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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 September 26, 2007 AT 4:00 p.m. . ONLY WRITTEN COMMENTS WILL BE ACCEPTED AND ARE TO BE MAILED TO THE FOLLOWING ADDRESS:

Carla Williamson
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 THIS PROPOSED RULE.

Jack McClanahan
Deputy State Superintendent of Schools

ATTACH A **BRIEF** SUMMARY OF YOUR PROPOSAL

EXECUTIVE SUMMARY
FOR
WEST VIRGINIA BOARD OF EDUCATION POLICY 2520.2
21st CENTURY MATHEMATICS CONTENT STANDARDS AND OBJECTIVES FOR WEST VIRGINIA SCHOOLS

Policy Number and Title: West Virginia Board Of Education Policy 2520.2: *21st Century Mathematics Content Standards and Objectives for West Virginia Schools*

Background: Policies 2520 define the content standards and objectives for the programs of study required by Policy 2510 and establish a standardized format for such.

- The original effective date of Policy 2520 (Instructional Goals and Objectives for West Virginia Schools) was July 1997.
- The West Virginia Board of Education approved initial work on Mathematics content standards in December 2001. The revision placed on comment in November 2002 created a separate policy for each content area, expanded the number of performance levels from 3 to 5, and made minor editorial changes.
- Policy 2520.2 was filed February 25, 2003 and became effective July 1, 2003.
- Policy 2520.2 (21st Century) was filed November 15, 2006 and is to become effective July 1, 2008. In order to incorporate Algebra III and Calculus into Policy 2520.2 (effective July 1, 2008), the policy must be repealed and placed, in its entirety, on public comment.

Major Revisions or Reasons for New Policy: A repeal and replace of Policy 2520.2 is being recommended due to the format changes.

- The format of the math CSOs has been designed to facilitate easier use by West Virginia educators.
- The math CSOS have been revised to:
  - incorporate higher levels of critical thinking skills and problem solving skills.
  - establish an improved alignment with national assessments (NAEP, ACT, and SAT), and
  - incorporate 21st century knowledge and skills that West Virginia students will need to be successful in the global world of the 21st century.
- The addition of a new course, Algebra III, content standards and objectives designed for work beyond Algebra II, transitioning students from Algebra II to Trigonometry or Trigonometry to Pre-Calculus
- Content standards and objectives for Calculus, a course that has been taught throughout West Virginia for which we had no content standards and objectives, have been identified.

Impact:

- Students will be better prepared for success on national assessments, in postgraduate studies and in the workplace of the 21st century.
- Students will acquire a higher level of critical thinking and problem solving skills needed for success in post graduate studies and the workplace of the 21st century.
- The revised format will better enable West Virginia educators to focus instruction on the approved CSOs.

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. - West Virginia Board of Education 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 W. Va. 126CSR42 (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. -

1.4. Effective Date. – July 1, 2008.

1.5. Repeal of former rule. - This legislative rule repeals and replaces W. Va. 126CSR44B "21st Century Mathematics Content Standards and Objectives for West Virginia Schools (2520.2)" filed November 15, 2006 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. 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.

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.

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	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	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	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 5^{th}. They group objects by ones and tens and identify place value using standard form through 20. They solve addition and subtraction sentences using whole numbers to 10. 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 5^{th}. They copy place values of numbers using standard form. They model addition and subtraction sentences using numbers to 10. They solve one-step problems using pictures.

operations and the 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.	and subtraction sentences using whole numbers to 15 and solve two-step problems using pictures. They present their results offering more than one solution.	operations. They create picture story problems and present and justify their solutions.		

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	Kindergarten students at the above mastery level in mathematics justify the classification of self-	Kindergarten students at the mastery level in mathematics justify the classification of self-	Kindergarten students at the partial mastery level in mathematics classify objects by one attribute.	Kindergarten students at the novice level in mathematics sort objects and identify patterns of counting by 10's.

several attributes. They create, extend and describe repeating patterns. They count by 2's, 5's, 10's, and 20's to 100.	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.	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.	They repeat a pattern using common objects and model patterns of 5's and 10's.	They identify a repeating pattern.

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 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 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 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 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.

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 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	Kindergarten students at the 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 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	Kindergarten students at 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 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.

and a nickel, and a nickel to pennies.		penny, nickel, and dime and determine the value of a set of pennies up to 20. They explain the relationship between the coins.		

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 and interpret results. They make predictions, present	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 create simple probability experiments and use tallies	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. They conduct simple probability experiments and	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. They conduct simple probability experiments.	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 probability experiments

their findings and justify their solutions.	to record results in a table. They make predictions based on the results and present their findings.	use tallies to record results in a table. They make predictions based on results.		

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 20^{th}. 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 10^{th}. 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 10^{th}.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.

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.	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.	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.	less and present their solutions.	

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 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 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 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 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.

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 using numbers or words. They classify shapes as open and closed and congruent shapes, justifying their classification orally. 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.	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 shapes to the environment. They classify shapes as open, closed and congruent shapes. 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.	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 identify open, closed, and congruent shapes. 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.	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 congruent shapes. They identify three-dimensional shapes in the environment.. They name locations on a first quadrant grid. They draw decomposing two/three dimensional figures.	Students at the novice level in first grade mathematics recognize plane shapes and three-dimensional figures. They recognize open, closed and congruent shapes. 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.

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.	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.	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	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.	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.

		the relationship between coins and make change from a dollar.		

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 collect, sort, organize, and analyze data using bar graphs and	Students at the above mastery level in first grade mathematics collect, sort, organize, and analyze data using bar graphs and	Students at the mastery level in first grade mathematics collect, sort, organize, and draw conclusions about data	Students at the partial mastery level in first grade mathematics collect, sort, and organize data using bar graphs and pictographs.	Students at the novice level in first grade mathematics collect data. They read pictographs. They conduct simple probability

pictographs. 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.	pictographs. They create simple probability experiments and record data in charts. They make predictions based on the results and present their findings.	using bar graphs and pictographs. 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.	They conduct simple probability experiments and record data in a chart.	experiments.

Objectives	Students will
M.O.1.5.1	collect, sort, organize, and draw conclusions about data using a bar graph and a pictograph.
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 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-appropriate one and two student problems using multiple strategies, present and justifying procedures in	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 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-world grade-appropriate one- and two-step problems using multiple strategies, present and justify results.	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 demonstrate quick recall of basic addition facts with sums to 18 and corresponding subtraction facts. They model and justify the relationship between addition and subtraction facts. They	Second grade students at the partial mastery level in mathematics read and write numbers to 1000 and identify ordinal numbers to the 20^{th} position. They identify place value to 1000 and round numbers to the nearer 100. They demonstrate recall of basic addition facts with sums to 18 and corresponding subtraction facts. They model two- and three-digit addition and subtraction without regrouping. They identify and name fractions as part of a whole and part of a set using models. They	Second grade students at the novice level in mathematics read numbers to 1000 and identify ordinal numbers to the 10^{th} 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 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 strategies.

a clear and concise manner.		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.	create one-step grade-appropriate story problems using multiple strategies.	

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	identify any number as odd or even and determine if a set has and 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 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 above mastery level in mathematics analyze, describe, extend and create a growing pattern, justifying their reasoning. They create a rule and then create a pattern to match the rule. They write equivalent numerical expressions.	Second grade students at the mastery level in mathematics analyze, describe, extend and create a growing pattern. They identify a rule for a pattern and use it to complete the pattern. They create equivalent numerical expressions.	Second grade students at the partial mastery level in mathematics describe, extend and create a growing pattern. They use a rule to complete a pattern. They describe equivalent numerical expressions.	Second grade students at the novice level in mathematics identify and extend a growing pattern. They recognize a rule used to complete a pattern. They recognize equivalent numerical expressions.

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	Second grade students at the above mastery level in mathematics identify, describe and analyze geometric solids. They compare and contrast plane	Second grade students at the mastery level in mathematics identify and describe geometric solids. They compare and contrast plane and solid geometric	Second grade students at the partial mastery level in mathematics identify geometric solids. They compare plane and solid geometric shapes. They	Second grade students at the novice level in mathematics recognize three-dimensional solids. They identify plane and solid geometric shapes.

reasoning in a clear and concise manner. They create shapes and the reflected image. They create paths between locations on a grid. They create similar shapes and justify why they are similar in written form.	and solid geometric shapes communicating their reasoning orally. They 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.	shapes. They identify and draw congruent shapes that have been rotated or reflected. They model and draw line segments and angles. They plot and describe the path between locations on a grid. They identify similar shapes.	identify congruent shapes that have been rotated or reflected. They identify line segments and angles. They describe the path between locations on a grid They recognize similar shapes.	They recognize congruent shapes. They locate points on a grid. They recognize line segments and angles.

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 estimate measures, select and correctly use the	Second grade students at the above mastery level in mathematics estimate measures, select and correctly use the	Second grade students at the mastery level in mathematics estimate measures, select and correctly use the	Second grade students at the partial mastery level in mathematics select and correctly use the appropriate measuring tool.	Second grade students at the novice level in mathematics, given a measuring tool determines, the measure of an object.

appropriate measuring tool to compare objects and justify their reasoning. They determine the perimeter and area of a given shape using manipulatives and justify their reasoning. They explain the relationship between coins and make change from $1.00 justifying their procedures.	appropriate measuring tool to compare objects. 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 and make change from $1.00 explaining their procedures.	appropriate measuring tool. They determine the perimeter and the area of a given shape using manipulatives. They 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.	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.	They read time to the nearest hour on an analog clock. They read dates on a calendar. They explain the relationship between coins.

Objectives	Students will
M.O.2.4.1	estimate measures, select and correctly use the appropriate measurement tool to measure the object and determine the reasonableness of the estimate: • length in centimeters and inches, • temperature in Celsius and Fahrenheit, • weight/mass in pounds and kilograms, and justify estimates when communicating results.
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 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 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 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 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. They formulate questions, collect data, organize and display data in a chart, table or bar graph.	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 novice level in mathematics read a pictograph. They conduct simple probability experiments. They organize data into a table or bar graph.

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 use symbolic representations to compare fractions as parts of a whole and part of a set, to compare and order fractions, and to add and subtract fractions with like denominators. They justify procedures used to perform	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 use pictorials and symbolic representations to compare fractions as parts of a 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	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 use concrete models to represent fractions as part of a whole and part of a set, to compare and order fractions, and to add and subtract fractions. They perform basic computation with addition, subtraction, multiplication of multi-digit	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 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 addition, subtraction and multiplication and division of a 2-digit number by a 1-digit number. They solve grade-appropriate real-world	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 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 real-world problems.

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.	basic computation with addition, subtraction, multiplication and division. They create grade-appropriate real-world problems justifying the reasoning and procedures.	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.	problems.	

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 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 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 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 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 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 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.

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 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 above mastery level in 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 mastery level in 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 partial mastery level in 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 novice level in mathematics 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.

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 mathematics estimate, measure, compare and order common measurements of objects and communicate their understanding of measurement in a clear and concise manner. They communicate their understanding of perimeter and area in a clear and concise manner. They create real-world problems using time, including elapsed time, 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 above mastery level in mathematics estimate, measure, compare and order common measurements of objects and communicate their understanding of measurement. 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 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 mastery level in mathematics estimate, measure, compare and order common measurements of objects. They estimate and find the perimeter and area of familiar geometric shapes. They read time to five minute intervals 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 partial mastery level in mathematics measure and compare common measurements of objects. 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 novice level in mathematics measure common objects. 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.

Objectives	Students will

M.O.3.4.1	estimate, measure, compare, and order common measurements of objects: • length using customary and metric (to the nearest 1/2 inch) • temperature in Celsius and Fahrenheit • mass/weight
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 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.

Grade 3	**Mathematics**
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-	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 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 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 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.

world data.				

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.	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.	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.	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.	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.
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	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	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	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	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

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 to describe that problem and then evaluate that expression. They create and solve real-world problems involving order of operations with variables.	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.	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.	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.	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.

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 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 the relationship between the	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 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 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 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 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 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.

parts of a circle. They select, analyze, and justify appropriate use of transformations to solve geometry problems. They use transformations to create tessellations.				

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 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	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	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	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 apply a	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 recognize a formula used to

order real-world measurements. They analyze, justify and communicate results both orally and in writing. They construct real-world problems involving area. They investigate formulas for area and select the appropriate one in context to the problem. They demonstrate an understanding of the formula used to determine area and use this formula to compare and contrast areas and communicate to others both orally and in writing. 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.	analyze, justify and communicate results both orally and written. They investigate formulas for area and select the appropriate one in context to the problem. They demonstrate an understanding of the formula used to determine area and use this formula to compare and contrast areas. 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.	and present results. They demonstrate an understanding of the formula used to determine area and use this formula to compare areas. 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.	formula used to determine area and use this formula to compare areas. They read 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.	determine area. They read time to the quarter hour and calculate elapsed time in hours/minutes within a 24 hour period using either analog or digital clocks. They count coins and/or bills given real-world situations.

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	demonstrate an understanding of the formula used to determine the area of rectangles and squares and use this formula to compare

	areas of rectangles and squares.
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 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,	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. 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.	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 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.	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 experiment, list possible combinations using a tree diagram, represent the outcomes and present the results.	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 experiment, list some combinations using a tree diagram, and identify the outcomes.

and analyze and present the results both orally and in writing.				

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.

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, classifing 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.	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.	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.	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.	contain fractions, mixed numbers and decimals. They solve multi-digit whole number division problems They solve addition, subtraction, multiplication and division of whole numbers.

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 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.	Fifth grade students at the above mastery level in mathematics use inductive 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.	Fifth grade students at the mastery level in mathematics use inductive reasoning to find missing elements in patterns. They infer rules from an input/output model, identify, and describe square, prime and composite numbers.	Fifth grade students at the partial mastery level in mathematics use inductive reasoning to confirm missing elements in patterns. They determine rules from an input/output model and recognize square, prime and composite numbers.	Fifth grade students at the novice level in mathematics use inductive reasoning models to label missing elements in patterns. They name rules from an input/output model and verify square, prime and composite numbers.

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 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 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 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 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 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.

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.	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.	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.	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.	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.

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.

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 design experiments or surveys to collect, interpret and analyze data from a problem-solving situation. They design, construct and manipulate sample spaces to predict the probability of a real-world simulation. They collect and organize data into a circle graph, draw conclusions, interpret results and summarize findings from similar data sets.	Fifth grade students at the above mastery level in mathematics collect, interpret and analyze data from a problem-solving situation. They design and construct sample spaces to predict the probability of a real-world simulation. They collect and organize data into a circle graph, draw conclusions and interpret results.	Fifth grade students at the mastery level in mathematics collect and interpret data from a problem-solving situation. They construct sample spaces to predict the probability of a real-world simulation. They organize data into a circle graph and draw conclusions.	Fifth grade students at the partial mastery level in mathematics collect data from a problem-solving situation. They use existing sample spaces to predict the probability of a real-world simulation. They organize data into a circle graph.	Fifth grade students at the novice level in mathematics display data from a problem-solving situation. They identify existing sample spaces to recognize a real-world simulation. They identify data.

Objectives	Students will
M.O.5.5.1	construct a sample space to predict the probability of a real-world simulation and test the prediction with experimentation.
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.

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.	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.	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.	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.	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.

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 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-	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 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 mastery level in mathematics write algebraic expressions for word phrases, simplify numeric and evaluate algebraic expressions using order of 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 partial mastery level in mathematics write algebraic expressions for word phrases and simplify numeric expressions using order of operations. They 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 novice level in mathematics write algebraic expressions for word phrases involving one operation and simplify numeric expressions using order of operations. They 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.

step equations to solve real-world problems. They present the justification of the use of the equation and their solution, using clear, concise language.				

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	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	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	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	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

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 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	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.	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.	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.	them as parallel, perpendicular, or intersecting. They identify lines of symmetry. They plot points on a coordinate plane.

can be reproduced.				

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	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	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	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	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

of parallelograms and triangles, circumference and area of circles, volume of rectangular prisms, and 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.	triangles, circumference and area of circles, volume of rectangular prisms, and perimeter and area of 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.	perimeter and area of composite figures. 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 construct scale drawings of regular polygons.	rectangular prism. They identify and find the area of the surfaces of a rectangular prism. They identify similar polygons and construct scale drawings of rectangles.	prism. They identify similar polygons.

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, 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 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	Sixth grade students at the above mastery level in mathematics design an experiment from a problem-solving situation in order to collect, organize, display, 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. 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	Sixth grade students at the mastery level in mathematics collect, organize, display, and interprets data in bar, line and circle graphs, stem and leaf plots, and frequency tables. They collect and interpret real-world data using mean, median, mode, and range; 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 partial mastery level in mathematics organize and display data in bar, line, and circle graphs, stem and leaf plots, and frequency tables. 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 novice level in mathematics display data in bar and line graphs. 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.

determine the number of combinations and permutations; they find and describe ways that this information is useful in real-world situations.	and permutations.			

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	collect and interpret real-world data, formulate questions using mean, median, mode, and range and determine the effect of outliers on the data (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.	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.	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.	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.	to solve them. They evaluate powers with positive exponents and convert between numbers in scientific notation with positive exponents and 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,	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	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	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	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

and exponents, using order of operations. They create input/output function tables 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.	of operations. They create input/output function tables to predict values in problem 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.	solving situations. They solve problems involving proportional situations. They solve one-step linear equations containing rational numbers and solve basic inequalities.	integers. They complete input/output function tables to predict values in problem solving situations. They recognize that two equal ratios form a proportion and solve one-step equations and inequalities involving whole numbers.	one-step equations involving whole numbers.

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 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 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 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 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.

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.
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 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 above mastery level in mathematics solve real-world problems involving perimeter, circumference, area, surface area, distance 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 mastery level in mathematics solve real-world problems involving perimeter, circumference, area, surface area, distance 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 below mastery level in mathematics solve problems involving perimeter, circumference, area, surface area, distance 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 novice level in mathematics solve problems involving perimeter, circumference, area and, surface area; they convert units of measure. They 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 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 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 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 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.
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.	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.	irrational numbers, verify solutions using estimation techniques, and explain the process used in solving.		using estimation techniques.	using estimation techniques.

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	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	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	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	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

table and rule to determine and explain whether or not there exists a functional relationship. 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.	table and rule to determine if a function relationship exists. 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.	and rules to determine if a functional relationship exists. 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.	pattern; they analyze the table and rule to determine if a function relationship exists. 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	solve one and two-step linear equations and solve and graph one and two-step inequalities involving whole 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.

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 prediction 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 prediction and the result of the investigation; present the problem 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	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	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	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	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

dimensions of geometric 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.	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; 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.	the plan; justify the results. They classify polyhedrons according to the number and shape of faces and use inductive reasoning to determine the relationship between vertices, faces and edges.	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; state the results. They classify polyhedrons according to the number and shape of faces and determine the number of vertices, faces and edges.	cylinder, cone and pyramid, 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

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, 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.	Eighth grade students at the above mastery level in mathematics determine the volume of prisms, pyramids, 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.	Eighth grade students at the mastery level in mathematics determine the volume of prisms, pyramids, 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.	Eighth grade students at the partial mastery level in mathematics determine the volume of prisms, cylinders, 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.	Eighth grade students at the novice level in mathematics determine the volume of prisms, cylinders, and 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.

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. 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.	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 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.	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 solve application problems involving combinations and permutations and investigation compound probability of dependent and independent events.	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 constructing sample spaces and determine experimental and theoretical probability of compound independent events.	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 simple events.

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	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	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 and systems of linear equations; select and	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	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

equations 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 analyze data to prove the existence 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	equations 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 analyze data to prove the existence of a pattern numerically, algebraically and graphically; they write 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.	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 analyze data to prove the existence of a pattern numerically, algebraically and graphically; they write equations from the patterns 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	literal equations. They 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 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 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.	solve appropriate literal 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 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 compute expected value, and conduct experiments to solve problems using concepts of sample space and probability distribution.

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.	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.			

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	extrapolate data represented by graphs, tables and formulas to make inferences and predictions on rate of change (slope) and justify when communicating results within a project based investigation.
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	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	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	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	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 use symbolic logic to construct arguments. They apply undefined terms, definitions, postulates, and theorems to construct	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 apply undefined terms, definitions, postulates, and theorems to solve problems and will distinguish between inductive and deductive reasoning. They identify

of similar triangles, the Pythagorean Theorem, or trigonometric ratios, solve it, and interpret the results. They apply principles of transformational geometry to families of algebraic functions. 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.	with proper identification 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	between undefined and 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	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.	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.

	results. They create, apply and analyze transformational geometry to construct transformations and explore congruencies and similarities, and develop and justify logical arguments. 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 logical concepts to be used in solving real-world problems.	to construct transformations and explore congruencies and similarities and develop logical arguments. 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.		

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	draw conclusions in problem solving situations that include two and three dimensions of figures based on the properties of similarity.
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 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 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 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	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	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

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	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	grouping, graphical 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	numerical and graphical 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 convert among graphs, equations, and table of values to solve practical problems.	of two squares and 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 convert between graphs and tables of values to solve practical problems.

expand expressions using 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	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 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 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.	generate quadratic regressions and both closed form and recursive equations to make predictions about data values, patterns, and sequences. They convert among words, graphs, equations and tables of values to solve problems.		

generating and extending families of functions using 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 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.				

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	perform a quadratic regression, determine the regression equation and use the results to predict specific values of a variable.
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	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	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	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	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

this data in a real-world 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.	payments, finance charges and taxes and analyze how these functions are used to solve real-world problems as well as research and compare various methods of investing money.	problems as well as compare various methods of investing money.	methods of investing money.	as name various methods of investing money.

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	compare various methods of investing money.

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	Conceptual Mathematics students at the above mastery level analyze and apply concepts of geometry.	Conceptual Mathematics students at the mastery level apply concepts of geometry. They compute	Conceptual Mathematics students at the partial mastery level identify concepts of geometry.	Conceptual Mathematics students at the novice level recognize concepts of geometry. They recognize

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.	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.	measures to solve real-world problems using relationships. They analyze the connection between geometric shapes and patterns, art, architecture, and nature.	They use measures to solve real-world problems using relationships. They model the connection between geometric shapes and patterns, art, architecture, and nature.	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.

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	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	Conceptual Mathematics students at the mastery level relate mathematical content to its historical development and integrate other disciplines into the study of mathematics. They	Conceptual Mathematics students at the partial mastery level describe mathematical content as it relates to its historical development and relates how other disciplines are	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

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 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.	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 applications. They relate and apply the measures of central tendency to workplace situations and analyze the results.	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.	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 situations.	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.

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	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	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	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	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

symmetry other than the 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	roots, and symmetry, 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,	tabular connections among 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.	functions and inverses of 1-1 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 2^{nd} and 3^{rd} degree polynomials and polynomials of two and four terms by appropriate methods, synthetic division, and properties of exponential functions. They recognize extraneous roots.	between non-vertical 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 2^{nd} degree dividend, and recognize extraneous roots.

systems of linear equations, using algebraic and 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.	using algebraic and graphical techniques such 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.			

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-	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	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	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	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

world problems. They 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	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). 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	domain) and solve 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.	the Law of Sines and the 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.	find the area of triangles 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.

problems and identify 3D vectors and real-world uses and use graphs, tables and equations to model periodic data sets and to analyze real-world problems				
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	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	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-	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 the	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

individual performance, 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 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.	and of correlation as applied in real-world situations. They perform, analyze, predict and interpret a regression analysis and perform and interpret the results of an analysis of variance using ANOVA.	world situations. They perform a regression analysis and perform and interpret the results of an analysis of variance.	regression equation and explain the results of the variance analysis.	set of data. They recognize the regression equation and explain the results of the variance analysis.

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	test the validity of a hypothesis using statistical concepts including a t-test, justify results.
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	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-	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	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	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

expand binomials in relation 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.	world situation. They 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.	exponential and logarithmic functions. They produce graphical and algebraic means to add vectors in two dimensions and apply to real-world problems.	algebraic procedures to add two dimensional vectors.	procedures to add two dimensional vectors.

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 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 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 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 novice level identify the graphs of equations representing specific conic sections and other functions using 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.

Grade 9-12	**Mathematics: Pre-Calculus**
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 above mastery level summarize and critique the results of an analysis performed on an exponential and/or logarithmic regression.	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 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 novice level select a regression equation for an exponential and/or logarithmic regression performed on a set of data.

Objectives	Students will
M.O.PC.5.1	perform an exponential and or logarithmic regression analysis on a set of data, write the regression equation and use the results to predict specific values of a variable.

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	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	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	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	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

methodology will best suit 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	an interval. They apply the 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	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 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	of the function, interpreting 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	are obtained from derivative 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.

differentiation to various types of functions as 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	them. They construct and apply mathematical models 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.	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 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.	of x given points of intersection. They apply the definite integral to calculate displacement for linear motion problems.	

change of the quantity over an interval and interpret its relevance to the given 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.				

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	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.	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	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	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

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 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.	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 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.	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.	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.	under a curve by applying a finite Riemann sum implementing left, right, or midpoint rules, given the end points and length of each subinterval.

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.

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 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 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 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 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, analytically, graphically and 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 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 verbally using the predictive and 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 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 analytic tools of calculus.

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.

FORM HD 201
(10-66)

FISCAL NOTE WORKSHEET
(Submit 4 Copies)

HD NO _____ DRAFT NO _____ BILL NO _____ RESOLUTION NO _____

SUBJECT **State Board Policy 2520.2: Mathematics Content Standards and Objectives for WV Schools** FUND _____

SOURCE OF REVENUE: ☐ GENERAL FUND ☐ SPECIAL ☐ OTHER (SPECIFY) _____

COST OF ESTIMATE BASED ON: ☐ AN ORIGINAL ESTIMATE ☐ BUDGET BILL ☐ OTHER (SPECIFY) _____

INCOME ESTIMATE BASED ON: ☐ AN ORIGINAL ESTIMATE ☐ BUDGET BILL ☐ OTHER (SPECIFY) _____

SHOW OVER-ALL EFFECT IN ITEMS 1 AND 2 & GIVE EXPLANATION OF BREAKDOWN BY FISCAL YEAR INCLUDING LONG-RANGE EFFECT

EFFECT OF PROPOSAL	ANNUAL INCREASE	ANNUAL DECREASE	FISCAL YEAR CURRENT	FISCAL YEAR NEXT	FISCAL YEAR THEREAFTER
1. ESTIMATED TOTAL COST	$ 0	$ 0	$ 0	$ 0	$ 0
PERSONAL SERVICES CURRENT EXPENSES REPAIRS/ALTERATIONS EQUIPMENT OTHER	$ 0	$ 0	$ 0	$ 0	$ 0
2. ESTIMATED TOTAL REVENUES	$ 0	$ 0	$ 0	$ 0	$ 0

3. EXPLANATION OF ABOVE ESTIMATES (INCLUDING LONG-RANGE EFFECT):

There is no cost associated with the addition of Calculus content standards and objectives. It is difficult to estimate the cost of textbooks for the new course titl Algebra III because it is designed as an elective course that transitions students from Algebra II to Trigonometry and Pre-calculus, and we have no way to estimat the number of schools who will offer the course or the number of students who will be enrolled in the course. Students are not required to take Algebra III.

DATE 7/17/07

AGENCY West Virginia Department of Education

AUTHORIZED REPRESENTATIVE _____

POLICY 2520.2: 21st Century Mathematics Content Standards and Objectives for West Virginia Schools

COMMENT PERIOD ENDS: September 26, 2007

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

COMMENTS/SUGGESTIONS
§126-44B-1. General.
§126-44B-2. Purpose

§126-44B-3. Incorporation by References
§126-44B-4. Summary of the Content Standards and Objectives.
§126-44B. 21 Century Mathematics Content Standards and Objectives for West Virginia Schools

Please direct all comments to:

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