figures in the plane (e.g., intersection of a circle and a line), and justify the results.

Grade 8	Mathematics
Standard 4	Measurement
M.S.8.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of measurable attributes of objects and the units, systems, and processes of measurements, and • apply appropriate techniques, tools, and formulas to determine measurements.

Performance Descriptors (M.PD.8.4)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Eighth grade students at the distinguished level in mathematics determine the volume of prisms, pyramids,~~	~~Eighth grade students at the above mastery level in mathematics determine the volume of prisms, pyramids,~~	~~Eighth grade students at the mastery level in mathematics determine the volume of prisms, pyramids,~~	~~Eighth grade students at the partial mastery level in mathematics determine the volume of prisms, cylinders,~~	~~Eighth grade students at the novice level in mathematics determine the volume of prisms, cylinders, and~~

~~cylinders, cones, and spheres in real-world problem situations; they explain and justify the reasonableness of their method and solution in a clear, concise manner. They solve problems involving missing measurements in plane and solid geometric figures; they justify the results in a clear, concise manner. They create and solve problems involving the Pythagorean Theorem and indirect measurement in right triangles; they justify the results in a clear, concise manner.~~Eight grade students at the distinguished level in mathematics: determine volume of prisms, pyramids, cylinders, cones, and spheres in real world problems and justify reasonableness of method and solution in a clear, concise manner; solve/justify in a clear, concise manner problems involving missing measurements in plane and solid geometric figures; create/solve/justify in a clear, concise manner	~~cylinders, cones, and spheres in real-world problem situations; they explain and justify the reasonableness of their method and solution. They solve problems involving missing measurements in plane and solid geometric figures; they justify the results. They create and solve problems involving the Pythagorean Theorem and indirect measurement in right triangles.~~Eight grade students at the above mastery level in mathematics: determine volume of prisms, pyramids, cylinders, cones, and spheres in real world problems and justify reasonableness of method and solution; solve/justify problems involving missing measurements in plane and solid geometric figures; create/solve problems involving the Pythagorean Theorem and indirect measurement in right triangle.	~~cylinders, cones, and spheres in real-world problem situations and justify the reasonableness of the solution. They solve problems involving missing measurements in plane and solid geometric figures. They use the Pythagorean Theorem, indirect measure, and definitions to solve right-triangle application problems.~~Eight grade students at the mastery level in mathematics: determine volume of prisms, pyramids, cylinders, cones, and spheres in real world problems and justify method reasonableness of solution; solve problems involving missing measurements in plane and solid geometric figures; use Pythagorean Theorem, indirect measure, and definitions to solve right triangle application problems.	~~cones, and pyramids in real-world problem situations and justify the reasonableness of the solution. They solve problems involving missing measurements in rectangular prisms and plane geometric figures. They use the Pythagorean Theorem to find unknown sides of right triangles.~~ Eight grade students at the partial mastery level in mathematics: determine volume of prisms, cylinders, cones, and pyramid in real world problems and justify reasonableness; solve problems involving missing measurement in rectangular prisms and plane geometric figures; use Pythagorean Theorem to find unknown sides of right triangles.	~~pyramids in real-world problem situations and justify the reasonableness of the solution. They solve problems involving missing measurements in plane geometric figures. They use the Pythagorean Theorem to find the hypotenuse of right triangles.~~Eight grade students at the novice level in mathematics: determine volume of prisms, cylinders, and pyramids in real world problems and justify reasonableness; solve problems involving missing measurement in plane geometric figures; use Pythagorean Theorem to find the hypotenuse of right triangle.

problems involving the Pythagorean Theorem and indirect measurement in right triangle.				

Objectives	Students will
M.O.8.4.1	select and apply an appropriate method to solve; justify the method and the reasonableness of the solution of problems involving volume of • prisms • cylinders • cones • pyramids • spheres given real-world problem solving situations.
M.O.8.4.2	solve problems involving missing measurements in plane and solid geometric figures using formulas and drawings including irregular figures, models or definitions.
M.O.8.4.3	solve right triangle problems where the existence of triangles is not obvious using the Pythagorean Theorem and indirect measurement in real-world problem solving situations.

Grade 8	Mathematics
Standard 5	Data Analysis and Probability
M.S.8.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will: • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.

Performance Descriptors (M.PD.8.5)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Eighth grade students at the distinguished level in mathematics make hypotheses, collect data, create and extrapolate information from multiple data displays and construct convincing arguments based on data analysis.~~	~~Eighth grade students at the above mastery level in mathematics collect data, create and extrapolate information from multiple data displays and construct convincing arguments based on data analysis. They use appropriate~~	~~Eighth grade students at the mastery level in mathematics create and extrapolate information from multiple data displays and construct convincing arguments based on data analysis. They use appropriate technology to~~	~~Eighth grade students at the partial mastery level in mathematics create and extrapolate data from multiple displays and draw conclusions based on data analysis. They determine combinations and permutations by~~	~~Eighth grade students at the novice level in mathematics extrapolate information from data displays. They determine combinations and permutations by constructing sample spaces and determine experimental and theoretical probability of~~

~~They use appropriate technology to solve application problems involving combinations and permutations and investigation compound probability of dependent and independent events; they compare and contrast simple probability with compound probability and dependent events with independent events; they design and conduct experiments involving compound probability, dependent events, or independent events.~~Eight grade students at the distinguished level in mathematics: use appropriate technology to solve application problems involving combinations/permutations and investigate compound probability of dependent/ independent events by comparing/contrasting their design/conduct experiments; make hypotheses, collect data, create/extrapolate information from multiple data displays and construct convincing arguments based on data analysis.	~~technology to solve application problems involving combinations and permutations and investigation compound probability of dependent and independent events; they compare and contrast simple probability with compound probability and dependent events with independent events.~~Eight grade students at the above mastery level in mathematics: use appropriate technology to solve application problems involving combinations/permutations and investigate compound probability of dependent/ independent events and compare/contrast experiments with events; collect data, create/ extrapolate information from multiple data displays and construct convincing arguments based on data analysis.	~~solve application problems involving combinations and permutations and investigation compound probability of dependent and independent events.~~Eight grade students at the mastery level in mathematics: use appropriate technology to solve application problems involving combinations/permutations and investigate compound probability of dependent/ independent events; create/extrapolate information from multiple data displays and construct convincing arguments based on data analysis.	~~constructing sample spaces and determine experimental and theoretical probability of compound independent events.~~Eight grade students at the partial mastery level in mathematics: determine combinations/ permutations by constructing sample spaces and determine experimental/theoretical probability of compound independent events; create/extrapolate information from multiple data displays and draw conclusions based on data analysis.	~~simple events.~~Eight grade students at the novice level in mathematics: determine combinations/ permutations by constructing sample spaces and determine experimental/theoretical probability of simple events; extrapolate information from data displays.
Objectives	Students will			

M.O.8.5.1	determine and explain whether a real-world situation involves permutations or combinations, then use appropriate technology to solve the problem.
M.O.8.5.2	compare the experimental and theoretical probability of a given situation (including compound probability of a dependent and independent event).
M.O.8.5.3	create and extrapolate information from multiple-bar graphs, box and whisker plots, and other data displays using appropriate technology.
M.O.8.5.4	analyze problem situations, games of chance, and consumer applications using random and non-random samplings to determine probability, make predictions, and identify sources of bias.
M.O.8.5.5	draw inferences, make conjectures and construct convincing arguments involving • different effects that changes in data values have on measures of central tendency • misuses of statistical or numeric information, based on data analysis of same and different sets of data.

ALGEBRA I CONTENT STANDARDS AND OBJECTIVES

Algebra I objectives provide the gateway to all higher mathematics courses. An emphasis on conceptual development and multiple representations will be used to draw generalizations and to serve as a tool for solving real-world problems. Algeblocks may be used to bridge the gap from the concrete to the abstract. Available technology such as calculators, computers, and interactive utilities are to be used as tools to enhance learning. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 9-12	Mathematics: Algebra I
Standard 2	Algebra
M.S.A1.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD.A1.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Algebra I students at the distinguished level formulate and simplify algebraic expressions (including polynomial) for use in equations and inequalities; they develop and justify each step in the simplification process using order of operation and properties of real numbers. They create, solve, and provide clear, concise mathematical reasoning and justification of solutions for: multi-step linear equations, absolute value equations, linear inequalities (in one variable), quadratic equations (choosing the~~	~~Algebra I students at the above mastery level formulate and simplify algebraic expressions (including polynomial) for use in equations and inequalities; they justify each step in the simplification process using order of operation and properties of real numbers. They create, solve, and provide mathematical reasoning and justification of solutions for: multi-step linear equations, absolute value equations, linear inequalities (in one variable), quadratic equations (choosing the~~	~~Algebra I students at the mastery level formulate and simplify algebraic expressions (including polynomial) for use in equations and inequalities. They derive and use the laws of exponents on expressions with integral exponents. They create, solve, and judge the reasonableness of solutions for: multi-step linear equations, absolute value equations, linear inequalities (in one variable), quadratic equations (choosing the most efficient method) and systems of linear equations;~~	~~Algebra I students at the partial mastery level formulate and simplify algebraic expressions, with integer coefficients, (including polynomial) for use in equations and inequalities. They create solve, and judge the reasonableness of solutions for: multi-step linear equations, absolute value equations, linear inequalities (in one variable), quadratic equations and systems of linear equations that contain only integral coefficients; select and solve appropriate literal equations. They~~	~~Algebra I students at the novice level formulate and simplify algebraic expressions, with whole number coefficients (including polynomial) for use in equations and inequalities. They create, solve, and judge the reasonableness of solutions for: multi-step linear equations, absolute value equations, linear inequalities (in one variable), quadratic equations and systems of linear equations that contain only whole number coefficients; select and solve appropriate literal~~

most efficient method) and systems of linear equations; select and solve appropriate literal equations. They design investigations or experiments and gather data and display the data in a variety of graphs and tables to make and support inferences and predictions, including those based on the rate of change; they justify steps and summarize results in clear, concise manner. They identify a real life situation that involves a constant rate of change; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous linear function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra in a clear and concise manner (with and without technology). They analyze data to prove the existence	most efficient method) and systems of linear equations; select and solve appropriate literal equations. They gather data and display the data in a variety of graphs and tables to make and support inferences and predictions, including those based on the rate of change; they justify steps and summarize results in clear concise manner. They identify a real life situation that involves a constant rate of change; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous linear function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra (with and without technology). They analyze data to prove the existence of a pattern numerically, algebraically and graphically; they write	select and solve appropriate literal equations. They gather data and display the data in a variety of graphs and tables to make and support inferences and predictions, including those based on the rate of change. They use a variety of methods to determine the slope of a line and perform linear regressions. They identify a real life situation that involves a constant rate of change; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous linear function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra (with and without technology).They analyze data to prove the existence of a pattern numerically, algebraically and graphically; they write equations from the patterns	gather data and display the data in a variety of graphs and tables to identify patterns and make predictions, including those based on the rate of change. They use a variety of methods to determine the slope of a line and perform linear regressions. They identify a real life situation that involves a constant rate of change; pose a question; make a hypothesis as to the answer; and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous linear function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra (with and without technology). They analyze data to prove the existence of a pattern numerically, algebraically and graphically; they write equations from the patterns. They identify real-life situations involving exponential growth and	equations. They gather data and display the data in a variety of graphs and tables to make predictions from an identified pattern, including those based on the rate of change. They identify a real life situation that involves a constant rate of change; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous linear function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion They analyze data to prove the existence of a pattern numerically, algebraically and graphically. They recognize real-life situations involving exponential grown and decay equations comparing equations $y = 2^x$ for integral values of x. They model factoring through the use of area models and add, subtract, multiply, and divide polynomial, rational, and radical expressions. They use simulations and rules of probability to

~~of a pattern numerically, algebraically and graphically; they write equations from the patterns and make and justify inferences and predictions in a clear, concise manner. They use multiple representations to model real-life situations involving exponential growth and decay equations comparing equations $y = 2^x$ and $y=(½)^x$ for integral values of x and summarize the relationship in a clear, concise manner. They develop and explain methods of factoring through the use of area models; write the linear factors of a higher order polynomial by examining a graph; use factoring in problem solving situations; and add, subtract, multiply, and divide polynomials, rational and radical expressions. They use simulations and rules of probability to compute and interpret expected value; and identify problem situations and design experiments to solve these using concepts of sample space, probability distribution and justifying the reasonableness of the approach in a clear, concise manner.~~Algebra I students	~~equations from the patterns and make and justify inferences and predictions. They use multiple representations to model real-life situations involving exponential growth and decay equations comparing equations $y = 2^x$ and $y=(½)^x$ for integral values of x. They develop and explain methods of factoring through the use of area models; recognize how factored forms of quadratic equations are related to x-intercepts on a graph; use factoring in problem solving situations; and add, subtract, multiply, and divide polynomials, rational and radical expressions. They use simulations and rules of probability to compute and interpret expected value; and identify problem situations and design experiments to solve these using concepts of sample space and probability distribution.~~Algebra I students at the above mastery level will: formulate and simplify algebraic expressions for use in equations and inequalities, derive and use the laws of integral	~~and make inferences and predictions. They describe real-life situations involving exponential growth and decay equations comparing equations $y = 2^x$ and $y=(½)^x$ for integral values of x. They develop and explain methods of factoring through the use of area models and add, subtract, multiply, and divide polynomials, rational and radical expressions. They use simulations and rules of probability to compute and interpret expected value; and design experiments to solve problems using concepts of sample space and probability distribution~~Algebra I students at the mastery level will: formulate and simplify algebraic expressions for use in equations and inequalities, derive and use the laws of integral exponents; create, solve, and interpret solutions for multi-step equations; and solve literal equations; identify a real life situation;	~~decay equations comparing equations $y = 2^x$ for integral values of x. They model and explain factoring through the use of area models and add, subtract, multiply, and divide polynomials, rational and radical expressions. They use simulations and rules of probability to compute and interpret expected value; and conduct experiments to solve problems using concepts of sample space and probability distribution.~~Algebra I students at the partial mastery level will: formulate and simplify algebraic expressions with integer coefficients for use in equations and inequalities, and use the laws of integral exponents; create, solve, and interpret solutions for multi-step equations that contain only integral coefficients; and solve literal equations; identify a real life situation; collect and organize related data for display in multiple representations; make a conclusion; present the project;	~~compute expected value, and conduct experiments to solve problems using concepts of sample space and probability distribution.~~Algebra I students at the novice level will: formulate and simplify algebraic expressions with whole number coefficients for use in equations and inequalities, and use integral exponents; create, solve, and interpret solutions for multi-step equations that contain only whole number coefficients; and solve literal equations; identify a real life situation; collect and organize related data for display in multiple representations; make a conclusion; prove the existence of a pattern; identify real-life situations involving exponential growth; model operations with and

at the distinguished level will: formulate and simplify algebraic expressions for use in equations and inequalities, developing and justifying each step, derive and use the laws of integral exponents; create, solve, and concisely and clearly interpret solutions for multi-step equations; and solve literal equations; identify a real life situation with experiments to collect, organize, and analyze related data in a clear concise manner for display in multiple representations; formulate a conclusion; present the project with clarity and conciseness; model real-life situations involving exponential growth and decay equations and summarize the relationship in a clear, concise manner; develop and explain operations with and factoring of higher order polynomials, rational and radical expressions. Use intercepts on a graph in problem solving;	exponents; create, solve, and interpret solutions for multi-step equations; and solve literal equations; identify a real life situation and collect, organize, and analyze related data in a clear concise manner for display in multiple representations; formulate a conclusion; present the project; model real-life situations involving exponential growth and decay equations; develop and explain operations with and factoring of polynomials, rational and radical expressions. Use intercepts on a graph in problem solving; use simulations and rules of probability to design and interpret experiments to solve problems.	collect, organize, and analyze related data for display in multiple representations; make a conclusion; present the project; describe real-life situations involving exponential growth and decay equations; develop and explain operations with and factoring of polynomials, rational and radical expressions; use simulations and rules of probability to design experiments to solve problems.	identify real-life situations involving exponential growth and decay equations; model and explain operations with and factoring of polynomials, rational and radical expressions; use simulations and rules of probability to conduct and interpret experiments to solve problems.	factoring of polynomials, rational and radical expressions; use simulations and rules of probability to conduct experiments to solve problems.

use simulations and rules of probability to design experiments to solve problems justifying the reasonableness of the approach in a clear, concise manner.				

Objectives	Students will
M.O.A1.2.1	formulate algebraic expressions for use in equations and inequalities that require planning to accurately model real-world problems.
M.O.A1.2.2	create and solve multi-step linear equations, absolute value equations, and linear inequalities in one variable, (with and without technology); apply skills toward solving practical problems such as distance, mixtures or motion and judge the reasonableness of solutions.
M.O.A1.2.3	evaluate data provided, given a real-world situation, select an appropriate literal equation and solve for a needed variable.
M.O.A1.2.4	develop and test hypotheses to derive the laws of exponents and use them to perform operations on expressions with integral exponents.
M.O.A1.2.5	analyze a given set of data and prove the existence of a pattern numerically, algebraically and graphically, write equations from the patterns and make inferences and predictions based on observing the pattern.
M.O.A.1.2.6	determine the slope of a line through a variety of strategies (e.g. given an equation or graph).
M.O.A1.2.7	analyze situations and solve problems by determining the equation of a line given a graph of a line, two points on the line, the slope and a point, or the slope and y intercept.
M.O.A1.2.8	identify a real life situation that involves a constant rate of change; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous linear function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra (with and without technology).
M.O.A1.2.9	create and solve systems of linear equations graphically and numerically using the elimination method and the substitution method, given a real-world situation.
M.O.A1.2.10	simplify and evaluate algebraic expressions • add and subtract polynomials • multiply and divide binomials by binomials or monomials
M.O.A1.2.11	create polynomials to represent and solve problems from real-world situations while focusing on symbolic and graphical patterns.
M.O.A1.2.12	use area models and graphical representations to develop and explain appropriate methods of factoring.
M.O.A1.2.13	simplify radical expressions • through adding, subtracting, multiplying and dividing • exact and approximate forms
M.O.A1.2.14	choose the most efficient method to solve quadratic equations by

	• graphing (with and without technology), • factoring • quadratic formula and draw reasonable conclusions about a situation being modeled.
M.O.A1.2.15	describe real life situations involving exponential growth and decay equations including $y=2^x$ and $y=(½)^x$; compare the equation with attributes of an associated table and graph to demonstrate an understanding of their interrelationship.
M.O.A1.2.16	simplify and evaluate rational expressions • add, subtract, multiply and divide • determine when an expression is undefined.
M.O.A1.2.17	perform a linear regression (with and without technology), • compare and evaluate methods of fitting lines to data. • identify the equation for the line of regression, • examine the correlation coefficient to determine how well the line fits the data • use the equation to predict specific values of a variable.
M.O.A1.2.18	compute and interpret the expected value of random variables in simple cases using simulations and rules of probability (with and without technology).
M.O.A1.2.19	gather data to create histograms, box plots, scatter plots and normal distribution curves and use them to draw and support conclusions about the data.
M.O.A1.2.20	design experiments to model and solve problems using the concepts of sample space and probability distribution.
M.O.A1.2.21	use multiple representations, such as words, graphs, tables of values and equations, to solve practical problems; describe advantages and disadvantages of the use of each representation.

Geometry Content Standards and Objectives

Geometry objectives are designed for students who have completed the objectives for Algebra I. Study includes experiences and activities that foster in students a feeling for the value of geometry in their lives. Emphasis is placed on development of conjectures by inductive processes using manipulatives and computer software. Cooperative learning groups are particularly effective in allowing students to become proficient in analyzing conjectures and in formulating both formal and informal proofs. Emphasis should be placed on connections to other branches of mathematics and other disciplines, and on workplace applications. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 9-12	Mathematics: Geometry and Applied Geometry
Standard 3	Geometry
M.S.G.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformations and use symmetry to analyze mathematical situations, and • solve problems using visualization, spatial reasoning, and geometric modeling.

Performance Descriptors (M.PD.G.3)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Geometry students at the distinguished level create arguments involving parallel and perpendicular lines, right triangles, congruent and similar figures, convex and concave quadrilaterals, other polygons, tessellating figures, and circles. They transfer the principles of formal and informal proof to situations that integrate geometry with other disciplines. They construct a problem that can be solved using the properties of similar triangles, the~~	~~Geometry students at the above mastery level investigate, make conjectures, justify, compare and contrast, apply and critique arguments involving properties of parallel and perpendicular lines, right triangles, congruent and similar figures, convex and concave quadrilaterals, other polygons, tessellating figures and circles. They construct and represent geometric figures pictorially with proper identification~~	~~Geometry students at the mastery level investigate, make conjectures, justify, compare and contrast and apply, as appropriate relationships involving the properties of parallel and perpendicular lines, right triangles, congruent and similar figures, convex and concave quadrilaterals, other polygons, tessellating figures, and circles. They represent geometric figures pictorially with proper identification and distinguish between undefined and~~	~~Geometry students at the partial mastery level investigate and apply relationships involving the properties of parallel and perpendicular lines, right triangles, congruent and similar figures, convex and concave quadrilaterals, other polygons, tessellating figures, and circles. They identify a real life situation that involves similarity in two or three dimensions; pose a question; make a hypothesis as to the answer, develop, and~~	~~Geometry students at the novice level investigate relationships involving the properties of parallel and perpendicular lines, right triangles, congruent and similar figures, convex and concave quadrilaterals, other polygons, tessellating figures, and circles. They identify a real life situation that involves similarity in two or three dimensions; pose a question; make a hypothesis as to the answer and implement a method to collect, organize, and~~

~~Pythagorean Theorem, or trigonometric ratios, solve it, and interpret the results. They apply principles of transformational geometry to families of algebraic functions. They identify a real life situation that involves similarity in two or three dimensions; pose a question; make a hypothesis as to the answer, develop, justify, and implement a method to collect, organize, and analyze related data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra and geometry in a clear and concise manner (with and without technology). They solve problems and prove, both formally and informally, conjectures using properties of geometric solids. They develop arguments about basic properties of non-Euclidean geometries like finite, hyperbolic, or spherical geometries.~~Geometry students at the distinguished level:	~~and distinguish between undefined and defined terms. They draw and justify conclusions in real-world settings and construct counterexamples or prove a conjecture as they differentiate and apply inductive and deductive reasoning. They investigate the proof of and apply the Pythagorean Theorem, draw conclusions that include two and three dimensions, and derive and solve formulas using nets. They use symbolic logic to construct logical arguments, test the validity of conclusions and interpret truth tables. They apply undefined terms, definitions, postulates, and theorems to construct and critique formal and informal proofs. They discover and use the properties of similar triangles to verify, justify and solve the trigonometric ratios by applying the results to design and construct a physical model that illustrates the use of a scale drawing in a real-world situation, and determine the measure of inaccessible heights or distances and interpret the results. They create, apply and analyze~~	~~defined terms. They investigate measures of angles and draw conclusions for the relationship to its arcs. They draw and justify conclusions in real-world settings as they differentiate and apply inductive and deductive reasoning. In a problem solving situation, they apply the Pythagorean Theorem and its converse, draw conclusions that include two and three dimensions, and solve formulas using nets. They use symbolic logic to construct logical arguments and test the validity of conclusions. They apply undefined terms, definitions, postulates, and theorems to construct formal and informal proofs. They use the properties of similar triangles to verify and justify the trigonometric ratios by applying the results to construct a physical model that illustrates the use of a scale drawing in a real-world situation and determine the measure of inaccessible heights or distances. They create and apply concepts using transformational geometry to construct transformations and explore congruencies~~	~~implement a method to collect, organize, and analyze related data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra and geometry (with and without technology). They use symbolic logic to construct arguments. They apply undefined terms, definitions, postulates, and theorems to construct informal proofs and will distinguish between inductive and deductive reasoning. They use the properties of similar triangles to construct scale drawings. They use transformational geometry to construct transformations and explore congruencies. They use analytical geometry to apply formulas and to verify properties of geometric figures. They explain the similarities and differences of basic geometric forms in Euclidean and spherical geometry.~~ Geometry students at the partial mastery level:	~~analyze related data; They apply undefined terms, definitions, postulates, and theorems to solve problems and will distinguish between inductive and deductive reasoning. They identify corresponding parts of similar triangles. They use transformational geometry to construct transformations. They use analytical geometry to apply formulas. They investigate basic properties of segments, lines, parallel lines, and triangles in spherical geometry.~~Geometry students at the novice level: investigate relationships involving the properties of lines, polygons, measures of angles, circles, Pythagorean Theorem, transformational geometry, tessellating figures, concepts of analytical geometry trigonometric ratios, and use analytical geometry to apply formulas; identify corresponding parts of similar triangles;

investigate, create arguments, justify, compare and contrast, make conjectures, critique arguments and apply relationships involving the properties of lines, polygons, measures of angles, circles, Pythagorean Theorem, transformational geometry, tessellating figures, trigonometric ratios, and the properties of Euclidean geometry with other geometries concepts of analytical geometry; construct the parts of a triangle and develop and justify logical concepts to be used in solving real-world problems; draw and justify conclusions in real-world settings and construct proofs, counterexamples, and logical arguments; identify a real life situation involving similarity; pose a question; make a hypothesis; collect, organize, and analyze related data; make a conclusion; compare the hypothesis and the conclusion; and present the project.	~~transformational geometry to construct transformations and explore congruencies and similarities, and develop and justify logical arguments. They identify a real life situation that involves similarity in two or three dimensions; pose a question; make a hypothesis as to the answer, develop, justify, and implement a method to collect, organize, and analyze related data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra and geometry (with and without technology). They apply and summarize concepts of analytical geometry to develop and apply formulas to construct and prove arguments and to solve practical problems. They research applications of and compare and contrast the properties of Euclidean geometry with non-Euclidean geometries. They construct a triangle's medians, altitudes, angle and perpendicular bisectors and develop and justify~~	~~and similarities and develop logical arguments. They identify a real life situation that involves similarity in two or three dimensions; pose a question; make a hypothesis as to the answer, develop, justify, and implement a method to collect, organize, and analyze related data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra and geometry (with and without technology).They apply concepts of analytical geometry to develop and apply formulas, to construct arguments, and to solve practical problems. They compare and contrast the properties of Euclidean geometry with other geometries. They construct a triangle's medians, altitudes, angle and perpendicular bisectors and develop logical concepts to be used in solving real-world problems.~~Geometry students at the mastery level: investigate, make	investigate and apply relationships involving the properties of lines, polygons, measures of angles, circles, Pythagorean Theorem, transformational geometry, tessellating figures, trigonometric ratios, the properties of Euclidean geometry with other geometries, and concepts of analytical geometry; construct the parts of a triangle and use logical concepts to solve real-world problems; draw and justify conclusions in real-world settings and construct informal proofs; identify a real life situation involving similarity; pose a question; make a hypothesis; collect and organize data; make a conclusion; compare the hypothesis and the conclusion.	draw conclusions in real-world settings and construct informal proof; identify a real life situation involving similarity; pose a question; make a hypothesis; collect and organize data; make a conclusion; compare the hypothesis and the conclusion.

	~~logical concepts to be used in solving real-world problems.~~Geometry students at the above mastery level: investigate, justify, make conjectures, compare and contrast, critique arguments and apply relationships involving the properties of lines, polygons, measures of angles, circles, Pythagorean Theorem, transformational geometry, tessellating figures, trigonometric ratios, the properties of Euclidean geometry with other geometries, and concepts of analytical geometry; construct the parts of a triangle and develop and justify logical concepts to be used in solving real-world problems; draw and justify conclusions in real-world settings and construct proofs, counterexamples, and logical arguments; identify a real life situation involving similarity; pose a question; make a hypothesis; collect, organize, and analyze	conjectures, compare and contrast, and/or apply relationships involving the properties of lines, polygons, measures of angles, circles, Pythagorean Theorem, transformational geometry, tessellating figures, trigonometric ratios, the properties of Euclidean geometry with other geometries, and concepts of analytical geometry; construct the parts of a triangle and develop logical concepts to be used in solving real-world problems; draw and justify conclusions in real-world settings and construct proofs and logical arguments; identify a real life situation involving similarity; pose a question; make a hypothesis; collect, organize, and analyze related data; make a conclusion; compare the hypothesis and the conclusion; and present the project.		

	related data; make a conclusion; compare the hypothesis and the conclusion; and present the project.			

Objectives	Students will
M.O.G.3.1	represent geometric figures, such as points, lines, planes, segments, rays, and angles pictorially with proper identification and distinguish between undefined and defined terms.
M.O.G.3.2	differentiate and apply inductive and deductive reasoning, justify conclusions in real-world settings.
M.O.G.3.3	use the basic concepts of symbolic logic including identifying the converse, inverse, and contrapositive of a conditional statement and test the validity of conclusions with methods that include Venn Diagrams.
M.O.G.3.4	validate conclusions by constructing logical arguments using both formal and informal methods with direct and indirect reasoning.
M.O.G.3.5	construct formal and informal proofs by applying definitions, theorems, and postulates related to such topics as • complementary, • supplementary, • vertical angles, • angles formed by perpendicular lines, and justify the steps.
M.O.G.3.6	compare and contrast the relationships between angles formed by two lines cut by a transversal when lines are parallel and when they are not parallel, and use the results to develop concepts that will justify parallelism.
M.O.G.3.7	make conjectures and justify congruence relationships with an emphasis on triangles and employ these relationships to solve problems.
M.O.G.3.8	identify general properties of and compare and contrast the properties of convex and concave quadrilaterals • parallelograms • rectangles • rhombuses • squares • trapezoids
M.O.G.3.9	identify a real life situation that involves similarity in two or three dimensions; pose a question; make a hypothesis as to the answer, develop, justify, and implement a method to collect, organize, and analyze related data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra and geometry (with and without technology).
M.O.G.3.10	investigate measures of angles and lengths of segments to determine the existence of a triangle (triangle inequality) and to establish the relationship between the measures of the angles and the length of the sides (with and without technology).
M.O.G.3.11	verify and justify the basis for the trigonometric ratios by applying properties of similar triangles and use the results to find inaccessible heights and distances. Using the ratios of similar triangles to find unknown side lengths and angle measures, construct a physical model that illustrates the use of a scale drawing in a real-world situation.
M.O.G.3.12	apply the Pythagorean Theorem and its converse to solve real-world problems and derive the special right triangle relationships (i.e.

	30-60-90, 45-45-90).
M.O.G.3.13	investigate measures of angles formed by chords, tangents, and secants of a circle and draw conclusions for the relationship to its arcs.
M.O.G.3.14	find angle measures of interior and exterior angles; given a polygon, find the length of sides from given data; and use properties of regular polygons to find any unknown measurements of sides or angles.
M.O.G.3.15	develop properties of tessellating figures and use those properties to tessellate the plane.
M.O.G.3.16	derive and justify formulas for area, perimeter, surface area, and volume using nets and apply them to solve real-world problems.
M.O.G.3.17	apply concepts of analytical geometry such as formulas for distance, slope, and midpoint and apply these to finding dimensions of polygons on the coordinate plane.
M.O.G.3.18	construct a triangle's medians, altitudes, angle and perpendicular bisectors using various methods; and develop logical concepts about their relationships to be used in solving real-world problems.
M.O.G.3.19	create and apply concepts using transformational geometry and laws of symmetry, of a • reflection, • translation, • rotation, • glide reflection, • dilation of a figure, and develop logical arguments for congruency and similarity.
M.O.G.3.20	compare and contrast Euclidean geometry to other geometries (i.e. spherical, elliptic) using various forms of communication such as development of physical models, oral or written reports.
M.O.G.3.21	approximate the area of irregularly shaped regions based on the approximations and the attributes of the related region, develop a formula for finding the area of irregularly shaped regions. Plan, organize and present results by justifying conclusions.

Algebra II Content Standards and Objectives

Algebra II objectives emphasize the use of investigation to more advanced functions, using them to solve real-world problems. Focus is on multiple representations to develop conjectures, testing and justifying validity. Calculators, computers, and interactive utilities are an integral part of instruction. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 9-12	Mathematics: Algebra II
Standard 2	Algebra
M.S.A2.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD.A2.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Algebra II ~~Algebra II students at the distinguished level pose and solve problems, which require strategies that implement properties of lines. They pose problems and choose to solve using variations, quadratic equations over the set of complex numbers, systems of linear equations using matrices, quadratic inequalities, systems of linear inequalities, or absolute value inequalities and defend their choice. Their solutions synthesize the use of words, interval notation, graphs, tables, and equations and are well~~	Algebra II ~~Algebra II students at the above mastery level analyze practical situations to develop and use equations of lines to solve problems. They solve practical problems involving variations, quadratic equations over the set of complex numbers, systems of linear equations using matrices, quadratic inequalities, systems of linear inequalities, and absolute value inequalities by using words, interval notation, graphs, tables, and equations. They generate, analyze, and explain solutions by~~	Algebra II ~~Algebra II students at the mastery level determine, compare and contrast equations of lines. They solve problems involving variations, quadratic equations over the set of complex numbers, systems of linear equations using matrices, quadratic inequalities, systems of linear inequalities, and absolute value inequalities. They use words, interval notation, graphs, tables and equations to generate and analyze solutions. They extend techniques of factoring polynomials by applying methods of grouping, graphical~~	~~Algebra II students at the partial mastery level, given sets of points, determine the equations of lines. They generate tables of values to graph and analyze quadratic functions. They solve problems involving direct and inverse variations, quadratic equations over the set of real numbers, systems of two linear equations with integral coefficients using matrices, radical and exponential equations, systems of two linear inequalities, and absolute value equations. They express solutions in both numerical and graphical~~	Algebra II ~~Algebra II students at the novice level, given a graph determine the equation of lines. They solve problems involving direct variation, quadratic equations over the set of rational numbers, systems of two linear equations with integral coefficients using substitution or elimination, systems of two linear inequalities, and absolute value equations, and express solutions in numerical form. They factor polynomials using greatest common factor; binomials and trinomials using area models; and the difference of two squares and~~

~~organized and clearly written. They identify situations that result with more than one solution and justify their reasoning when choosing an answer. They generate, analyze, and explain solutions by comparing and contrasting the use of multiple representations in a clear, concise manner. They extend techniques of factoring polynomials by applying methods of grouping, graphical representation, and the sum and difference of two cubes and explain how the factored form of an equation can be used to find solutions to practical problems and from a graphical representation, predicts a factored form equation that yields the same approximate roots. When solving practical problems, they exhibit understanding of properties about and fluency with operations on matrices, complex numbers, radicals, and expressions with fractional exponents; justify the solution process; and give the solution in simplest form in a clear, concise manner. They simplify and expand expressions using~~	~~comparing and contrasting the use of multiple representations in a clear, concise manner. They extend techniques of factoring polynomials by applying methods of grouping, graphical representation, and the sum and difference of two cubes and explain how the factored form of an equation can be used to find solutions to practical problems. They exhibit understanding of properties about and fluency with operations on matrices, complex numbers, radicals, and expressions with fractional exponents when determining the simplest form of solutions to equations and can justify the solution process. They simplify and expand expressions using properties of logarithms and compare properties of logarithms using laws of exponents. They convert between graphical and algebraic forms of conic sections and between exponential and logarithmic forms of functions and can analyze and describe characteristics of each form. They solve practical problems by determining~~	~~representation, and the sum and difference of two cubes to solve equations. They exhibit understanding of properties about and fluency with operations on matrices, complex numbers, radicals, and expressions with fractional exponents when determining the simplest form of solutions to equations. They simplify and expand expressions using properties of logarithms. They convert between graphs and equations of conic sections and between exponential and logarithmic functions. They determine the constraints and feasible region of a solution for a system of linear inequalities and then use linear programming to determine the optimum value of a function. They analyze, explain, and use functions by finding zeros, maximum and minimum values, and inverses; expressing domain and range in interval notation; performing basic function operations including composition; and generating and extending families of functions using transformations. They generate quadratic regressions and both closed~~	~~forms. They factor quadratic trinomials when the coefficient of the quadratic term is greater than one, and the sum or difference of cubes. They simplify radical expressions, find the determinant of a 3 X 3 matrix, multiply square matrices, multiply complex numbers, and simplify powers of "i". They sketch the graph of an ellipse, identifying the major and minor axes. They identify the base and exponent of a logarithmic equation. They determine the feasible region and the optimum value of a function, given the constraints for a system of linear inequalities. They explore and use functions by finding zeros, express the domain and range in interval notation, and determine the domain of functions resulting from function operations. They make predictions about data values and patterns and sequences, given a recursive model. They identify a real life situation that exhibits characteristics of change that can be modeled by a quadratic equations; pose a questions; make a hypothesis as to the answer~~	~~trinomials into two binomials, when the coefficient of the quadratic term is one. They convert between fractional exponents and radical form of a monomial, add and subtract matrices, multiply a matrix by a scalar, find the determinant of a 2 X 2 matrix, and add and subtract complex numbers. They determine the conic type and sketch a parabola and a circle. They identify the base and exponent of an exponential expression. They determine the optimum value for a function, given the graph of a feasible region. They determine the domain and range of a function and add, subtract, multiply, and divide functions. They identify a quadratic pattern using a table of data values or a recursive sequence. They identify a real life situation that exhibits characteristics of change that can be modeled by a quadratic equations; pose a questions; make a hypothesis as to the answer and implement a method to collect, organize and analyze related data; extend the nature of collected, discrete data to that of a~~

~~properties of logarithms and justify properties of logarithms using laws of exponents. They convert between graphical and algebraic forms of conic sections and between exponential and logarithmic forms of functions and can analyze and describe characteristics of each form. They estimate solutions to simple problems by synthesizing knowledge about the related forms. They pose and solve practical problems by determining the constraints and feasible region of a solution for a system of linear inequalities and then use linear programming to determine the optimum value of a function. They explain why the use of linear programming yields an optimal solution with all explanations and solutions given in a clear, concise manner. They synthesize knowledge about finding zeros, maximum and minimum values, and inverses; expressing domain and range in interval notation; performing basic function operations including composition; and generating and extending families of functions using~~	~~the constraints and feasible region of a solution for a system of linear inequalities and then use linear programming to determine the optimum value of a function and interpret the results in a clear, concise manner. They synthesize knowledge about finding zeros, maximum and minimum values, and inverses; expressing domain and range in interval notation; performing basic function operations including composition; and generating and extending families of functions using transformations to solve problems. They generate quadratic regressions and both closed form and recursive equations to make predictions about data values, patterns, and sequences and explain how the situation, equations, and predictions, are interrelated. They identify a real life situation that exhibits characteristics of change that can be modeled by a quadratic equations; pose a questions; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize and analyze related data; extend~~	~~form and recursive equations to make predictions about data values, patterns, and sequences. They identify a real life situation that exhibits characteristics of change that can be modeled by a quadratic equations; pose a questions; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra (with and without technology).They convert among words, graphs, equations and tables of values to solve problems.~~students at the mastery level: determine, graph and solve various types of equations, inequalities, and systems	~~and implement a method to collect, organize and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra (with and without technology). They convert among graphs, equations, and table of values to solve practical problems.~~Algebra II students at partial mastery level: graph and solve various types of equations, inequalities, and systems and express answers using various formats; factor polynomials when given the appropriate method; convert between the graphs and equations of functions and conic sections;	~~continuous function that describes the known data set; They convert between graphs and tables of values to solve practical problems.~~students at the novice level: graph and solve various types of equations, inequalities, and systems; factor most polynomials when given the appropriate method; graph functions and conic sections from the given equation; simplify and expand most expressions; recognize quadratic regressions; identify a real world

~~transformations to solve problems. Their solutions synthesize the use of words, graphs, tables, and equations and are well organized and clearly written. They justify the solution process. They choose practical situations to make predictions about data values, patterns, and sequences using quadratic regressions or closed form and recursive equations explaining the process and prediction in a clear and concise manner. They identify a real life situation that exhibits characteristics of change that can be modeled by a quadratic equations; pose a questions; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra~~	~~the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra (with and without technology). They analyze teacher generated practical problems and synthesize the use of words, graphs, equations, and tables of values to give solutions and justify their results in a clear and concise manner.~~students at the above mastery level: analyze practical situations to determine, graph and solve various types of equations, inequalities, and systems and express answers using various formats; extend the techniques of factoring polynomials; convert between the graphs and equations of functions and conic sections using an	and express answers using various formats; apply the appropriate method to factor polynomials; convert between the graphs and equations of functions and conic sections using an analysis of their properties and graphing techniques; simplify and expand expressions and convert between appropriate forms; generate quadratic regressions to make predictions; identify a real world situation that models quadratics, pose a question, collect and analyze data.	simplify and expand expressions; make predictions given a quadratic regression; identify a real world situation that models quadratics and pose a question.	situation that models quadratics.

~~(with and without technology). They pose practical problems, find solutions using a variety of strategies, synthesize the use of words, tables, graphs, and equations to give solutions and communicate results and justify the solution process in a clear and concise manner. They identify situations that result in more than one solution and justify their reasoning when choosing an answer.~~students at the distinguished level: develop and analyze practical situations to determine, graph and solve various types of equations, inequalities, and systems and express answers using various formats; extend the techniques of factoring polynomials and explain their application; convert between the graphs and equations of functions and conic sections using an analysis of their properties and graphing techniques and describe their characteristics; justify properties used to	analysis of their properties and graphing techniques and describe their characteristics; apply properties to simplify and expand expressions and convert between appropriate forms; generate quadratic regressions to make predictions and analyze results; identify a real world situation that models quadratics, pose a question, collect and analyze data, and present their results.			

simplify and expand expressions and convert between appropriate forms; generate quadratic regressions to make predictions and present analysis of results; identify a real world situation that models quadratics, pose a question, collect and analyze data, and present and justify their results.				

Objectives	Students will
M.O.A2.2.1	determine equations of lines including parallel, perpendicular, vertical and horizontal lines, and compare and contrast the properties of these equations.
M.O.A2.2.2	factor higher order polynomials by applying various methods including factoring by grouping and the sum and difference of two cubes; analyze and describe the relationship between the factored form and the graphical representation.
M.O.A2.2.3	define complex numbers, simplify powers of 'i', perform basic operations with complex numbers, and give answers as complex numbers in simplest form.
M.O.A2.2. 4	simplify expressions involving radicals and fractional exponents, convert between the two forms, and solve equations containing radicals and exponents.
M.O.A2.2. 5	solve quadratic equations over the set of complex numbers: apply the techniques of factoring, completing the square, and the quadratic formula; use the discriminate to determine the number and nature of the roots; identify the maxima and minima; use words, graphs, tables, and equations to generate and analyze solutions to practical problems..
M.O.A2.2.6	develop and use the appropriate field properties of matrices by adding, subtracting, and multiplying; solve a system of linear equations using matrices; and apply skills toward solving practical problems.
M.O.A2.2.7	define a function and find its zeros; express the domain and range using interval notation; find the inverse of a function; find the value of a function for a given element in its domain; and perform basic operations on functions including composition of functions.
M.O.A2.2.8	analyze families of functions and their transformations; recognize linear, quadratic, radical, absolute value, step, piece-wise, and exponential functions; analyze connections among words, graphs, tables and equations when solving practical problems with and without technology.
M.O.A2.2.9	solve quadratic inequalities, graph their solution sets, and express solutions using interval notation.
M.O.A2.2.10	solve and graph the solution set of systems of linear inequalities in two variables by finding the maximum or minimum values of a function over the feasible region using linear programming techniques.
M.O.A2.2.11	solve practical problems involving direct, inverse and joint variation.
M.O.A2.2.12	analyze the conic sections; identify and sketch the graphs of a parabola, circle, ellipse, and hyperbola and convert between graphs and equations.

M.O.A2.2.13	solve absolute value inequalities graphically, numerically and algebraically and express the solution set in interval notation.
M.O.A2.2.14	define a logarithmic function, transform between exponential and logarithmic forms, and apply the basic properties of logarithms to simplify or expand an expression.
M.O.A2.2.15	identify a real life situation that exhibits characteristics of change that can be modeled by a quadratic equations; pose a questions; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra (with and without technology).
M.O.A2.2.16	describe and illustrate how patterns and sequences are used to develop recursive and closed form equations; analyze and describe characteristics of each form.

Conceptual Mathematics Content Standards and Objectives

Conceptual Mathematics objectives include major topics from algebra and geometry and extend these ideas to practical usage. Basic ideas of probability and statistics and the mathematics of finance are included. These big ideas are to be presented in the context of their historical development. Full integration of calculators, computers, and interactive utilities are essential for mastery. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 9-12	Mathematics: Conceptual Mathematics
Standard 2	Algebra
M.S.CM.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD. CM.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Conceptual Mathematics students at the distinguished level research, apply, compare and design a variety of problem solving strategies to solve real-world problems. They develop and solve application problems using linear, quadratic and exponential functions and interpret their graphs. They assess how these application problems are related to real-world situations. They conduct research and design experiments to collect data and analyze and interpret this data in a real-world~~	~~Conceptual Mathematics students at the above mastery level research, apply and compare a variety of problem solving strategies to solve real-world problems. They develop and solve application problems using linear, quadratic and exponential functions and interpret their graphs. They design experiment to collect data and analyze this data in a real-world situation. They research, describe and illustrate how to calculate costs, interest, loan payments, finance charges and taxes and~~	~~Conceptual Mathematics students at the mastery level apply and compare a variety of problem solving strategies to solve real-world problems. They solve application problems using linear, quadratic and exponential functions and interpret their graphs. They collect data and analyze this data in a real-world situation. They describe and illustrate how to calculate costs, interest, loan payments, finance charges and taxes and analyze how these functions are used to solve real-world problems as well as~~	~~Conceptual Mathematics students at the partial mastery level compare a variety of problem solving strategies to solve real-world problems. They apply application problems using linear, quadratic and exponential functions and explain their graphs. They describe data used in real-world situations. They describe how to calculate costs, interest, loan payments, finance charges and taxes and relate how these functions are used to solve real-world problems as well as compare various methods of investing~~	~~Conceptual Mathematics students at the novice level recognize a variety of problem solving strategies to solve real-world problems. They recognize application problems using linear, quadratic and exponential functions and explain their graphs. They recognize data used in real-world situations. They identify formulas that are used to calculate costs, interest, loan payments, finance charges and taxes and recognize how these functions are used to solve real-world problems as well as name various methods of~~

~~situation. They research, and design problems related to real-world situations that involve calculating costs, interest, loan payments, finance charges and taxes. They analyze and recommend how to use these functions to optimize their budget. They research and critique various methods of investing money. They identify a real life situation that involves investing money over time; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using words, graphs, models, or tables in a clear and concise manner (with and without technology).~~Conceptual Mathematics students at the distinguished level: research, create, apply, and compare a variety of problem-solving strategies to solve real-world problems	~~analyze how these functions are used to solve real-world problems as well as research and compare various methods of investing money. They identify a real life situation that involves investing money over time; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; generalize the results to justify a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using words, graphs, models, or tables (with and without technology).~~Conceptual Mathematics students at the above mastery level: create, apply, and compare a variety of problem-solving strategies to solve real-world problems and justify the reasonableness of the solutions; develop and solve application problems involving functions and interpret and analyze their	~~compare various methods of investing money. They identify a real life situation that involves investing money over time; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using words, graphs, models, or tables (with and without technology).~~Conceptual Mathematics students at the mastery level: apply and compare a variety of problem-solving strategies to solve real-world problems and justify the reasonableness of the solutions; solve application problems involving functions and interpret and analyze the graphs; pose questions, make hypotheses, and implement	~~money. They identify a real life situation that involves investing money over time; pose a question; make a hypothesis as to the answer; develop, and implement a method to collect, organize, and analyze related data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using words, graphs, models, or tables (with and without technology).~~Conceptual Mathematics students at the partial mastery level: apply problem-solving strategies to solve real-world problems; solve application problems involving functions and read the graphs; implement appropriate methods to collect, organize, and present data (with and without	~~investing money. They identify a real life situation that involves investing money over time; pose a question; make a hypothesis as to the answer; and implement a method to collect, organize, and analyze related data; and generalize the results to make a conclusion.~~ Conceptual Mathematics students at the novice level: apply problem-solving strategies to solve problems; recognize problems involving functions; collect, organize, and present data (with and without technology); compute using personal finance formulas.

and justify the reasonableness of the solutions; develop and solve applications problems involving functions and assess their usefulness in the real world; pose questions, make hypotheses, and implement appropriate methods to collect, organize, analyze, draw conclusions, and present data (with and without technology); research and investigate real-world personal finance situations and differentiate between the types of personal finance functions in order to solve and make recommendations to optimize the situation.	graphs; pose questions, make hypotheses, and implement appropriate methods to collect, organize, analyze, draw conclusions, and present data (with and without technology); research and investigate real-world personal finance situations and differentiate between the types of personal finance functions in order to solve the problem.	appropriate methods to collect, organize, analyze, draw conclusions, and present data (with and without technology); differentiate between the types of personal finance functions in order to solve real-world problems.	technology); solve real-world problems when given the appropriate personal finance function.	

Objectives	Students will
M.O.CM.2.1	use a variety of problem solving strategies (e.g., draw a diagram, look for a pattern, work backwards) to solve real-world problems.
M.O.CM.2.2	interpret graphs of functions including linear, quadratic, and exponential.
M.O.CM.2.3	solve application problems using linear, quadratic and exponential functions with emphasis on data collection and analysis.
M.O.CM.2.4	choose the appropriate formulas to solve workplace problems and judge the reasonableness of the solutions.
M.O.CM.2.5	describe and illustrate how calculating costs, simple and compound interest, finance charge, loan payment and tax functions are used to solve real-world problems.
M.O.CM.2.6	identify a real life situation that involves investing money over time; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using words, graphs, models, or tables (with and without technology).

Grade 9-12	Mathematics: Conceptual Mathematics

Standard 3	Geometry
M.S.CM.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformations and use symmetry to analyze mathematical situations, and • solve problems using visualization, spatial reasoning, and geometric modeling.

Performance Descriptors (M.PD. CM.3

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Conceptual Mathematics students at the distinguished level apply and analyze concepts of geometry and use this knowledge to solve real-world problems. They research and compare methods to compute measures and then compute measures to solve real-world problems using relationships. They research and analyze the connection between geometric shapes and patterns, art, architecture, and nature. They design a project that incorporates these connections.~~Conceptual Mathematics students at the distinguished level: design and implement a project which applies concepts of geometry to compute measures and analyze connections between geometric shapes	~~Conceptual Mathematics students at the above mastery level analyze and apply concepts of geometry. They compare methods to compute measures and then compute measures to solve real-world problems using relationships. They research and analyze the connection between geometric shapes and patterns art, architecture, and nature.~~Conceptual Mathematics students at the above mastery level: determine and apply concepts of geometry to compute measures and analyze connections between geometric shapes and their real-world applications.	~~Conceptual Mathematics students at the mastery level apply concepts of geometry. They compute measures to solve real-world problems using relationships. They analyze the connection between geometric shapes and patterns, art, architecture, and nature.~~Conceptual Mathematics students at the mastery level: apply concepts of geometry to compute measures and analyze connections between geometric shapes and their real-world applications.	~~Conceptual Mathematics students at the partial mastery level identify concepts of geometry. They use measures to solve real-world problems using relationships. They model the connection between geometric shapes and patterns, art, architecture, and nature.~~Conceptual Mathematics students at the partial mastery level: use concepts of geometry to compute measures and model connections between geometric shapes and their real-world applications.	~~Conceptual Mathematics students at the novice level recognize concepts of geometry. They recognize that measures can be used to solve real-world problems using relationships. They describe the connection between geometric shapes and patterns, art, architecture, and nature.~~Conceptual Mathematics students at the novice level: recognize concepts of geometry to compute measures and describe connections between geometric shapes and their real-world applications.

and their real-world applications.				

Objectives	Students will
M.O.CM.3.1	apply concepts of geometry including the Pythagorean Theorem, similar triangles, and right triangle trigonometry.
M.O.CM.3.2	compute measures to solve real-world problems, using relationships involving perimeter, area, surface area and volume of geometric figures.
M.O.CM.3.3	analyze the connections of various geometric shapes and patterns to art, architecture, and nature.

Grade 9-12	Mathematics: Conceptual Mathematics
Standard 3	Data Analysis and Probability
M.S.CM.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.

Performance Descriptors (M.PD CM.5)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Conceptual Mathematics students at the distinguished level research and relate mathematical content to its historical development and integrate other disciplines into the study of mathematics. They research and critique a variety of methods and then determine possible outcomes. They develop, interpret and analyze conclusions. They research, design and conduct probability investigations and then determine, analyze and communicate the results. They relate the results to other disciplines and~~	~~Conceptual Mathematics students at the above mastery level research and relate mathematical content to its historical development and integrate other disciplines into the study of mathematics. They determine possible outcomes using a variety of methods and develop and interpret conclusions. They design and conduct probability investigations and determine, analyze and communicate the results. They present these results in a variety of methods. They research the best statistical tools and use them for workplace~~	~~Conceptual Mathematics students at the mastery level relate mathematical content to its historical development and integrate other disciplines into the study of mathematics. They determine possible outcomes using a variety of methods and develop conclusions. They design and conduct probability investigations and then determine, analyze and communicate the results. They use statistical tools for workplace applications. They relate and apply the measures of central tendency to workplace situations.~~Conceptual	~~Conceptual Mathematics students at the partial mastery level describe mathematical content as it relates to its historical development and relates how other disciplines are integrated into the study of mathematics. They identify possible outcomes using a variety of methods and develop conclusions. They conduct probability investigations and then determine and communicate the results. They use statistical tools for workplace applications. They apply the measures of central tendency to workplace~~	~~Conceptual Mathematics students at the novice level recognize that mathematical content is related to its historical development and see how other disciplines are integrated into the study of mathematics. They recognize possible outcomes using a variety of methods and develop conclusions. They conduct probability investigations and then communicate the results. They recognize that there are statistical tools that are used for workplace applications. They describe the measures of central tendency.~~Conceptual Mathematics students at

~~present these results in a variety of methods. They research the best statistical tools and use them for workplace applications. They relate and apply the measures of central tendency to workplace situations and analyze the results.~~Conceptual Mathematics students at distinguished level: research and relate mathematical content to its historical development and connect to other disciplines; design and conduct probability investigations using counting techniques, and determine, analyze and communicate the results and develop rules of probability; compare and contrast more than one set of data that they collect, summarize, and interpret numerically and graphically.	~~applications. They relate and apply the measures of central tendency to workplace situations and analyze the results.~~Conceptual Mathematics students at above mastery level: research and relate mathematical content to its historical development and integrate other disciplines into the study of mathematics; design and conduct probability investigations using counting techniques, and determine, analyze and communicate the results and develop rules of probability; collect, summarize, and interpret data numerically and graphically to make predictions.	Mathematics students at mastery level: relate mathematical content to its historical development and integrate other disciplines into the study of mathematics; design and conduct probability investigations using counting techniques, and determine, analyze and communicate the results; collect, summarize, and interpret data numerically and graphically to make predictions.	~~situations.~~Conceptual Mathematics students at partial mastery level: recognize mathematical content as it relates to its historical development and relate how other disciplines are integrated into the study of mathematics; conduct probability investigations using counting techniques, and determine, analyze and communicate the results; collect and summarize data numerically and graphically.	novice level: recognize that mathematical content is related to its historical development and see how other disciplines are integrated into the study of mathematics; conduct probability investigations using counting techniques and communicate results; collect and summarize data numerically and graphically.

Objectives	Students will
M.O.CM.5.1	relate mathematical content to its historical development.
M.O.CM.5.2	integrate other disciplines into the study of mathematics through simulations, research, and projects.
M.O.CM.5.3	determine possible outcomes using tree diagrams and the counting principles of permutations and combinations, develop conclusions and offer solutions for new situations, using real-world data.
M.O.CM.5.4	design and conduct probability investigations and then determine, analyze, and communicate the results.

M.O.CM.5.5	collect and interpret data using various methods of displaying numerical data, including frequency distributions, graphs, histograms, stem-and-leaf plots, and box-and-whiskers plots, using technology when appropriate.
M.O.CM.5.6	relate the measures of central tendency and the measures of dispersion to a normal distribution.
M.O.CM.5.7	apply the measures of central tendency and the measures of dispersion to workplace situations.
M.O.CM.5.8	use statistical tools for workplace applications such as quality control, marketing and predicting trends.

Algebra III Content Standards and Objectives

Algebra III is intended for students who have mastered the concepts of Algebra I, Geometry, and Algebra II. Algebra III objectives develop and extend properties of higher degree polynomial functions, rational functions, exponential functions and logarithmic functions using the common concepts and language of algebraic, graphical, and tabular representations. The use of analytic geometry for sense making, conceptual understanding of abstract ideas and modeling real world applications is stressed, making use of calculators, computers, and interactive activities. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 9-12	Mathematics: Algebra III
Standard 2	Algebra
M.S.A3.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD.A3.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Algebra III students at the Distinguished Level research practical situations and choose appropriate representations from families of functions, including piecewise defined functions such as step functions, and justify the choice of the model, using characteristics such as asymptotes, end behavior, domain and range, maximum and minimum values, intercepts and multiplicity of roots, and symmetry, including lines of symmetry other than the~~	~~Algebra III students at the Above Mastery Level analyze practical situations to compare and apply multiple representations of families of functions, including piecewise defined functions such as step functions, using characteristics such as asymptotes, end behavior, domain and range (represented using interval notation, set notation, and the number line), maximum and minimum values, intercepts and multiplicity of roots, and symmetry,~~	~~Algebra III students at the Mastery Level compare and apply multiple representations of families of functions, including piecewise defined functions, using characteristics such as asymptotes, end behavior, domain and range (represented using interval notation, set notation, and the number line), maximum and minimum values, intercepts and multiplicity of roots, and symmetry. They recognize and demonstrate algebraic, graphical and tabular connections among~~	~~Algebra III students at the Partial Mastery Level explore multiple representations of families of functions, including absolute value functions, using characteristics such as asymptotes, end behavior, domain and range (represented using interval notation, set notation, or the number line), maximum and minimum values, intercepts and multiplicity of roots, and symmetry. They recognize algebraic and graphical connections among functions and inverses of 1-~~	~~Algebra III students at the Novice Level recognize multiple representations of families of functions and their domain and range. They can graphically recognize maximum and minimum values, intercepts, and symmetry. They recognize inverses of 1-1 functions graphically and can perform compositions and arithmetic operations on them. They recognize and determine the slope of a line, equations of circles, and the relationship between non-vertical~~

~~coordinate axes. They demonstrate, generate, and assess algebraic graphical, and tabular connections among functions and inverses of 1-1 functions by applying transformations, compositions, and arithmetic operations. They justify restricting domains of functions to guarantee the existence of an inverse. They use the properties of analytic geometry to apply the slope of a line and interpret it as a rate of change, to convert between forms of equations of circles and extract geometric information, to interpret the negative reciprocal relationship for non-vertical perpendicular lines as sufficient justification for right angles, and to justify and use the distance formula and midpoint formula. They can relate the difference quotient calculated between any two points on a graph to the average rate of change. They work collaboratively in groups to choose a real world problem that can be modeled by polynomial equations, logarithmic or exponential equations, or systems of linear equations, using algebraic and~~	~~including lines of symmetry other than the coordinate axes. They recognize, demonstrate, and generate algebraic, graphical and tabular connections among functions and inverses of 1-1 functions by applying transformations, compositions, and arithmetic operations. They appropriately restrict domains of functions to guarantee the existence of an inverse. They use the properties of analytic geometry to determine the slope of a line and interpret it as a rate of change, to convert between forms of equations of circles, to relate the negative reciprocal relationship for non-vertical perpendicular lines to right angles, and to develop the distance formula and midpoint formula. They can relate the difference quotient calculated between any two points on a graph to the average rate of change. They create models of real world applied problems involving polynomial equations, logarithmic and exponential equations, and systems of linear equations, using algebraic and graphical techniques such~~	~~functions and inverses of 1-1 functions by applying transformations, compositions, and arithmetic operations. They use the properties of analytic geometry to determine the slope of a line, equations of circles, and to apply the distance formula, midpoint formula and the negative reciprocal relationship for non-vertical perpendicular lines. They relate the slope of a secant line to the average rate of change. They model real world applied problems involving polynomial equations, logarithmic and exponential equations, and systems of linear equations, using algebraic and graphical techniques such as the quadratic formula (including complex roots and an analysis of the discriminant), factoring higher degree polynomials and polynomials with rational exponents (using alternate techniques such as substitution), synthetic division, and properties of logarithmic and exponential functions. They screen for and recognize extraneous roots.~~Algebra III students at the mastery level:	~~1 functions by performing transformations, compositions, and arithmetic operations. They use formulas from analytic geometry to determine the slope of a line, the equations of circles, and the negative reciprocal relationship between non-vertical perpendicular lines; and they apply the distance formula and midpoint formula. They can relate the slope of a secant line to the average rate of change. They solve real world applied problems involving polynomial equations, one-step logarithmic and exponential equations, and 2x2 systems of linear equations, using algebraic and graphical techniques such as the quadratic formula with analysis of the discriminant, factoring of 2nd and 3rd degree polynomials and polynomials of two and four terms by appropriate methods, synthetic division, and properties of exponential functions. They recognize extraneous roots.~~Algebra III students at the partial mastery level: explore multiple representations of families of functions using	~~perpendicular lines; and they calculate using the distance formula and midpoint formula. They confirm the solutions of problems involving polynomial equations, exponential equations, and 2X2 systems of linear equations using algebraic and graphical techniques. They factor out common factors in polynomials, factor trinomials into two binomials, factor the difference of two perfect squares, factor the sum and difference of two perfect cubes, perform synthetic division involving a 2nd degree dividend, and recognize extraneous roots.~~Algebra III students at the novice level: recognize multiple representations of families of functions using basic characteristics of the functions; recognize inverse functions and perform compositions and arithmetic operations;

~~graphical techniques such as the quadratic formula (including complex roots and an analysis of the discriminant), using higher order and multi-variable polynomial factoring when appropriate, synthetic division, and properties of logarithmic and exponential functions. They screen for and recognize extraneous roots, and explain why they arise. They predict, justify, and present their model.~~Algebra III students at the distinguished level: research practical solutions to choose appropriate representations from the families of functions using characteristics of the functions; demonstrate, relate, and assess connections between functions and their inverses, justify restricting the domain to guarantee an inverse, and apply transformations, compositions, and operations; use properties of analytic geometry to apply elements of equations, interpret rates of change, convert between forms of equations, develop	~~as the quadratic formula (including complex roots and an analysis of the discriminant), factoring (including higher order polynomials), synthetic division, and properties of logarithmic and exponential functions. They screen for and recognize extraneous roots, and explain why they arise. They screen for and recognize extraneous roots, and explain why they arise.~~Algebra III students at the above mastery level: analyze practical solutions to compare and apply multiple representations of families of functions using characteristics of the functions; recognize, demonstrate, and relate connections between functions and their inverses, appropriately restrict the domain to guarantee an inverse and apply transformations, compositions, and operations; use properties of analytic geometry to determine equations, interpret rates of change, convert between forms of equations, and develop the distance and	compare and apply multiple representations of families of functions using characteristics of the functions; recognize and demonstrate connections between functions and their inverses and apply transformations, compositions and operations; use properties of analytic geometry to determine equations, their components and relationships and apply the distance and midpoint formulas; model real world problems using algebraic and graphical techniques and screen for extraneous solutions.	characteristics of the function; recognize connections between functions and their inverses by performing transformations, compositions, and operations; use properties from analytic geometry to determine slope, equations of circles, and apply the distance and midpoint formulas; solve real world problems using algebraic and graphing techniques and recognize extraneous solutions.	recognize slope of a line, equations of circles, and calculate distance and midpoint using formulas; confirm solutions of real world problems using algebraic and graphical techniques and recognize extraneous roots.

and justify the use of the distance and midpoint formulas; collaborate to choose a real world problem that can be modeled using algebraic and graphical techniques, predict, justify, and explain the model, and screen for extraneous solutions explaining their existence.	midpoint formulas; create models of real world problems using algebraic and graphical techniques, screen for extraneous solutions, and explain their existence.			

Objectives	Students will
M.O.A3.2.1	use properties of analytic geometry to justify and use the distance and midpoint formulas and negative reciprocal criterion for non-vertical perpendicular lines.
M.O.A3.2.2	factor higher order polynomials by using techniques that can be applied to the factoring of second degree polynomials; relate factored forms of polynomials to graphs, tables, and solutions to problems in context.
M.O.A3.2.3	relate analytical attributes such as characteristics of zeros, x- and y- intercepts, symmetry, asymptotes, end behavior, maximum and minimum points, and domain and range, to graphical and algebraic representations of polynomials and rational functions.
M.O.A3.2.4	analyze the discriminant to classify the roots of quadratic equations with real coefficients, and relate the existence of x-intercepts of the graph to information obtained from the discriminant.
M.O.A3.2.5	solve equations with extraneous roots; explain why the extraneous roots are excluded from the solution set.
M.O.A3.2.6	compare and contrast the use of interval notation, set notation, and number line representations to express the domain and range of functions.
M.O.A3.2.7	compare and contrast the domain and range of a modeling function with the restricted domain and range used in a real world situation; justify the restricted domain and range choice for a problem in context.
M.O.A3.2.8	differentiate between functions and relations; evaluate, add, subtract, multiply, divide, rationalize, simplify, and compose functions (including rational, radical and those with fractional exponents); express domain and range of functions.
M.O.A3.2.9	convert between graphs and equations of circles identifying important features from either representation; translate from general form to standard form by completing the square and describe readily usable characteristics of each form; represent a circle as two functions graphically and algebraically.
M.O.A3.2.10	analyze a piecewise defined function in multiple representations, to give its domain, intercepts, range, constituent pieces as elementary functions, and end behavior; apply to real world data.
M.O.A3.2.11	determine the average rate of change of a function between any two points on its graph and use this rate to find the equation of a secant line; interpret the average rate of change to solve real world problems; relate signs of average rate of change to the function increasing or decreasing; and demonstrate a geometrical and conceptual understanding of the difference quotient.
M.O.A3.2.12	use synthetic division to divide a polynomial, verify a factor, and determine its roots; compare and contrast synthetic division to long division.
M.O.A3.2.13	investigate how the multiplicity of zeros of polynomial functions affects the graph; characterize a polynomial given the zeros, the

	behavior of the graph at the zeros, and the end-behavior.
M.O.A3.2.14	given the characteristics of a transformation involving polynomial, radical, absolute value, logarithmic, or exponential functions, determine a representative function; unravel the effect of a series of transformations using multiple representations.
M.O.A3.2.15	define and discuss one-to-one functions including the role of the Vertical and Horizontal Line Tests; use multiple representations in describing the relationship between a function and its inverse, including the domain and range of each; identify and explain the need for appropriate restrictions necessary to guarantee an inverse function; discuss the symmetrical relationship associated with the line y=x between the function and its inverse and explain the geometric reason the symmetry exists; demonstrate how to algebraically verify that two functions are inverses of each other.
M.O.A3.2.16	prioritize relevant techniques to graph a given rational function, explaining the relevance of symmetry, end behavior, and domain and range; use zeros of the denominator to differentiate between vertical asymptotes and points of discontinuity; use long division to determine end behavior and explain the role of quotient and remainder in the process; explain how the factors of the numerator and denominator can be used to analytically and graphically determine where the graph will fall above or below the x-axis.
M.O.A3.2.17	restrict the possible rational zeros of a polynomial function by using the Rational Zeros Theorem and Descartes' Rule of Signs; confirm the real zeros of a polynomial function by using the Remainder and Factor Theorems; approximate zeros of a polynomial or rational function using a graphing utility and the Intermediate Value Theorem.
M.O.A3.2.18	analyze polynomial equations with real coefficients and complex roots using factoring, the Conjugate Roots Theorem, the quadratic formula, or root restricting theorems; confirm roots using numerical and graphical methods; discuss and justify how the graph of a polynomial function gives information about complex zeros.
M.O.A3.2.19	compare and contrast the cases when $0<a<1$ and $a>1$ for the general exponential function $f(x) = a^x$: graphs, asymptotes, domain and range, and transformations. Interpret the number e as a limit and use e to build exponential functions modeling real world applications.
M.O.A3.2.20	use common and natural logarithms in the evaluation of logarithmic functions whose base is neither 10 nor e. Incorporate the change of base formula and properties of logarithms to simplify and expand algebraic expressions and to solve logarithmic and exponential equations.
M.O.A3.2.21	through algebraic, graphical, numerical, and verbal techniques, solve equations involving radical, exponential, and logarithmic expressions. Formulate strategies to solve real life problems including compound interest and exponential growth and decay.
M.O.A3.2.22	build on the skills of solving linear equations in two variables using elimination, substitution, or matrix methods to solve systems with three or more unknowns involving real world applications. Categorize systems of equations as zero, one, or infinitely many solutions, by both geometric and algebraic methods.
M.O.A3.2.23	work in groups to choose a real life situation that could be modeled by a polynomial, rational, exponential, or logarithmic function, and make a hypothesis, design an experiment, gather data, analyze data, refine the hypothesis into an appropriate mathematical model, use the model to make a prediction, test the prediction using the experimental setup, and compare the results. Present the collaboration as a project using words, graphs, tables, equations, and appropriate presentation tools.

Trigonometry Content Standards and Objectives

Trigonometry objectives emphasize making connections between right triangle trigonometry and circular functions. Calculators, computers, and interactive utilities will be used to enhance student learning. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 9-12	Mathematics: Trigonometry
Standard 3	Geometry
M.S.T.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformations and use symmetry to analyze mathematical situations, and • solve problems using visualization, spatial reasoning, and geometric modeling.

Performance Descriptors (M.PD.T.3)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Trigonometry students at the distinguished level define and relate the six trigonometric functions in right triangles and circular functions and apply in problem solving. They convert from degrees to radians (and vice versa); and test hypothesis or hypotheses to derive formulas to find arclength, area of a sector, angular velocity and linear velocity and apply these concepts to real-world problems; and graph the trigonometric functions and the inverse functions and apply to real-world problems. They~~	~~Trigonometry students at the above mastery level define and relate the six trigonometric functions in right triangles and circular functions and apply in problem solving. They convert from degrees to radians (and vice versa) and test hypothesis and derive formulas to find arclength, area of a sector, angular velocity and linear velocity and graph the trigonometric functions and apply to real-world problems and graph the inverse functions. They evaluate the functions of any angle and the inverse functions~~	~~Trigonometry students at the mastery level define and relate the six trigonometric functions in right triangles and circular functions, and apply in problem solving. They convert from degrees to radians (and vice versa) and develop formulas to find arclength, area of a sector, angular velocity and linear velocity and graph the trigonometric functions and the inverse functions and apply to real-world problems. They evaluate the functions of any angle and the inverse functions (with and without restricted domain) and solve~~	~~Trigonometry students at the partial mastery level identify the six trigonometric functions as defined with right triangles and circular functions. They convert degrees to radians and use formulas to find arclength, area of a sector, angular velocity and linear velocity and identify the graphs of the trig functions. They evaluate the functions of any angle and the inverse functions and solve trigonometric equations with infinite and finite solutions (over a restricted domain). They solve triangles using the Law of Sines and the~~	~~Trigonometry students at the novice level recognize the six trigonometric functions as defined with right triangles. They recognize radians and formulas to find arclength, area of a sector, angular velocity and linear velocity and recognize the graphs of the trig functions. They evaluate the functions of any angle and the inverse functions and solve trigonometric equations with finite solutions (over a restricted domain). They recognize the Law of Sines and the Law of Cosines and find the area of triangles~~

~~evaluate the functions of any angle and the inverse functions (with and without restricted domains) and solve trigonometric equations yielding infinite solutions, finite solutions, or no solution (over a restricted domain) and apply to real-world problems. They determine appropriate use for the Law of Sines and the Law of Cosines and apply to real-world situations, and they find the area of triangles and figures made up of multiple shapes using Heron's formula. They convert complex numbers to polar form, perform computations and use DeMoivre's Theorem, as well as graph on the polar coordinate system and apply models to real-world situations. They verify the basic identities to prove other identities and derive the formulas for sum and difference of angles, half-angle formulas, and double angle formulas and apply them in real-world situations. They perform graphical and algebraic addition of vectors in 2D vectors, apply to real-world problems and identify 3D vectors and real-world uses~~	~~(with and without restricted domains) and solve trigonometric equations yielding infinite solutions, finite solutions or no solution (over a restricted domain). They determine appropriate use for the Law of Sines and the Law of Cosines to solve triangles and apply Heron's formula to find the area of triangles and figures constructed of multiple shapes. They convert complex numbers to polar form, perform computations and use DeMoivre's Theorem, as well as graph in the polar coordinate plane and compare the graph to real-world situations. They verify the basic identities and use them to verify other identities and use formulas for sum and difference of angles, half-angle formulas, and double angle formulas and evaluate them. They perform graphical and algebraic addition of vectors in 2D and apply to real-world problems and use graphs, tables and equations to model periodic data sets and to analyze real-world problems~~ Trigonometry students at the above mastery level:	~~trigonometric equations yielding both infinite and finite solutions (over a restricted domain). They determine the appropriate use for the Law of Sines and the Law of Cosines and solve triangles and apply Heron's formula to find the area of a triangle. They convert complex numbers to polar form, perform computations and use DeMoivre's Theorem, as well as graph in the polar coordinate plane. They verify the basic identities and use them to verify other identities and use formulas for sum and difference of angles, half-angle formulas, and double angle formulas. They perform graphical and algebraic addition of vectors in 2D and use graphs, tables and equations to model periodic data sets and to analyze real-world problems.~~Trigonometry students at the mastery level: define and relate the six trigonometric functions in right triangles and in circular functions; graph and evaluate them and their inverse functions; solve trigonometric equations and apply them to real-	~~Law of Cosines and find the area of triangles using Heron's formula. They identify complex numbers to polar form, perform operations and use DeMoivre's Theorem and identify the graph on the polar coordinate plane. They identify basic identities to verify other identities and use formulas for sum and difference of angles, half-angle formulas, and double angle formulas. They identify vectors in 2D and use graphs, tables and equations to model periodic data sets.~~Trigonometry students at the partial mastery level: define and relate the six trigonometric functions in right triangles and in circular functions; graph and evaluate them and their inverse functions; solve trigonometric equations; convert from degrees to radians and develop formulas to find applications of radian measure; use for the Law of Sines	~~using Heron's formula. They recognize complex numbers to polar form and the graphs on the polar coordinate system and DeMoivre's Theorem. They recognize basic identities and formulas for sum and difference of angles, half-angle formulas, and double angle formulas. They recognize vectors in 2D and use graphs, tables and equations to model periodic data sets.~~Trigonometry students at the novice level: recognize the six trigonometric functions in right triangles and in circular functions, recognize the graphs and evaluate the functions and their inverses; solve trigonometric equations; recognize radians and formulas to convert from degrees to radians and recognize formulas to find applications of radian measure; recognize the Law of Sines and the Law of Cosines and find the area of triangles;

~~and use graphs, tables and equations to model periodic data sets and to analyze real-world problems~~Trigonometry students at the distinguished level: define and relate the six trigonometric functions in right triangles and in circular functions; graph and evaluate them and their inverse functions; solve trigonometric equations and apply them to real-world problems; convert from degrees to radians (and vice versa) and test hypothesis or hypotheses to derive formulas to find applications of radian measure; determine the appropriate use for the Law of Sines and the Law of Cosines; apply to real-world situations; solve triangles and figures of multiple shapes; perform graphical and algebraic addition of vectors; convert complex numbers to polar form and graph in the polar coordinate plane and compare the graph to real	define and relate the six trigonometric functions in right triangles and in circular functions; graph and evaluate them and their inverse functions; solve trigonometric equations and apply them to real-world problems; convert from degrees to radians (and vice versa) and test hypothesis to derive formulas to find applications of radian measure; determine the appropriate use for the Law of Sines and the Law of Cosines and solve triangles and figures of multiple shapes; perform graphical and algebraic addition of vectors; convert complex numbers to polar form and graph in the polar coordinate plane; compare the graph to real-world situations; verify the basic identities	world problems; convert from degrees to radians (and vice versa) and develop formulas to find applications of radian measure; determine the appropriate use for the Law of Sines and the Law of Cosines and solve triangles; perform graphical and algebraic addition of vectors; convert complex numbers to polar form and graph in the polar coordinate plane; verify the basic identities and use them to verify other identities.	and the Law of Cosines and solve triangles; perform graphical and algebraic addition of vectors; convert complex numbers to polar form and identify graphs in the polar coordinate plane; identify the basic identities and use them to verify other identities.	recognize graphical and algebraic addition of vectors; recognize the conversion of complex numbers to polar form and identify graphs in the polar coordinate plane; recognize the formulas for the basic identities.

world situations; identify three-dimensional vectors and use graphs, tables and equations to model periodic data sets and to analyze real world problems; verify the basic identities and use them to verify and evaluate other identities.	and use them to verify and evaluate other identities.			

Objectives	Students will
M.O.T.3.1	apply the right triangle definition of the six trigonometric functions of an angle to determine the values of the function values of an angle in standard position given a point on the terminal side of the angle. • determine the value of the other trigonometric functions given the value of one of the trigonometric functions and verify these values with technology. • using geometric principles and the Pythagorean Theorem, determine the six function values for the special angles and the quadrantal angles and use them in real-world problems. • compare circular functions and the trigonometric function values to draw inferences about coterminal angles and co-functions.
M.O.T.3.2	convert angle measures from degrees to radians (and vice versa) and apply this concept to • create a data set, analyze, and formulate a hypotheses to test and develop formulas for the arclength, area of a sector, and angular velocity and use the formula for application in the real-world. • compare and contrast the concepts of angular velocity and linear velocity and demonstrate by graphical or algebraic means relationship between them and apply to real-world problems.
M.O.T.3.3	using various methods, basic identities and graphical representation • verify trigonometric identities • prove the sum and difference to two angles, double-angles, and half-angle identities
M.O.T.3.4	justify and present the solutions of trigonometric equations that include both infinite and finite (over a restricted domain) solutions.
M.O.T.3.5	find the value of the inverse trigonometric functions using special angle trigonometric function values and technology. • draw inferences of restricted domain to recognize and produce a graph of the inverse trigonometric functions. • prove conjectures made about the solution of the equations such as x = sin (arcsin y), x = sin (arcos y) being sure to consider restrictions of the domain.
M.O.T.3.6	identify a real life problem utilizing graphs of trigonometric functions and/or the inverse functions; make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project using words, graphs, drawings, models, or tables.
M.O.T.3.7	model periodic data sets using graphs, tables, and equations and use them to analyze real-world problems such as electricity and harmonic motion.
M.O.T.3.8	investigate real-world problems within a project based investigation involving triangles using the trigonometric functions, the law of

	sines and the law of cosines, justify and present results.
M.O.T.3.9	develop and test a hypothesis to find the area of a triangle given the measures of two sides and the included angle or the measures of three sides (Heron's formula) and use these formulas to find total area of figures constructed of multiple shapes.
M.O.T.3.10	express complex numbers in polar form: • perform operations including adding, subtracting, multiplying, and dividing; • evaluate powers and roots of complex numbers using De Moivre's Theorem; and graph complex numbers. • graph complex numbers in the polar coordinate plane and make conjectures about some polar graphs and real-world situations such as the paths that the planets travel.
M.O.T.3.11	create graphical and algebraic representations for performing vector operations and analyze these to solve real-world problems such as force analysis and navigation.

Probability and Statistics Content Standards and Objectives

Probability and Statistics is one of the most important branches of the mathematical sciences. Knowledge of these topics is critical to decision-making and to the analysis of data. Using concepts of probability and statistics, individuals are able to predict the likelihood of an event occurring, organize and evaluate data, and identify the significance of statements. Connections between content and applications to the real-world will be emphasized. Graphing utilities such as calculators and computers will be used to enhance student learning and to aid in the solution of practical problems. Prerequisites for this course are successful completion of Algebra II and Geometry. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

Grade 9-12	Mathematics: Probability and Statistics
Standard 5	Data Analysis and Probability
M.S.PS.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.

Performance Descriptors (M.PD.PS.3)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Probability and Statistics students at the distinguished level investigate the types of probability, determine probability and odds using multiple counting principles and distributions and apply the concepts to real-world problems. They create data and compare and contrast the measures of central tendency and the measures of dispersions. They differentiate, make predictions about and support the analysis of individual performance,~~	~~Probability and Statistics students at the above mastery level interpret the types of probability and determine probability and odds using multiple counting principles and distributions. They create data and distinguish between the measures of central tendency and of dispersions. They make predictions about and support the analysis of individual performance, characteristics of samples and justify statistical concepts to test validity of a hypothesis and of correlation as applied~~	~~Probability and Statistics students at the mastery level distinguish types of probability and determine probability and odds using multiple counting principles and distributions. They create data and interpret the measures of central tendency and of dispersions. They analyze individual performance and characteristics of samples, use and justify statistical concepts to test validity of a hypothesis, and determine correlation as applied in real-world situations. They identify~~	~~Probability and Statistics students at the partial mastery level identify the types of probability and multiple counting principles and distributions to determine probability and odds. They interpret the measures of central tendency and of dispersions. They recognize differences in the descriptors for individual performance, characteristics of samples, use statistical concepts to test validity of a hypothesis, and determine correlation for a set of data. They identify a real life situation that involves~~	~~Probability and Statistics students at the novice level recognize the types of probability and multiple counting principles and distributions to determine probability and odds. They find the measures of central tendency and of dispersions. They distinguish between descriptors of individual performance, characteristics of samples, and use statistical concepts to analyze validity and determine correlation for a set of data. They identify a~~

~~characteristics of samples and analyze and justify using statistical concepts to test validity of a hypothesis and of correlation as applied in real-world situations. They identify a real life situation that involves statistical concepts including a t-test, make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize and analyze data; generalize the results to make a conclusion, compare the hypothesis and the conclusion; present the project using predictive and analytic tools in a clear and concise manner (with and without technology). They use a set of data created through experimentation to perform, analyze, predict and interpret a regression analysis and perform, interpret and present with justifications the results of an analysis of variance using ANOVA.~~Probability and Statistics students at the distinguished level: distinguish between, justify and investigate types of probability using multiple counting principles and	~~in real-world situations. They identify a real life situation that involves statistical concepts including a t-test, make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize and analyze data; generalize the results to make a conclusion, compare the hypothesis and the conclusion; present the project using predictive and analytic tools (with and without technology). They perform, analyze, predict and interpret a regression analysis and perform and interpret the results of an analysis of variance using ANOVA.~~Probability and Statistics students at the above mastery level: distinguish between, justify and investigate types of probability using multiple counting principles and distributions; use proper sampling techniques to collect, summarize, and interpret data numerically and graphically in both one-variable and two-variable situations; test the validity of a	~~a real life situation that involves statistical concepts including a t-test, make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize and analyze data; generalize the results to make a conclusion, compare the hypothesis and the conclusion; present the project using predictive and analytic tools (with and without technology). They perform a regression analysis and perform and interpret the results of an analysis of variance.~~ Probability and Statistics students at the mastery level: distinguish between types of probability using multiple counting principles and distributions; use proper sampling techniques to collect, summarize, and interpret data numerically and graphically in both one-variable and two-variable situations; test the validity of a hypothesis in real-world situations by determining the	~~statistical concepts including a t-test, make a hypothesis as to the outcome; develop and implement a method to collect, organize and analyze data; generalize the results to make a conclusion, compare the hypothesis and the conclusion; present the project using predictive and analytic tools (with and without technology). They identify the regression equation and explain the results of the variance analysis.~~Probability and Statistics students at the partial mastery level: calculate probabilities given the type using multiple counting principles and distributions; use proper sampling techniques to collect and summarize data numerically and graphically in both one-variable and two-variable situations; test the validity of a hypothesis in real-world situations using the provided inference technique to make a conclusion about the population of interest.	~~real life situation that involves statistical concepts including a t-test, make a hypothesis as to the outcome; and implement a method to collect, organize and analyze data; They recognize the regression equation and explain the results of the variance analysis.~~Probability and Statistics students at the novice level: recognize the types of probability using multiple counting principles and distributions; collect and summarize data numerically and graphically in both one-variable and two-variable situation; identify a hypothesis in real-world situations to recognize that an inference technique needs to be used in order to make a conclusion about the population of interest.

distributions; use proper sampling techniques to compare and contrast more than one set of data that they collect, summarize, and interpret numerically and graphically in both one-variable and two-variable situations; test the validity of a hypothesis in real-world situations by determining the appropriate inference technique to make a conclusion about the population of interest	hypothesis in real-world situations by determining the appropriate inference technique to make a conclusion about the population of interest	appropriate inference technique to make a conclusion about the population of interest.		

Objectives	Students will
M.O.PS.5.1	distinguish between experimental and theoretical probability.
M.O.PS.5.2	using a real-world problem solving investigation, create and interpret data using various methods of displaying circle graphs, histograms, and frequency curves, make predictions, include information concerning outliers, present and justify results.
M.O.PS.5.3	determine possible outcomes using tree diagrams and the counting principles of permutations and combinations.
M.O.PS.5.4	express the chances of events occurring either in terms of a probability or odds.
M.O.PS.5.5	use the normal distribution and the binomial distribution including Pascal's triangle, to determine probability of events.
M.O.PS.5.6	analyze measures of central tendency (mean, median, and mode) from data presented in a variety of forms such as charts, tables, and graphs or from data created through experimentation.
M.O.PS.5.7	interpret and calculate measures of dispersions (range and standard deviation) from data presented in a variety of forms such as charts, tables and graphs or from data created through experimentation.
M.O.PS.5.8	analyze individual performances in terms of percentiles, z-scores, and t- scores.
M.O.PS.5.9	analyze the role of sampling, randomness, bias, and sample size in data collection and interpretation.
M.O.PS.5.10	identify a real life situation that involves statistical concepts including a t-test, make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize and analyze data; generalize the results to make a conclusion, compare the hypothesis and the conclusion; present the project using predictive and analytic tools (with and without technology).
M.O.PS.5.11	determine the correlation values for given data or for data generated by students and use the results to describe the association of the variables within the given data. Identify whether this association is systematic or predictable.
M.O.PS.5.12	calculate the Chi-Square values for a given population.
M.O.PS.5.13	perform a regression analysis on a set of data, either given or created through experimentation, and use the results to predict specific values of a variable. Identify the regression equation.

M.O.PS.5.14	perform an analysis of variance (ANOVA) and interpret the results.

Pre-Calculus Content Standards and Objectives

Pre-Calculus objectives extend students' knowledge of functions and equations (e.g., higher-order functions, exponential, and logarithmic) as well as provide preparation for a calculus course. Available technology will be used by students and teachers to enhance learning. Graphing utilities are powerful tools for solving and verifying equations and inequalities. They also aid in investigating functions, and their inverses. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and content standards and objectives.

Grade 9-12	Mathematics: Pre-Calculus
Standard 2	Algebra
M.S.PC.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations, and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD.PC.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Pre-Calculus students at the distinguished level investigate and formulate a solution to a real-world problem using equations of higher order polynomials, exponential, and logarithmic forms. They solve problems involving finite and infinite sequences and series, and formulate a hypothesis about evaluating limits. They consider and justify the use of math induction to prove formulas and statements. They compare and contrast the Binomial Theorem and Pascal's Triangle and use them to expand binomials in relation~~	~~Pre-Calculus students at the above mastery level hypothesize and develop a plan to solve higher order polynomials, exponential, and logarithmic equations. They solve problems involving finite and infinite sequences and series and evaluate limits using a variety of methods. They investigate, plan, and construct a method for proving formulas and statements. They expand binomials by applying the Binomial Theorem and Pascal's Triangle and relate the expansion to a real-world situation. They~~	~~Pre-Calculus students at the mastery level determine the reasonableness of the solution of higher order polynomials, exponential, and logarithmic equations. They evaluate finite and infinite sequences and series to find or estimate a limit. They differentiate the process of proving formulas and statements with math induction. They expand binomials by applying the Binomial Theorem and Pascal's Triangle. They interpret the techniques of curve sketching to graph polynomials and rational exponential and logarithmic~~	~~Pre-Calculus students at the partial mastery level examine the solutions of higher order polynomials, exponential, and logarithmic equations. They distinguish finite and infinite sequences and series and find or estimate a limit. They apply math induction to find formulas and statements. They identify the Binomial Theorem and Pascal's Triangle as methods for expanding binomials. They graph polynomials and rational, exponential and logarithmic functions. They identify graphical and algebraic procedures to add~~	~~Pre-Calculus students at the novice level confirm the solutions of higher order polynomials, exponential and logarithmic equations. They identify finite and infinite sequences and series, and find or estimate a limit. They identify math induction process to prove formulas and statements. They recognize the Binomial Theorem and Pascal's Triangle. They recognize the graphs of polynomials and rational exponential and logarithmic functions. They recognize graphical and algebraic procedures to add two~~

~~to a real-world problem. They compare and contrast the graphs of polynomials and formulate a set of rules to aid in graphing and produce and support a solution to a real-world problem involving rational, exponential and logarithmic functions. They design and execute an approach to solve a real-world problem involving three-dimensional vectors.~~Pre-Calculus students at the distinguished level: investigate and formulate a solution to a real-world problem involving higher-order polynomials, exponential and logarithmic equations; solve application problems involving sequences and series, and formulate a hypothesis for evaluating limits; consider and justify using induction to prove formulas and statements; differentiate between appropriate methods to expand binomials in relation to real-world problems;	~~identify a real-world problem which requires the graphs of polynomials, rational, and exponential and logarithmic functions, produce and support a solution to the problem. They compare and contrast and produce the graphical and algebraic procedures to add two dimensional vectors and apply to real-world problems.~~Pre-Calculus students at the above mastery level: hypothesize and develop a plan to solve higher-order polynomials, exponential and logarithmic equations; solve application problems involving sequences and series and evaluate limits; devise a method for proving formulas and statements; expand binomials by applying appropriate methods and relate the expansion to real-world situations; identify and justify their	~~functions. They produce graphical and algebraic means to add vectors in two dimensions and apply to real-world problems.~~Pre-Calculus students at the mastery level: determine the reasonableness of the solutions of higher-order polynomials, exponential and logarithmic equations; evaluate sequences and series to find or estimate a limit; differentiate the process of proving formulas and statements; expand binomials by applying appropriate methods; interpret the techniques of curve sketching to graph functions of real-world situations; analyze and perform operations on vectors to solve practical problems.	~~two dimensional vectors.~~Pre-Calculus students at the partial mastery level: examine the solutions of higher-order polynomials, exponential and logarithmic equations; differentiate sequences and series, and find or estimate a limit; find formulas and statements by applying induction; identify the various methods for expanding binomials; graph various functions; perform operations on vectors to solve practical problems.	~~dimensional vectors.~~Pre-Calculus students at the novice level: confirm the solutions of higher-order polynomials, exponential and logarithmic equations; recognize sequences and series, and find or estimate a limit; recognize induction as a process to prove statements and formulas; recognize the methods for expanding binomials; identify the graphs of various functions; perform operations on vectors.

compare and contrast various graphs formulating a set of rules that produce and support a solution to a real-world problem; design and execute a method to solve a real-world problem involving vectors.	solutions to real-world problems which require various graphs; recognize the application of vectors to practical problems and perform operations on vectors to solve them.			

Objectives	Students will
M.O.PC.2.1	investigate and sketch the graphs of polynomials and rational functions by analyzing and using the characteristics of zeros, upper and lower bounds, y-intercepts, symmetry, asymptotes and end behavior, maximum and minimum points, and domain and range.
M.O.PC.2.2	solve higher order polynomial equations utilizing techniques such as Descartes' Rule of Signs, upper and lower bounds, and the Rational Root Theorem.
M.O.PC.2.3	relate Pascal's Triangle and the Binomial Theorem; use both to expand binomials with positive integral exponents.
M.O.PC.2.4	establish and explain the inverse relationship between exponential and logarithmic functions; graph related functions and include their domain and range using interval notation.
M.O.PC.2.5	compare laws of exponents to properties of logarithms; solve equations and practical problems involving exponential and logarithmic expressions, including natural and common logarithms; confirm solutions graphically and numerically.
M.O.PC.2.6	solve problems involving the sum of finite and infinite sequences and series, including Sigma notation.
M.O.PC.2.7	use tables of values, graphs, conjectures, algebraic methods, and numerical substitution to find or estimate the limit of a function, a sequence or a series.
M.O.PC.2.8	analyze and describe the geometry of vectors, perform mathematical operations with vectors and use vectors to solve practical problems.
M.O.PC.2.9	apply the method of mathematical induction to prove formulas and statements.
M.O.PC.2.10	apply parametric methods to represent motion of objects.
M.O.PC.2.11	use multiple representations, such as words, graphs, tables, and equations, to solve practical problems involving logarithmic, exponential, polynomial, rational, and radical functions; explain how the representations are related to each other, as well as to the problem.

Grade 9-12	Mathematics: Pre-Calculus
Standard 3	**Geometry**
M.S.PC.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems,

	• apply transformations and use symmetry to analyze mathematical situations, and • solve problems using visualization, spatial reasoning, and geometric modeling.

Performance Descriptors (M.PD.PD.3)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Pre-Calculus students at the distinguished level hypothesize, organize, and formulate a solution to a real-world problem using the conic sections, develop and present along with a written explanation of the solution, and illustrate the use of transformations and/or the graphs of other functions.~~Pre-Calculus students at the distinguished level: hypothesize, organize, determine and explain the justification for the solutions to real-world problems involving conic sections and their transformations.	~~Pre-Calculus students at the above mastery level analyze, interpret, and graph using the characteristics and transformations of the sections created when a 3D conical solid is intersected by a plane, graph other functions using transformations, and apply to a real-world situation.~~Pre-Calculus students at the above mastery level: analyze, interpret, and graph the conic sections along with their transformations, and apply to real-world situations.	~~Pre-Calculus students at the mastery level analyze, interpret, and graph the sections created when a 3D conical solid is intersected by a plane and graph other functions using transformations.~~Pre-Calculus students at the mastery level: analyze, interpret, and graph conic sections and their transformations.	~~Pre-Calculus students at the partial mastery level graph equations representing specific conic sections and identify the graphs and the transformations used on other functions.~~Pre-Calculus students at the partial mastery level: graph conic sections and their transformations.	~~Pre-Calculus students at the novice level identify the graphs of equations representing specific conic sections and other functions using transformations.~~Pre-Calculus students at the novice level: identify the graphs of conic sections and their transformations.

Objectives	Students will
M.O.PC.3.1	graph functions and conic sections using transformations.
M.O.PC.3.2	analyze and describe properties of conic sections; explain the interrelationship among the properties; solve practical problems involving conic sections.

Standard 5	Data Analysis and Probability
M.S.PC.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.

Performance Descriptors (M.PD.PC.5				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Pre-Calculus students at the distinguished level compare and contrast exponential and/or logarithmic regressions and relate and defend a solution to a real-world problem.~~ Pre-Calculus students at the distinguished level: relate and defend a solution to a developed real-world situation that involves use of regression equations.	~~Pre-Calculus students at the above mastery level summarize and critique the results of an analysis performed on an exponential and/or logarithmic regression.~~ Pre-Calculus students at the above mastery level: summarize the analysis of developed regression equations.	~~Pre-Calculus students at the mastery level investigate, analyze, hypothesize, and develop a regression equation on a given set of data, exponential and/or logarithm.~~ Pre-Calculus students at the mastery level: investigate, hypothesize, and develop a regression equation.	~~Pre-Calculus students at the partial mastery level explain the regression equation for an exponential and/or logarithmic regression performed on a set of data.~~ Pre-Calculus students at the partial mastery level: investigate and hypothesize regarding a regression equation.	~~Pre-Calculus students at the novice level select a regression equation for an exponential and/or logarithmic regression performed on a set of data.~~ Pre-Calculus students at the novice level: investigate and select a regression equation.

Objectives	Students will
M.O.PC.5.1	identify a real life situation that exhibits characteristics of exponential or logistic growth or decay; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of pre-calculus (with and without technology).

Calculus Content Standards and Objectives

Calculus objectives are designed for students who have completed Algebra I, Geometry, Algebra II, Trigonometry, and Pre-Calculus. Study includes functions and continuity, limits, differentiation and applications of derivatives, integration and its application to area, volume, and displacement. The Rule of Four (Numerical, Analytical, Graphical and Verbal) will be applied throughout the course. Available technology will be used by students and teachers to enhance learning. Graphing utilities will be used to investigate concepts and to evaluate derivatives and integrals. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and content standards and objectives.

Grade 9-12	**Mathematics: Calculus**
Standard 2	**Algebra**
M.S.C.2	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of patterns, relations, and functions, • represent and analyze mathematical situations and structures using algebraic symbols, • use mathematical models to represent and understand quantitative relationships, and • analyze change in various contexts.

Performance Descriptors (M.PD.C.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Calculus students at the distinguished level, given any initial description of a function, closely connect it to other representations such as algebraic, tabular, and graphical. They recognize real-life situations that involve limits and explain these limits using multiple representations. They evaluate limits using limit properties, the squeeze theorem and special limit forms, connecting algebraic behavior with graphical interpretation. They can predict which solution methodology will best suit~~	~~Calculus students at the above mastery level explain connections among abstract notation, graphical analysis and tabular data as applied to functional behavior. They explain limits using multiple representations and evaluate limits using limit properties, the squeeze theorem and special limit forms, connecting algebraic behavior with graphical interpretation. They determine if a function is continuous at a point and apply this to continuity over an interval. They apply the~~	~~Calculus students at the mastery level manipulate abstract notation to illustrate functions and confirm the results using graphs and tables. They determine limits both graphically and numerically and evaluate limits using limit properties, the squeeze theorem and special limit forms. They determine if a function is continuous at a point and apply this to continuity over an interval. They apply the Intermediate Value Theorem when appropriate. They demonstrate knowledge of the definition of the derivative of a~~	~~Calculus students at the partial mastery level demonstrate an understanding of abstract notation of functions and confirm results using graphs. They determine a limit either graphically or numerically and evaluate limits using limit properties and special limit forms. They determine if a function is continuous at a point numerically and graphically and apply the definition of the derivative of a function at a point to find the slope of the tangent line to the graph of the function, interpreting~~	~~Calculus students at the novice level recognize functions expressed algebraically and graphically and use functional notation. Given a graph or table, they determine a limit. They evaluate limits using limit properties and determine graphically if a function is continuous at a point. They construct the tangent line to a curve at a given point and use derivatives to aid in graphing functions. They calculate definite and indefinite integrals for polynomials, and those that are obtained from derivative~~

~~the characterization of functions at single points and at infinity. They express the importance of continuity as it relates to the definition of a function and demonstrate the relationships among the Intermediate Value Theorem, continuity, and root finding. They apply the various forms of the definition of the derivative of a function at a point; interpret this as the slope of the tangent line to the graph of the function at any x, and as the instantaneous rate of change. They recognize the tangent line and its slope as a limit of the converging secant lines and slopes, and apply the definition of derivative to find a general form for f'(x). They compare the average rate of change and the instantaneous rate of change in real-world applications. They prove that differentiability implies continuity and give examples of continuous functions that are not differentiable. They recognize when the Extreme Value Theorem applies and combine and apply the rules of differentiation to various types of functions as~~	~~Intermediate Value Theorem to find roots. They apply the definition of the derivative of a function at a point; interpret this as the slope of the tangent line to the graph of the function at any x, and as the instantaneous rate of change. They recognize the tangent line and its slope as a limit of the converging secant lines and slopes and apply the definition of derivative to find a general form for f'(x). They compare the average rate of change and the instantaneous rate of change in real-world applications, demonstrate that differentiability implies continuity, and give examples of continuous functions that are not differentiable They recognize when the Extreme Value Theorem applies and combine and apply the rules of differentiation to various types of functions as appropriate. They recognize when the hypotheses of Rolle's and the Mean Value Theorems are satisfied and solve real-world problems by applying them. They construct and apply mathematical models~~	~~function at a point, interpret this as the slope of the tangent line to the graph of the function at any x, and interpret the derivative as the instantaneous rate of change. They apply the definition of derivative to find a general form for f'(x). They investigate the average rate of change and instantaneous rate of change in real-world applications. They know the relationship between differentiability and continuity and give examples of continuous functions that are not differentiable. They recognize when the Extreme Value Theorem applies. They combine and apply the rules of differentiation to various types of functions as appropriate. They apply Rolle's and the Mean Value Theorems to solve problems. They construct and apply mathematical models to solve optimization, related rates, velocity, and acceleration problems. They calculate definite and indefinite integrals for polynomials, and those that are obtained from derivative formulas, including single substitutions and change of limits. They calculate a definite integral of a polynomial function using an infinite limit of a Riemann~~	~~the derivative as an instantaneous rate of change. They investigate the average rate of change and instantaneous rate of change graphically. They recognize that differentiable functions are also continuous and recognize when the Extreme Value Theorem applies. They apply the rules of differentiation to various types of functions and apply Rolle's Theorem and the Mean Value Theorem to the graphs of functions. They solve optimization, velocity, and acceleration problems. They calculate definite and indefinite integrals for polynomials, and those that are obtained from derivative formulas involving polynomials and trigonometric functions, including single substitutions. They apply the Fundamental Theorem of Calculus to evaluate a definite integral. They apply the indefinite integral to solve problems concerning position, velocity, and acceleration. They calculate the area under the graph of a nonnegative function the area between two functions of x given points of intersection. They apply the~~	~~formulas, including substitution with no modifications. They apply the Fundamental Theorem of Calculus to evaluate a definite integral. They apply the indefinite integral to solve problems concerning position, velocity, and acceleration. They calculate the area under the graph of a nonnegative function and recognize the definite integral can be applied to displacement.~~Calculus students at the novice level: recognize functions expressed algebraically and graphically and use functional notation correctly; given a graph or table, recognize a limit and evaluate limits using limit properties; determine graphically if a function is continuous at a point; construct the tangent line to a curve at a given point and use derivatives to aid in graphing functions;

~~appropriate. They use Rolle's Theorem to derive the Mean Value Theorem and apply and solve real world problems with these theorems. They propose optimization problems and use mathematical models to solve optimization, related rates, velocity, and acceleration problems. They compare and contrast the different ways one may calculate indefinite or definite integrals and select the most efficient approach that may involve multiple substitutions and change of limits. They calculate a definite integral of a polynomial function using an infinite limit of a Riemann sum and apply the Fundamental Theorem of Calculus to evaluate a definite integral and to define a continuous accumulation function whose derivative is the integrand, including continuous accumulation functions whose limits are functions different from x. They model a quantity that is changing with a function and apply the definite integral to calculate the total change of the quantity over an interval and interpret its relevance to the given~~	~~to solve optimization, related rates, velocity, and acceleration problems. They develop a plan to efficiently find definite and indefinite integrals that may involve multiple substitutions and change of limits and calculate a definite integral of a polynomial function using an infinite limit of a Riemann sum. They apply the Fundamental Theorem of Calculus to evaluate a definite integral and to define a continuous accumulation function whose derivative is the integrand. They recognize when a function represents the change of quantity and apply the definite integral to calculate the total change of this quantity over an interval. They apply the indefinite integral to solve problems concerning position, velocity, and acceleration. They calculate area between curves using either x or y as variables and apply the definite integral to find total distance and displacement for linear motion problems.~~ Calculus students at the above mastery level: explain connections among	~~sum. They apply the Fundamental Theorem of Calculus to evaluate a definite integral and to define a continuous accumulation function whose derivative is the integrand. They apply the definite integral to calculate the total change of a function over an interval and apply the indefinite integral to solve problems concerning position, velocity, and acceleration. They use the definite integral to calculate the area bounded by two functions and apply the definite integral to find total distance and displacement for linear motion problems.~~Calculus students at the mastery level: manipulate algebraic notation to study functions and relate the results to graphs and tables; determine limits algebraically, graphically and numerically, using appropriate limit properties; decide about continuity at a point and over an interval; interpret the derivative of a function as the slope of the	~~definite integral to calculate displacement for linear motion problems.~~Calculus students at the partial mastery level: use algebraic notation for functions and confirm results using graphs; determine limits graphically or numerically and evaluate limits using limit properties; determine if a function is continuous at a point numerically and graphically; apply the definition of the derivative of a function at a point to find the slope of the tangent line to the graph of the function, interpreting the derivative as an instantaneous rate of change; investigate the average rate of change and instantaneous rate of	calculate the average rate of change and the instantaneous rate of change; solve simple optimization problems; calculate definite and indefinite integrals for polynomials. They apply the Fundamental Theorem of Calculus to evaluate a definite integral.

~~situation. They apply the indefinite integral to solve problems concerning position, velocity, and acceleration. Given functions of x or y, they determine the most efficient method for calculating area and evaluate the area between the curves. They distinguish between and compute the total distance and displacement for linear motion problems using definite integrals.~~Calculus students at the distinguished level: closely connect all representations of a function; recognize real life situations that involve limits and interpret these limits using multiple representations and evaluate them using appropriate limit properties; relate the Intermediate Value Theorem, continuity, and root finding; apply the various forms of the definition of the derivative of a function at a point; interpreted as the slope of the tangent line to the graph of the function at	algebraic notation, graphical analysis and tabular data; explain limits using multiple representations and evaluate limits using appropriate limit properties; determine if a function is continuous at a point over an interval; apply the definition of the derivative of a function at a point; interpret this as the slope of the tangent line and as the instantaneous rate of change. They recognize the tangent line slope as a limit of the converging secant line slopes and apply the limit definition to find a general form for f'(x); compare the average rate of change and the instantaneous rate of change in real-world applications, demonstrate that differentiability implies continuity, and give examples of continuous functions that are not differentiable. They	tangent line to the graph of the function at any x, or as the instantaneous rate of change. They apply the limit definition to find the derivative at a point; investigate the average rate of change and instantaneous rate of change in real-world applications. They relate differentiability and continuity and combine and apply the algebraic rules of differentiation and theoretical results; construct and apply mathematical models to solve applied problems; calculate definite and indefinite integrals for integrable elementary functions. They calculate	change graphically. They recognize that differentiable functions are also continuous. They apply the rules of differentiation to various types of functions; solve applied problems about motion, area, and volume; calculate definite and indefinite integrals for integrable elementary functions. They apply the Fundamental Theorem of Calculus to evaluate a definite integral.	

any x, and as the instantaneous rate of change. They recognize the tangent line slope as a limit of the converging secant line slopes, and apply the limit definition to find a general form for f'(x); compare the average rate of change and the instantaneous rate of change in real-world applications. They prove that differentiability implies continuity and give examples of continuous functions that are not differentiable. They combine and apply the rules of differentiation to various types of functions as appropriate. They use Rolle's Theorem to derive the Mean Value Theorem; use mathematical models to solve applied problems; efficiently calculate indefinite or definite integrals . They calculate a definite integral of a polynomial function using an infinite limit of a Riemann sum and apply the Fundamental Theorem of	combine and apply the rules of differentiation to various types of functions as appropriate. They recognize when the hypotheses of Rolle's and the Mean Value Theorems are satisfied; construct and apply mathematical models to solve applied problems; find definite and indefinite integrals that may involve multiple substitutions and change of limits and calculate a definite integral of a polynomial function using an infinite limit of a Riemann sum. They apply the Fundamental Theorem of Calculus.	definite integrals using both Riemann sums and the Fundamental Theorem of Calculus.		

Calculus.				
~~Objectives~~	~~Students will~~			
M.O.C.2.1	use abstract notation to apply properties of algebraic, trigonometric, exponential, logarithmic and composite functions, as well as their inverses, represented graphically, numerically, analytically, and verbally; and demonstrate an understanding of the connections among these representations.			
M.O.C.2.2	demonstrate a conceptual understanding of the definition of a limit via the analysis of continuous and discontinuous functions represented using multiple representations (e.g. graphs and tables).			
M.O.C.2.3	use the properties of limits including addition, product, quotient, composition, and squeeze/sandwich theorem to calculate the various forms of limits: one-sided limits, limits at infinity, infinite limits, limits that do not exist, and special limits such as $\lim_{x\to 0}\left(\frac{\sin x}{x}\right)=1$, $\lim_{x\to 0}\frac{1-\cos x}{x}=0$.			
M.O.C.2.4	apply the definition of continuity to determine where a function is continuous or discontinuous including continuity at a point, continuity over an interval, application of the Intermediate Value Theorem, and graphical interpretation of continuity and discontinuity.			
M.O.C.2.5	investigate and apply the definition of the derivative graphically, numerically, and analytically at a point, conceptually interpreting the derivative as an instantaneous rate of change and the slope of the tangent line.			
M.O.C.2.6	discriminate between the average rate of change and the instantaneous rate of change using real-world problems.			
M.O.C.2.7	justify why differentiability implies continuity and classify functional cases when continuity does not imply differentiability.			
M.O.C.2.8	recognize when the Extreme Value Theorem indicates that function extrema exist.			
M.O.C.2.9	quickly recall and apply rules of differentiation including the constant multiple rule, sum rule, the difference rule, the product rule, the quotient rule, the power rule, and the chain rule as applied to algebraic, trigonometric, exponential, logarithmic, and inverse trigonometric functions using techniques of both explicit and implicit differentiation.			
M.O.C.2.10	apply Rolle's Theorem and the Mean Value Theorem to real-world problems.			
M.O.C.2.11	construct and use mathematical models to solve optimization, related-rates, velocity, and acceleration problems.			
M.O.C.2.12	determine antiderivatives that follow from derivatives of basic functions and apply substitution of variables.			
M.O.C.2.13	calculate a definite integral using Riemann sums by evaluating an infinite limit of a sum using summation notation and rules for summation.			
M.O.C.2.14	evaluate definite integrals using basic integration properties such as addition, subtraction, constant multipliers, the power rule, substitution, and change of limits.			
M.O.C.2.15	characterize the definite integral as the total change of a function over an interval and use this to solve real-world problems.			
M.O.C.2.16	apply the Fundamental Theorem of Calculus to evaluate definite integrals and to formulate a cumulative area function and interpret the function as it relates to the integrand.			
M.O.C.2.17	use integration to solve problems that involve linear displacement, total distance, position, velocity, acceleration and area between curves by looking at both functions of x and functions of y; utilize units to interpret the physical nature of the calculus process.			

Grade 9-12	Mathematics: Calculus
Standard 3	Geometry
M.S.C.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformations and use symmetry to analyze mathematical situations, and • solve problems using visualization, spatial reasoning, and geometric modeling.

Performance Descriptors (M.PD.C.3)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Calculus students at the distinguished level apply the definition of continuity and categorize discontinuities of functions presented algebraically, graphically and numerically. They use limits to find asymptotes and to explain end behavior of functions, and describe asymptotic behavior using multiple representations. They develop tangent lines as best linear approximations to functions near specific points; explain this conceptually; construct these tangent lines; and apply this concept to Newton's Method. They investigate and explain the relationships among the graphs of a function and its derivatives and construct a graph of a function given conceptual information about its derivatives. They determine, by nature of the~~	~~Calculus students at the above mastery level differentiate between continuous and discontinuous functions using limits, apply the definition of limit to graphs of functions, and identify characteristics of removable and infinite discontinuities. They use limits to find and justify the existence of asymptotes of functions. They develop tangent lines as best linear approximations to functions near specific points and construct these tangent lines; and apply this concept to Newton's Method. They investigate and explain the relationships among the graph of a function and its derivatives and construct a graph of a function given conceptual information about its derivatives. They approximate the area under~~	~~Calculus students at the mastery level differentiate between continuous and discontinuous functions graphically using limits and identify removable discontinuities. They apply limits to find asymptotes, use tangent lines to approximate functions, and apply Newton's Method to approximate zeroes of functions. They use derivatives and limits to graph functions and investigate and explain the relationships among the graph of a function and its derivatives. They approximate the area under a curve by applying a finite Riemann sum implementing left, right, or midpoint rules.~~Calculus students at the mastery level: recognize continuous and discontinuous functions	~~Calculus students at the partial mastery level distinguish between continuous and discontinuous functions graphically. They apply limits to find asymptotes. They use a tangent line to approximate a function at a point and can use Newton's Method to approximate zeroes of functions. They use derivatives to aid in graphing functions. They approximate the area under a curve by applying a finite Riemann sum implementing left, right, or midpoint rules.~~Calculus students at the partial mastery level: distinguish between continuous and discontinuous functions graphically; apply limits to find	~~Calculus students at the novice level identify a discontinuous function. Given a graph, they identify the location of asymptotes and construct the tangent line to a curve at a given point. They use derivatives to aid in graphing functions. They approximate the area under a curve by applying a finite Riemann sum implementing left, right, or midpoint rules, given the end points and length of each subinterval.~~Calculus students at the novice level: identify a discontinuous function graphically; given a graph, identify the location of asymptotes;

~~function, whether the left, right, or midpoint rule will yield the best approximation to a definite integral using a Riemann Sum with a finite number of sub-intervals. They propose a better method for approximating the actual area.~~Calculus students at the distinguished level: apply the definition of continuity to categorize discontinuities of functions presented algebraically and graphically; use asymptotes to explain end behavior of functions, and describe asymptotic behavior using multiple representations, develop tangent lines as best linear approximations to functions near specific points and apply this concept to Newton's Method; investigate and explain the relationships among the graphs of a function and its derivatives; anticipate whether the left, right, or midpoint rule will yield the best approximation to a definite integral using a Riemann Sum with a finite number of sub-intervals.	~~a curve by applying a finite Riemann sum implementing left, right, or midpoint rules, and determine whether the left hand and right hand approximations over-estimate or under-estimate the actual area.~~ Calculus students at the above mastery level: recognize continuous and discontinuous functions using limits; use limits to find and justify the existence of asymptotes of functions, develop tangent lines as best linear approximations to functions near specific points, construct these tangent lines and apply this concept to Newton's Method; investigate and explain the relationships among the graph of a function and its derivatives; approximate the area under a curve using a Riemann sum implementing left, right, or midpoint rules, and determine whether the left hand and right hand approximations over-	graphically; apply limits to recognize asymptotes, use tangent lines to locally approximate functions, and apply Newton's Method to approximate zeroes of functions; extract information about the graph of a function from its derivative and limiting values; approximate the area under a curve via a Riemann sum using left, right, or midpoint rules.	asymptotes, use a tangent line to approximate a function at a point and can apply Newton's Method to approximate zeroes of functions; use derivatives to aid in graphing functions; approximate the area under a curve by constructing a Riemann sum implementing left, right, or midpoint rules.	use information from derivatives to aid in graphing functions; approximate the area under a curve by applying a finite Riemann sum implementing left, right, or midpoint rules, given the subdivision.

They propose better methods for approximating the actual area.	estimate or under-estimate the actual area.			

Objectives	Students will
M.O.C.3.1	use limits to deduce asymptotic behavior of the graph of a function.
M.O.C.3.2	compare and contrast the limit definition (not delta epsilon) of continuity and the graphical interpretation of the continuity of a function at a point; recognize different types of discontinuities.
M.O.C.3.3	develop tangent lines as best linear approximations to functions near specific points; explain this conceptually; and construct these tangent lines; and apply this concept to Newton's Method.
M.O.C.3.4	investigate and explain the relationships among the graphs of a function, its derivative and its second derivative; construct the graph of a function using the first and second derivatives including extrema, points of inflection, and asymptotic behavior.
M.O.C.3.5	approximate areas under a curve using Riemann sums by applying and comparing left, right, and midpoint methods for a finite number of subintervals.

Grade 9-12	Mathematics: Calculus
Standard 5	Data Analysis and Probability
M.S.C.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.

Performance Descriptors (M.PD.C.5

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
~~Calculus students at the distinguished level individually identify a real life situation that involves quantities that change; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data~~	~~Calculus students at the above mastery level, in small groups, identify a real life situation that involves quantities that change; pose a question; make a hypothesis as to the answer; implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the~~	~~Calculus students at the mastery level, working in small groups, identify a real life situation that involves quantities that change; pose a question; implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; make a conclusion. They present the project numerically,~~	~~Calculus students at the partial mastery level, working in teacher facilitated groups, solve a real life problem using given data that involves quantities that change. They organize and analyze the data. extend the nature of collected, discrete data to that of a continuous function that describes the known data set. They present the projects numerically, analytically, graphically and~~	~~Calculus students at the novice level, working in teacher facilitated groups, solve a real life problem using provided data that involves quantities that change. They extend the nature of collected, discrete data to that of a continuous function that describes the known data set. They present the projects numerically, analytically, graphically and verbally using the predictive and~~

~~set; generalize the results to make a conclusion; compare the hypothesis and the conclusion. They present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of calculus.~~Calculus students at the distinguished level: apportion individual tasks in small groups to identify a real life situation that involves modeling change; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make predictions to test their model; compare the hypothesis and the conclusion. They present the project numerically, analytically, graphically and verbally.	~~results to make a conclusion; compare the hypothesis and the conclusion. They present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of calculus.~~Calculus students at the above mastery level: in small groups, identify a real life situation that involves modeling change; pose a question; make a hypothesis as to the answer; implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make predictions to test their model; compare the hypothesis and the conclusion. They collaborate using concepts from calculus to present the project numerically, analytically, graphically and verbally.	~~analytically, graphically and verbally using the predictive and analytic tools of calculus.~~Calculus students at the mastery level: working in small groups, identify a real life situation that involves modeling change; pose a question; implement a method to collect, organize, and analyze related data; find a continuous function that describes the known data set; make predictions to test their model. They collaborate using concepts from calculus to present the project numerically, analytically, graphically and verbally.	~~verbally using the predictive and analytic tools of calculus.~~ Calculus students at the partial mastery level: working in teacher facilitated groups, solve a real life problem using given data that involves modeling change. They organize and analyze the data; find a continuous function that describes the known data set. They collaborate using concepts from calculus to present the projects numerically, analytically, graphically and verbally.	~~analytic tools of calculus.~~ Calculus students at the novice level: working in teacher facilitated groups, solve a real life problem using provided data that involves modeling change. They extend collected, discrete data to values of a continuous function that describes the known data set. They present the projects numerically, analytically, graphically and verbally.

Objectives	Students will
M.O.C.5.1	identify a real life situation that involves quantities that change over time; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of calculus.

FISCAL NOTE FOR PROPOSED RULES

Rule Title: **W. Va. 126CSSR44B, Policy 2520.2 Mathematics Content Standards and Objectives for West Virginia Schools**

Type of Rule: **X** Legislative ☐ Interpretive ☐ Procedural

Agency: West Virginia Department of Education

Address: Capitol Building 6, Room 608

1900 Kanawha Boulevard, East

Charleston, WV 25305

Phone Number: 304.558.5325 Email: cljwilli@access.k12.wv.us

Fiscal Note Summary

Summarize in a clear and concise manner what impact this measure will have on costs and revenues of state government.

Fiscal Note Detail

Show over-all effect in Item 1 and 2 and, in Item 3, give an explanation of Breakdown by fiscal year, including long-range effect.

FISCAL YEAR			
Effect of Proposal	Current Increase/Decrease (use"-")	Next Increase/Decrease (use"-")	Fiscal Year (Upon Full Implementation)
1. Estimated Total Cost	0	0	0
Personal Services	0	0	0
Current Expenses	0	0	0
Repairs & Alterations	0	0	0
Assets	0	0	0
Other	0	0	0
2. Estimated Total Revenues	0	0	0

Rule Title: **W. Va. 126CSSR44B, Policy 2520.2 Mathematics Content Standards and Objectives for West Virginia Schools**

Rule Title: **W. Va. 126CSSR44B, Policy 2520.2 Mathematics Content Standards and Objectives for West Virginia Schools**

3. Explanation of above estimates (including long-range effect);
Please include any increase or decrease in fees in your estimated total revenues.

MEMORANDUM

Please identify any areas of vagueness, technical defects, reasons the proposed rule **would not** have a fiscal impact, and/or any special issues **not** captured elsewhere on this form.

No costs or revenues will be impacted by the proposed amendment of W. Va. 126CSR44B, Policy 2520.2 Mathematics Content Standards and Objectives.

Signature of Agency Head or Authorized Representative

Date

5-20-09

126CSR44B

POLICY2520.2: 21st Century Mathematics Content Standards and Objectives for West Virginia Schools

COMMENT PERIOD ENDS: July 13, 2009

COMMENT RESPONSE FORM

The following form is provided to assist those who choose to comment on Policy 2520.2: 21st Century Mathematics Content Standards and Objectives for West Virginia Schools. **NOTE: Amended performance descriptors are open for comment; no other comments will be accepted.** Additional sheets may be attached, if necessary.

Name : _____ Organization: _____

Title: _____

Street Address: _____

City: _____ State: _____ Zip: _____

Please check the box below that best describes your role.

☐ School System Superintendent	☐ School System Staff	☐ Parent/Family
☐ Principal	☐ Teacher	☐ Business/Industry
☐ Professional Support Staff	☐ Service Personnel	☐ Community Member

COMMENTS/SUGGESTIONS

§126-44B. Performance Descriptors

Please identify the performance descriptor prior to your comment.

EXAMPLE:

Grade 2, Mathematics, Performance Descriptor M.PD.2.1 – Add your comment.

Please direct all comments to:
Lou Maynus, Mathematics Coordinator
Office of Instruction
West Virginia Department of Education
Capitol Building 6, Room 608
1900 Kanawha Boulevard, East
Charleston, West Virginia 25305-0330
lmaynus@access.k12.wv.us
Fax No.: (304) 558-1834.