WEST VIRGINIA SECRETARY OF STATE

NATALIE E. TENNANT

ADMINISTRATIVE LAW DIVISION

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OFFICE OF
WEST VIRGINIA SECRETARY OF STATE

FORM 1 -- NOTICE OF A PUBLIC HEARING OR COMMENT PERIOD ON A PROPOSED RULE
(Page 1)

AGENCY
Education

TITLE NUMBER
126

RULE TYPE
Legislative Exempt

AMENDMENT TO EXISTING RULE
Yes

CITE AUTHORITY
W. Va. Code §§29A-3B-1 et seq.; W. Va. Board of Education v. Hechler, 180 W. Va. 451; 376 S.E.2d 839 (1988)

SERIES NUMBER OF RULE BEING AMENDED
044B

COMMENTS LIMITED TO
Written

DATE OF PUBLIC HEARING

LOCATION OF PUBLIC HEARING

DATE WRITTEN COMMENT PERIOD ENDS
Monday, April 16, 2012 4:00 PM

WRITTEN COMMENTS MAY BE MAILED TO
Lou Maynus, Mathematics Coordinator
WVDE Office of Instruction
Capitol Building 6, Room 603
1900 Kanawha Boulevard, East
Charleston, West Virginia 25305-0330

BY CHOOSING 'YES', I ATTEST THAT THE PREVIOUS STATEMENTS ARE TRUE AND CORRECT.

Yes

Charles K Heinlein -- By my signature, I certify that I am the person authorized to file legislative rules, in accordance with West Virginia Code §29A-3-11 and §39A-3-2.

Title-Series: 126-044B

Rule Id: 8569

Document 23482

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FORM 1 -- NOTICE OF A PUBLIC HEARING OR COMMENT PERIOD ON A PROPOSED RULE
(Page 2)

AGENCY
Education

TITLE NUMBER
126

RULE TYPE
Legislative Exempt

AMENDMENT TO EXISTING RULE
Yes

CITE AUTHORITY
W. Va. Code §§29A-3B-1 et seq.; W. Va. Board of Education v. Hechler, 180 W. Va. 451; 376 S.E.2d 839 (1988)

SERIES NUMBER OF RULE BEING AMENDED
44B

PROVIDE A BRIEF SUMMARY OF YOUR PROPOSAL
Removal of the first grade section of Policy 2520.2 is open for comment. The proposed revision will result in the implementation of the new Next Generation Content Standards and Objectives for Mathematics in West Virginia Schools in Grade 1 only beginning in August 2012 and thus continuing the phase-in process to culminate with full implementation in July 2014.

BY CHOOSING 'YES', I ATTEST THAT THE PREVIOUS STATEMENTS ARE TRUE AND CORRECT.

Yes
Charles K Heinlein -- By my signature, I certify that I am the person authorized to file legislative rules, in accordance with West Virginia Code §29A-3-11 and §39A-3-2.

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FORM 11 -- FISCAL NOTE FOR PROPOSED RULES (Page 1)

AGENCY
Education

TITLE NUMBER
126

RULE TYPE
Legislative Exempt

AMENDMENT TO EXISTING RULE
Yes

CITE AUTHORITY
W. Va. Code §§29A-3B-1 et seq.; W. Va. Board of Education v. Hechler, 180 W. Va. 451; 376 S.E.2d 839 (1988)

SERIES NUMBER OF RULE BEING AMENDED
44B

SUMMARIZE IN A CLEAR AND CONCISE MANNER WHAT IMPACT THIS MEASURE WILL HAVE ON COSTS AND REVENUES OF STATE GOVERNMENT.

No costs or revenue will be impacted by the proposed amendment of W. Va. 126CSR44B, Policy 2520.2 - 21st Century Mathematics Content Standards and Objectives for West Virginia Schools.

Charles K Heinlein -- By my signature, I certify that I am the person authorized to file legislative rules, in accordance with West Virginia Code §29A-3-11 and §39A-3-2.

Title-Series: 126-044B

Rule Id: 8569

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FORM 11 -- FISCAL NOTE FOR PROPOSED RULES (Page 2)

AGENCY		TITLE NUMBER
Education		**126**
RULE TYPE	AMENDMENT TO EXISTING RULE	CITE AUTHORITY
Legislative Exempt	**Yes**	**W. Va. Code §§29A-3B-1 et seq.; W. Va. Board of Education v. Hechler, 180 W. Va. 451, 376 S.E.2d 839 (1988)**
SERIES NUMBER OF RULE BEING AMENDED		
0448		

FISCAL NOTE DETAIL -- SHOW OVER-ALL EFFECT IN ITEM 1 AND 2 AND, IN ITEM 3, GIVE AN EXPLANATION OF BREAKDOWN BY FISCAL YEAR, INCLUDING LONG-RANGE EFFECT.

Effect Of Proposal	Current Increase/Decrease (use ' - ')	Next Increase/Decrease (use ' - ')	Fiscal Year (Upon Full Implementation)
ESTIMATED TOTAL COST	**0**	**0**	**0**
PERSONAL SERVICES	**0**	**0**	**0**
CURRENT EXPENSES	**0**	**0**	**0**
REPAIRS AND ALTERATIONS	**0**	**0**	**0**
ASSETS	**0**	**0**	**0**
OTHER	**0**	**0**	**0**
ESTIMATED TOTAL REVENUES	**0**	**0**	**0**

Charles K Heinlein -- By my signature, I certify that I am the person authorized to file legislative rules, in accordance with West Virginia Code §29A-3-11 and §39A-3-2.

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FORM 11 -- FISCAL NOTE FOR PROPOSED RULES (Page 3)

AGENCY
Education

TITLE NUMBER
126

RULE TYPE
Legislative Exempt

AMENDMENT TO EXISTING RULE
Yes

CITE AUTHORITY
W. Va. Code §§29A-3B-1 et seq.; W. Va. Board of Education v. Hechler, 180 W. Va. 451, 376 S.E.2d 839 (1988)

SERIES NUMBER OF RULE BEING AMENDED
44B

3. EXPLANATION OF ABOVE ESTIMATES (INCLUDING LONG-RANGE EFFECT). PLEASE INCLUDE ANY INCREASE OR DECREASE IN FEES IN YOUR ESTIMATED TOTAL REVENUES.

No costs or revenue will be impacted by the proposed amendment of W. Va. 126CSR44B, Policy 2520.2 - 21st Century Mathematics Content Standards and Objectives for West Virginia Schools.

Charles K Heinlein -- By my signature, I certify that I am the person authorized to file legislative rules, in accordance with West Virginia Code §29A-3-11 and §39A-3-2.

Title-Series: 126-044B

Rule Id: 8569

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FORM 11 -- FISCAL NOTE FOR PROPOSED RULES (Page 4)

AGENCY
Education

TITLE NUMBER
126

RULE TYPE
Legislative Exempt

AMENDMENT TO EXISTING RULE
Yes

CITE AUTHORITY
W. Va. Code §§29A-3B-1 et seq.; W. Va. Board of Education v. Hechler, 180 W. Va. 451; 376 S.E. 2d 839 (1988)

SERIES NUMBER OF RULE BEING AMENDED
44B

PLEASE IDENTIFY ANY AREAS OF VAGUENESS, TECHNICAL DEFECTS, REASONS THE PROPOSED RULE WOULD NOT HAVE A FISCAL IMPACT, AND OR ANY SPECIAL ISSUES NOT CAPTURED ELSEWHERE ON THIS FORM.

No costs or revenue will be impacted by the proposed amendment of W. Va. 126CSR44B, Policy 2520.2 - 21st Century Mathematics Content Standards and Objectives for West Virginia Schools.

BY CHOOSING 'YES', I ATTEST THAT THE PREVIOUS STATEMENTS ARE TRUE AND CORRECT.

Charles K Heinlein -- By my signature, I certify that I am the person authorized to file legislative rules, in accordance with West Virginia Code §29A-3-11 and §39A-3-2.

Title-Series: 126-044B

Rule Id: 8569

Document 23482

EXECUTIVE SUMMARY
WEST VIRGINIA DEPARTMENT OF EDUCATION

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

Background: The current version of Policy 2520.2 – 21st Century Mathematics Content Standards and Objectives for West Virginia Schools, became effective September 14, 2009. In May 2010, the West Virginia Board of Education adopted the Common Core State Standards and an 85 member stakeholder group immediately began placing these standards into the West Virginia Curriculum Framework. These new Next Generation Content Standards and Objectives for Mathematics in West Virginia Schools (Policy 2520.2B) have been presented for adoption with a phase-in schedule that began with kindergarten in August 2011, and continues with first grade in July 2012, second grade in July 2013, and concludes with grade three through twelve in July 2014. As a result, the current 21st Century Mathematics Content Standards and Objectives for first grade are being removed to allow the implementation of the Next Generation Content Standards according to the aforementioned schedule. Subsequent changes for grades two and three will occur annually until full implementation of the new Next Generation Content Standards and Objectives for Mathematics in West Virginia Schools is achieved in July 2014.

Proposals: It is recommended that the first grade section of Policy 2520.2 be removed to allow for the implementation of the new Next Generation Content Standards and Objectives for Mathematics in West Virginia Schools in Grade 1 only beginning in August 2012.

Impact: The proposed revision will result in the implementation of the new Next Generation Content Standards and Objectives for Mathematics in West Virginia Schools in Grade 1 only beginning in August 2012 and thus continuing the phase-in process to culminate with full implementation in July 2014.

Response to Comments:

TITLE 126
LEGISLATIVE RULE
BOARD OF EDUCATION

SERIES 44B
21st CENTURY MATHEMATICS CONTENT STANDARDS AND OBJECTIVES FOR WEST VIRGINIA SCHOOLS (2520.2)

§126-44B-1. General.

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

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

1.3. Filing Date. -- ~~July 15, 2011~~.

1.4. Effective Date. -- ~~August 15, 2011~~.

1.5. Repeal of former rule. -- This legislative rule amends W. Va. 126CSR44B West Virginia Board of Education Policy 2520.2 "21st Century Mathematics Content Standards and Objectives for West Virginia Schools (2520.2)" filed ~~August 14, 2009~~July 15, 2011 and effective ~~September 14, 2009~~August 15, 2011.

§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 for grades one through twelve.

§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.

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.

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 ~~1~~2-12 sequence of study.

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

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

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

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

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

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

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

Numbering of Standards

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

- the content area code (M for Mathematics),
- the letter S, for Standard,
- the grade level (exceptions are grades 9-12 mathematics courses) and
- the standard number.

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

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

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

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

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

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

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

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

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

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

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

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

Abbreviations

Content Area
M Mathematics

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

Other Abbreviations
O Objective
D Performance Descriptors
S Standard (Content Standard)

MATHEMATICS – POLICY 2520.2

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

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

1. **Equity.** High expectations and strong support for all student
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 ~~1~~2-12. The objectives spiral upward through the grade levels, eliminating repetition of content and increasing in rigor and depth of knowledge throughout the student's academic career. It is important that all students value mathematics and see themselves as mathematical problem solvers who can communicate mathematically and make connections to other content areas and the real-world application of mathematics.

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

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

Policy 2510 states that "students in the professional pathway and college bound students in the skilled pathway, who do not achieve the State assessment college readiness benchmarks for mathematics, shall be required to take a college transition mathematics course during their senior

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

Mathematics Content Standards ~~1~~2-12

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.

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, count and compare to 1000, identify any ordinal identify and number as odd or even; group and count objects by 2's, 3's, 4's, 5's and 10's; model place value to 1000 in standard and expanded form and round to the nearest 100;	First grade students at the above mastery level in mathematics: read, write, order, count and compare to 200 and identify any ordinal, model odd and even to 100; group and count objects by 1's, 2's, 5's and 10's; identify place value to 1000 in standard form and round to the nearest 100;	First grade students at the mastery level in mathematics: read, write, order, count and compare to 100, use ordinals to 20th, count back from 20, identify sets of odd and even to 20; group and count objects by 1's, 5's and 10's to 100, model and identify place value using standard and expanded to 100 and round to nearest 10;	First grade students at the partial mastery level in mathematics: read, write, order, count to 100, use ordinals to 10th, count back from 20, identify sets of odd and even to 10; group objects by 1's, 5's and 10's to 100 and count objects by 1's and 10's to 100; model and identify place value using standard form to 100 and round to the nearest 10;	First grade students at the novice level in mathematics: count to 100 and use ordinals to 10th, count back from 10 and identify odd and even to 10; group and count objects by 1's and 10's to 100; model and identify place value to 20 using standard form;

estimate, create and explain models for fractions of a whole and of a set, 1/6, 1/8; solve addition and subtraction of two digits with regrouping and justify relationship; create and present, one-step problems and justify results; construct real world one and two step problems using multiple strategies, present solutions and justify results	estimate, create and explain models for fractions of a whole and a set,1/2, 1/3, 1/4; model addition with multiple addends and two-digit subtraction model and solve 2-digit addition with regrouping; use basic addition and subtraction facts and create real world story problems, present solutions and justify results with and without technology.	estimate to 100, use models to explain 1/2, 1/3, ¼, of whole or of set; model 2 or 3 addends in addition and subtraction to 18, write sentence, model addition and subtraction and their relationship, model 2-digit addition and subtraction without regrouping; recall basic addition and subtraction facts to 10 and create story problems using variety of strategies, present solutions, and justify results with and without technology	estimate objects to 100 and use models to identify and name 1/2 and 1/4, as part of a whole; model addition and subtraction for sums to 12, write sentence; model addition and subtraction operations and the relationship between them; recall basic addition facts to 10 and some subtraction facts and solve story problems using models.	estimate objects to 20 and use models to identify 1/2 of a whole; model addition and subtraction to 10; model addition and subtraction and show relationship with fact families; recall some addition and subtraction facts to 10 and retell a story problem.

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: interpret sorting rules for self and others using two or more attributes and various strategies; create an input/output model; create, write, and analyze number patterns; create, analyze and interpret number patterns based on real-life situations using words, AB form, T-charts and justify results; prove equivalency of both sides of a number sentence.	First grade students at the above mastery level in mathematics: determine sorting rules for more than one attribute using various strategies; determine the input when given the rule and function of an input/output model; create and write number patterns; create, analyze and modify number patterns based on real-life situations, using words, AB form, T-charts and justify results; create and interpret number sentences that show equivalency.	First grade students at the mastery level in mathematics: sort and classify objects by more than one attribute, using various strategies, including Venn Diagrams; determine the rule or give the output, given an input/output model using addition and subtraction; identify and write number patterns by 2's, 5's,and 10's; create and analyze number patterns based on real-life situations, using words, AB form, and T-charts and present results; use concrete materials to demonstrate that quantities on both sides of a number sentence are equivalent.	First grade students at the partial mastery level in mathematics: sort and classify objects by one attribute using Venn Diagrams; give the output when input and function are given using the input/output model; identify and write number patterns by 5's and 10's; create number patterns based on real-life situations, using words, AB form, and T-chart and present results; identify equivalency of both sides of a simple number sentence.	First grade students at the novice level in mathematics: sort and classify objects by one attribute; give the output for addition using the input/output model; identify number patterns by 5's and 10's; recognize and create number patterns with AB form; recognize equivalency of both sides of a simple number sentence.

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

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

Performance Descriptors (M.PD.1.3)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
First grade students at the distinguished level in mathematics: interpret the relationships between plane figures; construct, identify, analyze and write about three dimensional figures and relationship to real world; justify the classification of open and closed figures and congruent plane shapes; create, analyze, describe symmetrical designs;	First grade students at the above mastery level in mathematics: draw, label and analyze plane figures; construct, identify, classify and analyze three-dimensional figures, draw three-dimensional shapes from the environment; classify open and closed figures and congruent plane shapes; create and analyze symmetrical designs;	First grade students at the mastery level in mathematics: draw, label and sort plane figures by sides and vertices; construct, identify and classify three-dimensional figures; recognize three-dimensional shapes in the environment; draw and identify open and closed figures and congruent plane shapes; create and describe simple symmetrical designs;	First grade students at the partial mastery level in mathematics: draw and sort plane shapes; identify three-dimensional figures and match three-dimensional shapes in the environment; identify open and closed figures and congruent shapes; describe simple symmetrical designs;	First grade students at the novice level in mathematics: sort plane shapes; sort three-dimensional figures, recognize plane shapes in the environment; recognize open and closed figures, congruent shapes and simple symmetrical designs;

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

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

Grade 1	**Mathematics**
Standard 4	Measurement
M.S.1.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of measurable attributes of objects and the units, systems, and processes of measurement, and

	• apply appropriate techniques, tools and formulas to determine measurements.

Performance Descriptors (M.PD.1.4)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
First grade students at the distinguished level in mathematics: estimate, measure, compare and order using customary metric and nonstandard units to determine length to nearest unit and justify answers;	First grade students at the above mastery level in mathematics: estimate, measure, compare, and order using customary, metric, and nonstandard units to determine length to nearest whole unit and justify answers;	First grade students at the mastery level in mathematics: estimate, measure, compare and order using customary, metric, and nonstandard units to determine length to nearer whole unit;	First grade students at the partial mastery level in mathematics: estimate and measure using customary, metric, and nonstandard units to determine length to nearest whole unit;	First grade students at the novice level in mathematics: estimate and measure using customary and nonstandard units to determine length;
select units and tools to measure and compare objects using two or more attributes, justify and record results;	select units and tools to measure and compare two or more objects using one or more attributes (length, height, weight, time and volume), justify and record results;	select units and tools to measure and compare two objects or events using one or more attributes (length, height, weight, temperature, and volume) and justify results;	given the tool, measure length, height, weight, temperature, and volume;	given the tool, measure length, height, weight and temperature;
use the calendar to locate a specific day, date and identify one week later;	use calendar to find yesterday, today, tomorrow and birth date;	use calendar to identify date, days, and months;	use calendar to identify date, and days of week;	use the calendar and to identify the date;
use clocks to tell time to five minutes and relate to personal experiences;	use clocks to tell time to quarter hour and relate to personal experiences;	tell time to half hour, use analog and digital clock, and relate time to personal experience;	tell time to the hour on an analog and digital clock and relate time to personal experience;	tell time to the hour on an analog clock and relate to personal experience;
create stories with money and make change from a dollar using all coins and bills.	identify all coins and dollar bill and make change from fifty cents.	identify, count, trade and organize (penny, nickel, dime, quarter, and dollar bill); display real life price values to 100 cents.	identify, count and trade pennies, nickels, dimes and quarters; display price values up to 25 cents.	identify pennies, nickels, dimes and quarters; count and trade pennies, nickels and dimes.

Objectives	**Students will**
M.O.1.4.1	estimate, measure, compare and order using customary, metric, and nonstandard units to determine length to nearer whole unit.
M.O.1.4.2	select appropriate units and tools to measure and compare two objects or events according to one or more of the following attributes: • length

	• height • weight • temperature • volume justify selection of units and tools used to measure the attributes and present results.
M.O.1.4.3	use calendar to identify date, sequence of days of the week, and months of the year.
M.O.1.4.4	explain time concept in context of personal experience.
M.O.1.4.5	read time to the half hour using an analog and digital clock.
M.O.1.4.6	identify, count, trade and organize the following coins and bill to display a variety of price values from real life examples with a total value of 100 cents or less. • penny • nickel • dime • quarter • dollar bill

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

Performance Descriptors (M.PD.1.5)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
First grade students at the distinguished level in mathematics: identify a real life situation, gather data over time, make a hypothesis as to the outcome, organize and analyze results, evaluate the validity of the hypothesis and communicate results using mathematical language;	First grade students at the above mastery level in mathematics: identify a real life situation, gather data over time, make a hypothesis as to the outcome, organize and analyze results, evaluate the validity of the hypothesis and communicate results;	First grade students at the mastery level in mathematics: identify a real life situation, gather data over time, make a hypothesis as to the outcome, organize and analyze results, and evaluate the validity of the hypothesis;	First grade students at the partial mastery level in mathematics: identify a real life situation, gather data over time, organize and interpret data;	First grade students at the novice level in mathematics: identify a real life situation, gather data over time, and organize data;

~~construct, interpret, and analyze probability experiments and explain how they relate to real life situations.~~	~~create and interpret probability experiments, record data, and use data to predict which events will be more or less likely to occur in repeated experiments.~~	~~conduct simple probability experiments, record data, and use data to predict which events will be more or less likely to occur in repeated experiment.~~	~~conduct simple probability experiments and record data.~~	~~conduct simple probability experiments.~~

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

Second Grade Mathematics Content Standards and Objectives

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

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

Performance Descriptors (M.PD.2.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Second grade students at the distinguished level in mathematics: model, read, compare, order, write (standard and expanded form), identify place value with numbers beyond 1000; read and compare ordinal numbers to identify position in real world situations; round three-digit numbers and use rounding to estimate and evaluate sums and differences to solve real world problems;	Second grade students at the above mastery level in mathematics: model, read, compare, order, write (standard and expanded form), identify place value with numbers to 1000; read and compare ordinal numbers to identify position in real world situations; round three-digit numbers and use rounding to estimate and evaluate sums and differences;	Second grade students at the mastery level in mathematics: model, read, compare, order, write (standard and expanded form), identify place value with numbers to 1000; read and use ordinal numbers to identify position; round three-digit numbers and use rounding to estimate and evaluate sums and differences;	Second grade students at the partial mastery level in mathematics: model, read, compare, order, write (standard form), and identify place value with numbers to 1000; read and use ordinal numbers to identify position, 1^{st}-10^{th}; round three-digit numbers to the nearest 100 and use rounding to estimate and evaluate sums and differences;	Second grade students at the novice level in mathematics: model, read, write (standard form), and identify place value with numbers to 1000; use ordinal numbers to identify position, 1^{st}-5^{th}; round three-digit numbers to the nearest 100 to estimate sums and differences;

justify any number as odd or even and create sets with and even and odd set of members; show quick recall of addition and subtraction facts; justify number properties and the relationship between addition and subtraction using clear mathematical language; add and subtract two- and three-digit numbers without and with regrouping and explain the procedures using clear mathematical language; identify, name, compare and explain fractions without models; create one and two-step story problems, solve using multiple strategies, present and justify results using clear mathematical language.	justify any number as odd or even; show quick recall of addition and subtraction facts; justify number properties and the relationship between addition and subtraction add and subtract two- and three- digit numbers without and with regrouping; identify, name, compare and explain fractions using models; create one and two-step story problems, solve using multiple strategies, present and justify results.	justify any number as odd or even and determine if a set has an odd or even number; show quick recall of addition and subtraction facts; model and justify number properties and the relationship between addition and subtraction add and subtract two- and three-digit numbers without regrouping; model addition and subtraction of two- and three-digit numbers with regrouping; identify, name, and explain fractions using models; create one and two-step story problems, solve using multiple strategies, present and justify results.	identify numbers as odd or even and determine if a set has an odd or even number; use strategies to recall of some addition and subtraction facts; model number properties and the relationship between addition and subtraction add and subtract two- and three- digit numbers without regrouping; model addition and subtraction of two-digit numbers with regrouping; identify and name fractions using models; solve one and two-step story problems using multiple strategies and present results.	determine if a set has an odd or even number; model of addition and subtraction facts; model the relationship between addition and subtraction add and subtract two-digit numbers without regrouping; model addition and subtraction of two-digit numbers without regrouping; identify fractions using models; solve one-step story problems and present results.

Objectives	**Students will**
M.O.2.1.1	read, write, order, and compare numbers to 1,000 using multiple strategies (e.g. symbols, manipulatives, number line).
M.O.2.1.2	justify any number as odd or even and determine if a set has an odd or even number of elements.
M.O.2.1.3	count and group concrete manipulatives by ones, tens, and hundreds to 1,000.
M.O.2.1.4	model and identify place value of each digit utilizing standard and expanded form through 1000.
M.O.2.1.5	identify and read any ordinal number to identify position in a sequence.
M.O.2.1.6	round any 3-digit number to both the nearer 10 and 100.
M.O.2.1.7	Identify and explain fractions as part of a whole and as part of a set/group using models.

M.O.2.1.8	model and justify the relationship between addition and subtraction (e.g., identity element of addition, associative property, commutative property, inverse operations, fact families).
M.O.2.1.9	demonstrate quick recall of basic addition facts with sums to 18 and corresponding subtraction facts.
M.O.2.1.10	model 2- and 3-digit addition and subtraction with regrouping using multiple strategies.
M.O.2.1.11	add and subtract 2- and 3-digit numbers without regrouping.
M.O.2.1.12	use rounding to analyze the reasonableness of a sum or a difference.
M.O.2.1.13	create story problems that require one or two-step procedures, using a variety of strategies explain the reasoning used, justify the procedures selected and present the results.

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

Performance Descriptors (M.PD.2.2)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Second grade students at the distinguished level in mathematics: analyze, describe, extend and create growing patterns; explain how one variable produces a change in another variable (e.g., input/output table) in a real world situation; describe, complete, extend, and create counting patterns when given the rule; write the rule when given the pattern;	Second grade students at the above mastery level in mathematics: analyze, describe, extend and create growing patterns; explain how one variable produces a change in another variable (e.g., input/output table) in a real world situation; describe, complete, extend, and create counting patterns when given the rule; create, analyze, and	Second grade students at the mastery level in mathematics: analyze, describe, extend and create growing patterns; explain how one variable produces a change in another variable (e.g., input/output table); describe, complete, extend counting patterns when given the rule; create and demonstrate	Second grade students at the partial mastery level in mathematics: analyze, describe, and extend growing patterns; determine input, output, or rule to show how one variable produces a change in another variable; extend counting patterns when given the rule; demonstrate equivalence	Second grade students at the novice level in mathematics: describe and extend growing patterns; determine output or rule to show how one variable produces a change in another variable; extend counting patterns when given the rule; model equivalent numerical

create and analyze equivalent numerical expressions.	demonstrate equivalent numerical expressions using models or manipulatives.	equivalent numerical expressions using models or manipulatives.	of numerical expressions using models or manipulatives	expressions using manipulatives.

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

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

Performance Descriptors (M.PD.2.3)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Second grade students at the distinguished level in mathematics: identify, describe, compare, and contrast plane and solid shapes using clear mathematical language; draw, describe, and combine shapes that show reflections and rotations; draw or build similar shapes; model, draw, and describe line segments and angles;	Second grade students at the above mastery level in mathematics: identify, describe, compare, and contrast plane and solid shapes using clear mathematical language; draw and describe shapes that show reflections and rotations; draw or build similar shapes; model, draw, and describe line segments and angles;	Second grade students at the mastery level in mathematics: identify, describe, compare, and contrast plane and solid shapes; identify and draw shapes that show reflections and rotations; identify similar shapes; model and draw line segments and angles;	Second grade students at the partial mastery level in mathematics: identify and describe plane and solid geometric shapes; identify shapes that have been reflected or rotated; define similar shapes; model line segments and angles and draw line	Second grade students at the novice level in mathematics: identify plane and solid geometric shapes; identify shapes that have been reflected or rotated; define similar shapes; model line segments and angles;

plot and describe the path between locations on a grid.	plot and describe the path between locations on a grid.	plot and describe the path between locations on a grid.	segments; plot locations on a grid.	identify locations on a grid.

Objectives	**Students will**
M.O.2.3.1	identify and describe the following geometric solids according to the number of faces and edges: • rectangular solid • cube • cylinder • cone • pyramid
M.O.2.3.2	compare and contrast plane and solid geometric shapes.
M.O.2.3.3	identify and draw congruent shapes that have been rotated or reflected
M.O.2.3.4	model and draw line segments and angles.
M.O.2.3.5	plot and describe the path between locations on a grid.
M.O.2.3.6	identify similar shapes.

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

Performance Descriptors (M.PD.2.4)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Second grade students at the distinguished level in mathematics: design a project to measure length, weight, or temperature; make and test a hypothesis; collect, organize, and analyze data; and present the results; estimate and measure to	Second grade students at the above mastery level in mathematics: design a project to measure length, weight, or temperature; make and test a hypothesis; collect, organize, and analyze data; and present the results; estimate and measure to	Second grade students at the above mastery level in mathematics: design a project to measure length, weight, or temperature; make and test a hypothesis; collect, organize, and analyze data; and present the results; estimate and measure to	Second grade students at the partial mastery level in mathematics: carry out a project using tools to measure length, weight, temperature; test a hypothesis; collect, organize, and analyze data; and present the results; find perimeter and count	Second grade students at the novice level in mathematics: carry out a project to measure length, weight, or temperature; collect, organize, and analyze data; and present the results; add to find perimeter and

determine perimeter and find area by counting square units of regular and irregular shapes; order events, tell time to the nearest five minutes; use a calendar to find past and future dates of specific events; show multiple solutions to model given values and to make change to the next dollar.	determine perimeter and find area by counting square units; order events and tell time to the nearest five minutes; use a calendar to find past and future dates; use coins to model given values and to make change up to the next dollar.	determine perimeter and find area by counting square units; order events and tell time to the nearest five minutes; use a calendar to find past and future dates; use coins to model given values and to make change up to the next dollar.	square units to determine area; order events and tell time to the nearest half hour; use a calendar to find today's date and future dates; use coins to model given values and to make change up to a quarter.	count square units to determine area; order events and tell time to the nearest hour; use a calendar to find today's date; use coins to model given values.

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

Grade 2	**Mathematics**
Standard 5	Data Analysis and Probability

M.S.2.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.

Performance Descriptors (M.PD.2.5)

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

Objectives	**Students will**
M.O.2.5.1	create, read, and interpret a pictograph with each picture representing greater than or equal to a single unit.
M.O.2.5.2	conduct simple experiments with more than two outcomes and use the data to predict which event is more, less, or equally likely to occur if the experiment is repeated.
M.O.2.5.3	analyze data represented on a graph using grade-appropriate questions.

M.O.2.5.4	formulate questions, collect data, organize and display as a chart, table or bar graph.

Third Grade Mathematics Content Standards and Objectives

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

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

Performance Descriptors (M.PD.3.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Third grade students at the distinguished level in mathematics: read, write (standard and expanded form), order, compare numbers beyond 10,000; model, read, write, order, compare decimals to hundredths; estimate to solve problems and to evaluate and justify reasonableness of answers; represent proper and improper fractions and	Third grade students at the above mastery level in mathematics: read, write (standard and expanded form), order, compare numbers to 10,000; model, read, write, order, compare decimals to hundredths; estimate to solve problems and to evaluate and justify reasonableness of answers; use models or pictures to represent proper and	Third grade students at the mastery level in mathematics: read, write (standard and expanded form), order, compare numbers to 10,000; model, read, write, order, compare decimals to hundredths; estimate to solve problems and to evaluate reasonableness of answers; use models and pictures to represent proper and	Third grade students at the partial mastery level in mathematics: read, write (standard form), order, compare numbers to 10,000; model, read, and write decimals to hundredths; estimate sums and differences; use models and pictures to represent fractions and	Third grade students at the novice level in mathematics: read and write (standard form) numbers to 10,000; model, read, and write decimals to tenths; estimate sums and differences; use models to represent fractions and mixed

mixed numbers, compare, order, and find equivalent fractions; add and subtract fractions with like denominators with or without models or pictures; add and subtract whole numbers and money and explain procedures used with and without regrouping; model and explain multiplication and division of three-digit numbers by one-digit numbers using clear mathematical language; demonstrate quick recall of multiplication/ division facts; use and explain number properties; model the distributive property; create and solve real-world problems, justify/present solutions.	improper fractions and mixed numbers, to compare, order, and find equivalent fractions; add and subtract fractions with like denominators; add and subtract three-digit numbers and money and explain procedures used with and without regrouping model and explain multiplication and division of three-digit numbers by one-digit numbers; recall basic multiplication and division facts; use and explain number properties; model the distributive property; create and solve real-world problems, justify reasoning, present solutions.	improper fractions and mixed numbers, to compare, order, and find equivalent fractions; add and subtract fractions with like denominators; add and subtract two- and three-digit numbers with and without regrouping and money; model multiplication and division of two- and three-digit numbers by one-digit numbers; recall basic multiplication and division facts; use and explain number properties; model the distributive property; create and solve real-world problems, justify reasoning when presenting solutions.	mixed numbers, to compare fractions, to find equivalent fractions, and to add and subtract fractions with like denominators; add and subtract two-digit numbers with regrouping and three-digit numbers without regrouping and money; model multiplication and division of two-digit numbers by one-digit numbers; recall some multiplication and division facts; use number properties; model distributive property; solve real-world problems, justify reasoning when presenting solutions.	numbers, to find equivalent fractions, and to add and subtract fractions with like denominators; add and subtract two- and three-digit numbers without regrouping; model multiplication and division of two-digit numbers by one-digit numbers; recall some multiplication and division facts; use number properties; solve real-world problems and present solutions

Objectives	**Students will**
M.O.3.1.1	read, write, order, and compare numbers to 10,000 using a variety of strategies (e.g., symbols, manipulatives, number line).
M.O.3.1.2	read, write, order, and compare decimals to hundredths, with manipulatives.
M.O.3.1.3	identify place value of each digit utilizing standard and expanded form to 10,000.
M.O.3.1.4	apply estimation skills (rounding, benchmarks, compatible numbers) to solve and evaluate reasonableness of an answer.
M.O.3.1.5	demonstrate an understanding of fractions as part of a whole/one and as part of a set/group using models and pictorial representations.
M.O.3.1.6	create concrete models and pictorial representations to compare and order fractions with like and unlike denominators, add and subtract fractions with like denominators,and verify results.

M.O.3.1.7	use concrete models and pictorial representations to demonstrate an understanding of equivalent fractions, proper and improper fractions, and mixed numbers.
M.O.3.1.8	add and subtract 2- and 3-digit whole numbers and money with and without regrouping.
M.O.3.1.9	demonstrate and model multiplication (repeated addition, arrays) and division (repeated subtraction, partitioning).
M.O.3.1.10	use and explain the operations of multiplication and division including the properties (e.g., identity element of multiplication, commutative property, property of zero, associative property, inverse operations).
M.O.3.1.11	recall basic multiplication facts and the corresponding division facts.
M.O.3.1.12	model the distributive property in multiplication of 2- and 3-digit numbers by a 1-digit number.
M.O.3.1.13	use models to demonstrate division of 2- and 3-digit numbers by a 1-digit number.
M.O.3.1.14	create grade-appropriate real-world problems involving any of the four operations using multiple strategies, explain the reasoning used, and justify the procedures selected when presenting solutions.

Grade 3	**Mathematics**
Standard 2	Algebra

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

Performance Descriptors (M.PD.3.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Third grade students at the distinguished level in mathematics: create, analyze, extend, and explain geometric and numeric patterns; create an input/output model using any operation; analyze and create patterns and write the rule using a variable; write and justify equivalent	Third grade students at the above mastery level in mathematics: analyze, extend, and explain geometric and numeric patterns; create an input/output model using any operation; analyze and create patterns and write the rule; write and justify equivalent	Third grade students at the mastery level in mathematics: analyze and extend geometric and numeric patterns; create an input/output model using any operation; analyze a given pattern and write the rule; write and justify equivalent	Third grade students at the partial mastery level in mathematics: extend geometric and numeric patterns; complete an input/output model using any operation; write the rule for a given pattern; model and write equivalent	Third grade students at the novice level in mathematics: extend simple geometric and numeric patterns; find the output when given the input using any operation; determine the rule for a given pattern; model and write equivalent

numerical expressions in real world situations; use a variable to represent an unknown quantity; determine the value of the variable in a problem-solving situation.	numerical expressions; use a variable to represent an unknown quantity; determine the value of the variable.	numerical expressions; use a variable to represent an unknown quantity; determine the value of the variable.	numerical expressions; determine the value of a variable in a given number sentence.	numerical expressions; determine the value of a variable in a given number sentence.

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

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

Performance Descriptors (M.PD.3.3)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Third grade students at the distinguished level in mathematics: identify, compare, contrast, combine, decompose, and draw transformations of polygons; identify, describe, compare, contrast, classify solids by faces, edges, and vertices;	Third grade students at the above mastery level in mathematics: identify, compare, combine, decompose, and draw transformations of polygons; identify, describe, compare, and classify solids by faces, edges, and vertices;	Third grade students at the mastery level in mathematics: identify, combine, decompose, and draw transformations of polygons; identify, describe, and classify solids by faces, edges, and vertices; construct and identify a	Third grade students at the partial mastery level in mathematics: identify and draw transformations of polygons; identify and describe solids according to faces, edges, and vertices; construct a solid figure	Third grade students at the novice level in mathematics: identify polygons and model transformations; identify and describe solids according to faces; construct a solid figure

construct and identify a solid from a plane drawing; create designs with lines of symmetry; model, describe, draw, and classify lines, rays, and angles; name points using ordered pairs; plot points when given coordinates on a first-quadrant grid.	construct and identify a solid from a plane drawing; identify, describe, and draw lines of symmetry; model, describe, draw, and classify lines, rays, and angles; name and write location of points using ordered pairs on a first-quadrant grid.	solid from a plane drawing; identify, describe, and draw lines of symmetry; model, describe, and draw lines, rays, and angles; name the location of a point using ordered pairs on a first-quadrant grid.	from a plane drawing; identify and draw lines of symmetry; model and draw lines, rays, and angles; match a point with the ordered pair describing its location on a first-quadrant grid.	from a plane drawing; identify lines of symmetry; model lines, rays, and angles; match a point with the ordered pair describing its location on a first-quadrant grid.

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:	Third grade students at the above mastery level in mathematics:	Third grade students at the mastery level in mathematics:	Third grade students at the partial mastery level in mathematics:	Third grade students at the novice level in mathematics:
design and implement a measurement project; make and test a hypothesis; collect, organize, analyze data; present results;	design and implement a measurement project; make and test a hypothesis; collect, organize, analyze data; present results;	design and implement a measurement project; make and test a hypothesis; collect, organize, analyze data; present results;	carry out a measurement project; make and test a hypothesis; collect, organize, analyze data; present results;	carry out a measurement project; collect, organize, and analyze data; present the results;
estimate and find perimeter of real world objects;	estimate and find perimeter;	estimate and find perimeter;	find perimeter;	find perimeter;
explain how the formula for area of rectangles relates to arrays;	use models to determine and explain the formula for area of a rectangle;	use models to determine and explain the formula for area of a rectangle;	use models to determine the formula for area of a rectangle;	use models to find the area of a rectangle;
read time to the minute; compute elapsed time to the quarter hour;	read time to 5-minute intervals; compute elapsed time to the quarter hour;	read time to 5-minute intervals; compute elapsed time to the quarter hour;	read time to 5-minute intervals; compute elapsed time to the half hour;	read time to 5-minute intervals;
identify, count, and organize coins and bills to show prices up to $100; make change using the fewest possible coins and bills.	identify, count, and organize coins and bills to show prices up to $100; model making change.	identify, count, and organize coins and bills to show prices up to $100; model making change.	identify, count, and organize coins and bills to show prices up to $10; model making change.	identify, count, and organize coins and bills to show prices up to $10; model making change.

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

	less and model making change using manipulatives.

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 and organize real-world data; identify and construct appropriate ways to display data; analyze data from graphs and communicate findings using concise mathematical language; develop, predict and conduct experiments to determine the likeliness of events; list all outcomes.	Third grade students at the above mastery level in mathematics: collect and organize real-world data; identify and construct appropriate ways to display data; analyze data from graphs and communicate findings; develop and conduct experiments to determine the likeliness of events; list all outcomes.	Third grade students at the mastery level in mathematics: collect and organize real-world data; identify and construct appropriate ways to display data; analyze data from graphs; develop and conduct experiments to determine the likeliness of events; list all outcomes.	Third grade students at the partial mastery level in mathematics: collect, organize, and construct displays of real-world data; analyze data from graphs; conduct experiments to determine the likeliness of events; list all outcomes.	Third grade students at the novice level in mathematics: collect, organize, and display real-world data; analyze data from graphs; conduct experiments to determine the likeliness of events; list outcomes.

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

Fourth Grade Mathematics Content Standards and Objectives

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

Grade 4	**Mathematics**
Standard 1	Number and Operations
M.S.4.1	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of numbers, ways of representing numbers, and relationships among numbers and number systems, • demonstrate meanings of operations and how they relate to one another, and • compute fluently and make reasonable estimates.

Performance Descriptors (M.PD.4.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Fourth grade students at the distinguished level in mathematics: demonstrate an understanding of whole numbers, decimals, and fractions, place value, standard and expanded form using a variety of methods, justify method used; design and critique real world problems justifying the reasonableness of a solution;	Fourth grade students at the above mastery level in mathematics: demonstrate an understanding of whole numbers, decimals, and fractions, place value, standard and expanded form using a variety of methods; create and demonstrate real world problems justifying the reasonableness of a solution;	Fourth grade students at the mastery level in mathematics: demonstrate an understanding of whole numbers, decimals, and fractions, place value, standard and expanded form using a variety of methods; evaluate, estimate, and solve real world problems justifying the reasonableness of a solution;	Fourth grade students at the partial mastery level in mathematics: demonstrate an understanding of whole numbers, decimals, and fractions, identify place value, standard and expanded form using any method; examine solutions of real world problems and explain the results;	Fourth grade students at the novice level in mathematics: demonstrate an understanding of whole numbers, decimals, and fractions, recognize place value, standard, and expanded form using any method; state and solve real world problems and recite the results;

create and critique real world story problems using multiple strategies and communicate the results using clear and concise mathematical language.	create and critique real world story problems using multiple strategies and communicate the results.	create real-world story problems using multiple strategies and communicate the results.	apply multiple strategies to solve real-world story problems and communicate the results.	identify real-world story problems 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 for variables using two operations; write and evaluate an expression, using a variable to solve a real-world situation and justify the process; create and solve real-world problems involving order of operations with variables.	Fourth grade students at the above level mastery in mathematics: determine and analyze the rule for variables using two operations; write and evaluate an expression, using a variable to solve a real-world situation; create and solve real-world problems involving order of operations.	Fourth grade students at the mastery level in mathematics: determine the rule for variables using two operations; write an expression, using a variable, to describe a real-world situation; solve real-world problems involving order of operations.	Fourth grade students at the partial mastery level in mathematics: identify the rule for two operation variables; apply an expression, using a variable, to describe a real-world situation; describe real-world problems involving order of operations.	Fourth grade students at the novice level in mathematics: recite the rule for one operation variables; select an expression, using a variable, to describe a situation; describe problems involving order of operations.

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

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

Performance Descriptors (M.PD.4.3)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Fourth grade students at the distinguished level in mathematics:	Fourth grade students at the above mastery level in mathematics:	Fourth grade students at the mastery level in mathematics:	Fourth grade students at the partial mastery level in mathematics:	Fourth grade students at the novice level in mathematics:

identify, classify, compare/contrast, construct, and analyze two- and three-dimensional geometric figures by attributes and different perspectives; construct figures and identify, draw, label, compare/contrast, and classify lines, angles, parts of a circle, and analyze the relationship between lines of symmetry and number of side of a polygon; graph ordered pairs on a first-quadrant grid and investigate the relationship between ordered pairs and the coordinate plane; select, analyze, and justify transformations to solve problems and use transformations to create tessellations.	identify, classify, compare/contrast, recognize, describe, and draw two- and three-dimensional geometric figures by attributes and different perspectives; construct figures and identify, draw, label, compare/contrast, and classify lines, angles, one or more lines of symmetry, and parts of a circle; graph ordered pairs on a first-quadrant grid and use the coordinate system; select, analyze, and justify use of transformations to solve problems and create transformations.	identify, classify, compare/contrast, recognize and describe two- and three-dimensional geometric figures by attributes and different perspectives; identify, draw, label, compare/contrast lines, angles, one line of symmetry and parts of a circle; graph ordered pairs on first-quadrant grid and use the coordinate system; select, analyze, and justify use of transformations to solve problems.	identify, classify, and recognize two- and three-dimensional geometric figures by attributes and different perspectives; identify, draw, and label lines, angles, one line of symmetry, and parts of a circle; graph ordered pairs on a first-quadrant grid and identify the coordinate system; select and justify use of transformations to solve problems.	identify and recognize two and three-dimensional geometric figures by attributes; identify and label lines, angles, one line of symmetry, and parts of a circle when given terms; locate ordered pairs on a first-quadrant grid; select use of transformations to solve problems.

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

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

Performance Descriptors (M.PD.4.4)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Fourth grade students at the distinguished level in mathematics: estimate, measure, compare, and order real-world measurements, analyze, justify and communicate results ; develop and justify the formula for area of a rectangle using a variety of strategies; read time to the minute and calculate elapsed time of real world events; create problems counting coins and bills and determine correct change and communicate the results.	Fourth grade students at the above mastery level in mathematics: estimate, measure, compare, and order real-world measurements, analyze, justify and communicate results; develop and justify the formula for area of a rectangle; read time to the minute and calculate elapsed time; create problems counting coins and bills and determine correct change.	Fourth grade students at the mastery level in mathematics: estimate, measure, compare, and order real-world measurements, justify and present results; develop and justify the formula for area of a rectangle; read time to the minute and calculate elapsed time; count coins and bills and determine correct change.	Fourth grade students at the partial mastery level in mathematics: estimate, measure, compare, and order real-world measurements, and present results; explain the formula for area of a rectangle; read time to the minute and calculate elapsed time with analog or digital clocks; count coins determine correct change.	Fourth grade students at the novice level in mathematics: estimate and measure real-world objects and describe results; determine area by finding the same sized units that cover a shape; read time to the quarter hour and calculate elapsed time with analog or digital clocks; count coins and bills.

Objectives	**Students will**
M.O.4.4.1	select appropriate measuring tools, apply and convert standard units within a system to estimate, measure, compare and order real-world measurements including: • lengths using customary (to the nearest one-fourth inch) and metric units, • weight, • capacity,

	• temperature, and justify and present results.
M.O.4.4.2	quantify area by finding the total number of same sized units that cover a shape, develop a rule and justify the formula for the area of a rectangle using the area model representing multiplication.
M.O.4.4.3	read time to the minute, calculate elapsed time in hours/minutes within a 24-hour period.
M.O.4.4.4	given real-world situations, count coins and bills and determine correct change.

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

Performance Descriptors (M.PD.4.5)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Fourth grade students at the distinguished level in mathematics: pose a question, collect, organize, display, and analyze data to answer the question using statistical measures; design, conduct a probability experiment and present results using clear and concise mathematical language.	Fourth grade students at the above mastery level in mathematics: pose a question, collect, organize, display, and analyze data to answer the question using statistical measures; design, conduct a probability experiment and present results.	Fourth grade students at the mastery level in mathematics: pose a question, collect, organize, display, and analyze data to answer the question using statistical measures; design, conduct a probability experiment and present results.	Fourth grade students at the partial mastery level in mathematics: collect and display data to answer a question; identify the mode and median; conduct a probability experiment.	Fourth grade students at the novice level in mathematics: collect and display data to answer a question; identify the mode and median; conduct a probability experiment.

Objectives	**Students will**
M.O.4.5.1	read and interpret information represented on a circle graph.
M.O.4.5.2	pose a grade-appropriate question that can be addressed with data, collect, organize, display, and analyze data in order to answer the question.
M.O.4.5.3	design and conduct a simple probability experiment using concrete objects, examine and list all possible combinations using a tree diagram, represent the outcomes as a ratio and present the results.
M.O.4.5.4	solve real world problems using mean, median and mode.

Fifth Grade Mathematics Content Standards and Objectives

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

Grade 5	**Mathematics**
Standard 1	Number and Operations
M.S.5.1	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of numbers, ways of representing numbers, and relationships among numbers and number systems, • demonstrate meanings of operations and how they relate to one another, and • compute fluently and make reasonable estimates.

Performance Descriptors (M.PD.5.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Fifth grade students at the distinguished level in mathematics: understand place value using multiple strategies to critique solutions to real-world problems; use real world problems to justify reasonableness of a solution or of estimation; demonstrate fluency in all of the four operations;	Fifth grade students at the above mastery level in mathematics: understand place value using multiple strategies within real-world problems; use real world problems to justify reasonableness of a solution or of estimation; demonstrate fluency in all of the four operations;	Fifth grade students at the mastery level in mathematics: understand place value using multiple strategies; solve real-world problems to justify reasonableness of a solution or estimation; demonstrate fluency in all of the four operations;	Fifth grade students at the partial mastery level in mathematics: identify place value using multiple strategies; solve or estimate real-world problems; solve problems in all of the four operations;	Fifth grade students at the novice level in mathematics: confirm place value using multiple strategies; solve or estimate a solution; solve problems in most of the four operations;

demonstrate understanding of equivalencies by constructing, designing and solving application problems; identify and develops divisibility rules and lowest common multiples.	demonstrate understanding of equivalencies; identify and develops divisibility rules and lowest common multiples.	demonstrate understanding of equivalencies; identify the divisibility rules and lowest common multiple.	identify equivalencies; use divisibility rules to solve division problems.	confirm that application problems contain equivalencies; solve multi-digit division and find common multiples.

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

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

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

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

Grade 5	**Mathematics**
Standard 3	Geometry
M.S.5.3	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, • specify locations and describe spatial relationships using coordinate geometry and other representational systems, • apply transformations and use symmetry to analyze mathematical situations, and

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

Performance Descriptors (M.PD.5.3)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Fifth grade students at the distinguished level in mathematics: develop properties of triangles through comparison and accurately use a protractor to construct a triangle to given measurements; analyze, classify, and construct three-dimensional shapes using properties; create and describe designs using more than one line of symmetry; construct a circle with a given radius or diameter; determine scale and draw a similar figure.	Fifth grade students at the above mastery level in mathematics: classify and compare triangles while discovering the properties of triangles and accurately use a protractor to construct a triangle to given measurements; construct and analyze three-dimensional shapes using properties; create and describe designs using more than one line of symmetry; construct a circle with a given radius or diameter; draw and describe a similar figure using scale.	Fifth grade students at the mastery level in mathematics: classify and compare triangles and can accurately use a protractor; construct and analyze three- dimensional shapes using properties; create designs using more than one line of symmetry; construct a circle with a given radius or diameter; draw a similar figure using scale.	Fifth grade students at the partial mastery level in mathematics: compare and model triangles and accurately use a protractor; construct and describe a three-dimensional shape; draw a line of symmetry; construct a circle with a given radius; identify a similar figure using scale.	Fifth grade students at the novice level in mathematics: recognize triangles and measure angles with a protractor; construct and identify three-dimensional shapes; recognize a line of symmetry; identify a circle with a given radius; recognize similar figures using a scale.

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

Grade 5	**Mathematics**
Standard 4	Measurement
M.S.5.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will

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

Performance Descriptors (M.PD.5.4)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Fifth grade students at the distinguished level in mathematics: estimate, measure, compare, order and draw lengths of real objects up to 1/8 of an inch and millimeters; find, develop and analyze strategies to determine area of triangles and parallelograms using multiple strategies; interpret the relationships of estimates, measurements, or solutions of real-world problems requiring weight /mass or conversions within a system of measurement; describe the effects on the measurement of a two-dimensional shape when the shape is changed; justify the changes in measurement; collect, record, estimate and calculate elapsed time while creating problems and analyzing the solution.	Fifth grade students at the above mastery level in mathematics: estimate, measure, compare, order and draw lengths of real objects up to 1/8 of an inch and millimeters; model, calculate and compare area of triangles and parallelograms using multiple strategies; estimate, measure, or solve real-world problems requiring weight/mass or conversions within a system of measurement; describe the effects on the measurement of a two-dimensional shape when the shape is changed; justify the changes in measurement; collect, record, estimate and calculate elapsed time within context problems.	Fifth grade students at the mastery level in mathematics: estimate, measure, compare, order and draw lengths of real objects up to 1/8 of an inch and millimeters; model, calculate and compare area of triangles and parallelograms using multiple strategies; estimate, measure, or solves real-world problems requiring weight/mass or conversions within a system of measurement; describe the effects on the measurement of a two-dimensional shape when the shape is changed; justify the changes in measurement; collect, record, estimate and calculate elapsed time from real-world situations.	Fifth grade students at the partial mastery level in mathematics: estimate, measure, compare and draw lengths of real objects up to 1/8 of an inch and millimeters; determine area of triangles and parallelograms; identify, measure, or solve real-world problems requiring weight/mass or conversions within a system of measurement; measure two-dimensional shapes and identify the change in measurement when a dimension is changed; measure elapsed time in real-world situations with controlled choices.	Fifth grade students at the novice level in mathematics: measure, indentify and compare lengths up to 1/4 of an inch. replicate how to find area of triangles and parallelograms. identify real-world problems requiring conversion with a system of measurement. measure two-dimensional shapes and identify the change in measurement when a dimension is changed; recognize time has elapsed in real-world settings.

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

Grade 5	Mathematics
Standard 5	Data Analysis and Probability
M.S.5.5	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, • select and use appropriate statistical methods to analyze data, • develop and evaluate inferences and predictions that are based on models, and • apply and demonstrate an understanding of basic concepts of probability.

Performance Descriptors (M.PD.5.5)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Fifth grade students at the distinguished level in mathematics: construct a sample space and make a hypothesis in a real life situation over time and test the prediction with experimentation and defend conclusions: collect, organize data into a circle graph while drawing conclusions, interpreting results, and summarize findings; construct, interpret tables,	Fifth grade students at the above mastery level in mathematics: construct a sample space and make a hypothesis in a real life situation over time and test the prediction with experimentation and present conclusions; collect, organize, construct, present the data and draw conclusions using a circle graph;	Fifth grade student at the mastery level in mathematics: construct a sample space and make a hypothesis in a real life situation over time and test the prediction with experimentation and present conclusions; collect, organize, construct, present the data and draw conclusions using a circle graph;	Fifth grade student at the partial mastery level in mathematics: construct a sample space and make a hypothesis as to the probability of a real life situation overtime, present conclusions; organize data into a circle graph; read and interpret tables,	Fifth grade student at the novice level in mathematics: construct a sample space. identify data on a circle graph; locate information on tables

charts, and graphs including stem and leaf plots to draw reasonable inferences and justify conclusions; collect and analyze data using mean, median and mode to determine the best statistical measure and defend their solutions.	charts and graphs including stem and leaf plots to draw reasonable inferences; collect and analyze data using mean, median and mode to determine the best statistical measure and defend their solutions.	charts, and graphs including stem and leaf plots to draw reasonable inferences; collect and analyze data using mean, median and mode to determine the best statistical measure.	charts and graphs including stem and leaf plots to draw reasonable inferences; collect data and calculate the mean, median, and mode.	and graphs which include stem and leaf plots; solve real-world problems using mean, median, and mode.

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

Sixth Grade Mathematics Content Standards and Objectives

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

Grade 6	**Mathematics**
Standard 1	Number and Operations
M.S.6.1	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of numbers, ways of representing numbers, and relationships among numbers and number systems, • demonstrate meanings of operations and how they relate to one another, and • compute fluently and make reasonable estimates.

Performance Descriptors (M.PD.6.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Sixth grade students at the distinguished level in mathematics: demonstrate an understanding of large numbers using standard and scientific notation; create, analyze and solve real-world problems involving whole numbers, fractions, mixed numbers, decimals, percents and integers justifying the method used, process and the reasonableness of the solutions.;	Sixth grade students at the above mastery level in mathematics: demonstrate an understanding of large numbers using standard and scientific notation; create, analyze and solve real-world problems involving whole numbers, fractions, mixed numbers, decimals, percents and integers justifying the method used and the reasonableness of the solutions;	Sixth grade students at the mastery level in mathematics: demonstrate an understanding of large numbers using standard and scientific notation; analyze and solve real-world problems involving whole numbers, fractions, mixed numbers, decimals, percents and integers justifying the reasonableness of the solutions;	Sixth grade students at the partial mastery level in mathematics: convert a number from scientific notation to standard notation; solve real-world problems involving whole numbers, fractions, mixed numbers, decimals, percents and integers;	Sixth grade students at the novice level in mathematics: identify large numbers using standard and scientific notation; solve problems involving whole numbers, fractions, mixed numbers, decimals, percents and integers;

develop, test and justify hypotheses to derive the rules of operations with integers; create problems from expressions and justify using number properties.	develop, test and justify hypotheses to derive the rules of operations with integers; create problems from numeric expressions.	develop, test and justify hypotheses to derive the rules of operations with integers; apply number properties to numeric expressions.	develop and test hypotheses to derive rules of operations with integers; identify examples of number properties in numeric expressions.	use rules of operations with integers; identify examples of number properties in numeric expressions.

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:	Sixth grade students at the above mastery level in mathematics:	Sixth grade students at the mastery level in mathematics:	Sixth grade students at the partial mastery level in mathematics:	Sixth grade students at the novice level in mathematics:
create algebraic expressions corresponding to real-world situations and use the expressions to solve problems justifying the process and solution in a clear and concise manner; complete, describe, and extend patterns and express the rule as an algebraic expression to predict the nth term; solve problems involving real-world proportional situations justifying the strategy; create a real world problem which can be solved using a one-step equation justifying the process and solution.	create algebraic expressions corresponding to real-world situations and use the expressions to solve problems and justify the solution; complete, describe, and extend patterns and express the rule as an algebraic expression to predict the nth term; solve problems involving real-world proportional situations justifying the strategy; write and use one-step equations to solve real-world problems justifying the reasonableness of the solution.	create algebraic expressions corresponding to real-world situations and use the expressions to solve problems; complete, describe, and extend patterns and express the rule as an algebraic expression to predict the nth term; solve problems involving real-world proportional situations justifying the strategy; write and use one-step equations to solve real-world problems.	create algebraic expressions for word phrases and use the expressions to solve problems; complete, describe, and extend patterns; solve proportion problems between equivalent fractions; translate word problems to one-step equations.	create algebraic expressions for word phrases involving one operation and use the expressions to solve problems; complete and/or extend patterns; recognize equivalent fractions; solve one-step equations.

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: use geometric figures to solve real world problems; use the concept of the sum of the measures of interior angles of a polygon to solve a real world situation; determine the name of the geometric figure given the sum of the measures of the interior angles; create a design for a real world situation using the plotting of polygons on a coordinate plane.	Sixth grade students at the above mastery level in mathematics: represent real world situations using geometric figures; derive the formula to determine the sum of the measures of the interior angles of a polygon and use the formula to find the sum of the measure of an n-gon; create designs using line and rotational symmetry; apply transformations to polygons in a coordinate plane and describe method used; create polygons on a coordinate plane with a given area and determine length of the sides.	Sixth grade students at the mastery level in mathematics: analyze geometric figures; derive the formula to determine the sum of the measures of the interior angles of a polygon; create designs using line and rotational symmetry; predict, describe, and perform transformations on two-dimensional figures; plot polygons on coordinate planes and determine lengths and areas from the graph.	Sixth grade students at the partial mastery level in mathematics: identify characteristics of geometric figures; find the sum of the measures of the interior angles of a polygon by partitioning the polygon into triangles; identify designs using line and rotational symmetry and transformations of two-dimensional figures; plot polygons on coordinate plane.	Sixth grade students at the novice level in mathematics: recognize geometric figures; find the sum of the measures of the interior angles of a polygon given a formula; identify lines of symmetry and transformations of two-dimensional figures; plot points on a coordinate plane.

Objectives	**Students will**
M.O.6.3.1	analyze characteristics using defining properties of • lines,

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

Grade 6	**Mathematics**
Standard 4	Measurement
M.S.6.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of measurable attributes of objects and the units, systems, and processes of measurement, and • apply appropriate techniques, tools and formulas to determine measurements.

Performance Descriptors (M.PD.6.4)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Sixth grade students at the distinguished level in mathematics: collect data by examination and by graphing, determine an approximation for pi; develop and test hypothesis for formulas for perimeter, area and volume of geometric figures and solids to solve real world problems justifying the process and	Sixth grade students at the above mastery level in mathematics: collect data, by examination, determine an approximation for pi; develop and test hypothesis for formulas for perimeter, area and volume of geometric figures and solids used to solve real world problems;	Sixth grade students at the mastery level in mathematics: determine an approximation for pi using actual measurements; develop and test hypothesis to determine formulas for perimeter, area, and volume of geometric figures and solids;	Sixth grade students at the partial mastery level in mathematics: measure and state that the distance around a circle is about three times the diameter; develop formulas to determine the perimeter, area and volume of geometric figures and solids;	Sixth grade students at the novice level in mathematics: state that the distance around a circle is about three times the diameter; use formulas to determine the perimeter and area geometric figures;

solution; solve real world problems related to surface area justifying the process and solution justifying the process and solution; construct scale drawings to solve real world problems justifying the process and solution.	solve real world problems related to surface area justifying the solution; construct scale drawings of regular polygons and describe the method used.	investigate, model, and describe surface area of rectangular prisms and cylinders; construct scale drawings of regular polygons.	identify and find the area of the surfaces of a rectangular prism; construct scale drawings of rectangles.	identify the surfaces of a rectangular prism; 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	Sixth grade students at the above mastery level in	Sixth grade students at the mastery level in	Sixth grade students at the partial mastery level in	Sixth grade students at the novice level in

mathematics: identify a real life situation, use statistical measures to make and check the validity of a hypothesis and communicate the results; design a probability experiment to investigate the probability of a real life situation and communicate likeliness of the event; determine whether to use a combination or permutation to analyze a real world situation and communicate their findings.	mathematics: identify a real life situation, use statistical measures to make and check the validity of a hypothesis and communicate the results; design a probability experiment to investigate the probability of a real life situation; determine whether to use a combination or permutation to analyze a real world situation.	mathematics: identify a real life situation, use statistical measures to make and check the validity of a hypothesis and communicate the results; perform simple probability experiments and use experimental and theoretical probability to predict the outcome of the event; determine combinations and permutations of a given real-world situations.	mathematics: collect, organize, display, read, and analyze data; compare and contrast experimental and theoretical probability; determine the combination and permutation of a given situation.	mathematics: collect, organize, display and read data; express probability as a ratio, decimal or percent; determine the combination of a given situation.

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

Seventh Grade Mathematics Content Standards and Objectives

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

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

Performance Descriptors (M.PD.7.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Seventh grade students at the distinguished level in mathematics: compare, order, differentiate, and convert between decimals/fraction representations of rational numbers and identify/justify a number between any two given numbers; model, estimate and evaluate the relationship between perfect squares/square roots and calculate/justify the square root; justify the use of the	Seventh grade students at the above mastery level in mathematics: compare, order, differentiate, and convert between decimal/fraction representations of rational numbers; model, estimate and evaluate the relationship between perfect squares/square roots and calculate the square root; justify the use of the	Seventh grade students at the mastery level in mathematics: compare, order, and differentiate between rational/irrational numbers; model, estimate and evaluate the relationship between perfect squares/ square roots; justify the use of the	Seventh grade students at the partial mastery level in mathematics: compare, order, and differentiate among rational numbers; evaluate and identify square root of perfect squares; use/identify properties to	Seventh grade students at the novice level in mathematics: compare/order integers, terminating decimals, and fractions; evaluate square root of perfect squares; use properties to simplify

properties to simply numeric/algebraic expressions and explain the connections; analyze, demonstrate fluency in performing operations required, justify, explain the process to solve real world problems; use laws of exponents for expressions with numeric/algebraic bases to generalize the rules algebraically and solve problems using scientific notations.	properties to simplify numeric/algebraic expressions; analyze, demonstrate fluency in performing operations required, justify, explain and solve real world problems; extend the laws of exponents for expressions with variable bases to numeric bases and solve problems using scientific notation.	properties to simplify numeric expressions; analyze, demonstrate fluency in performing operations required and solve real world problems; find/justify laws of exponents for expressions with numeric bases and solve problems using scientific notation.	simplify numeric/whole number expressions; analyze/solve with calculator assistance, and demonstrate/justify fluency in whole number operations; apply laws of positive exponents to expressions with numeric bases and solve problems using scientific notation with positive exponents.	numeric expressions/whole number expressions; analyze/solve with calculator assistance and demonstrate fluency in whole number operations; evaluate powers with positive exponents and convert between numbers in scientific notation/positive exponents/standard form.

Objectives	**Students will**
M.O.7.1.1	compare, order, and differentiate among integers, decimals, fractions, and irrational numbers using multiple representations (e.g., symbols, manipulatives, graphing on a number line).
M.O.7.1.2	model the relationship between perfect squares and square roots using physical representations; estimate square root and evaluate using technology.
M.O.7.1.3	using simple computation and problem-solving situations, demonstrate fluency and justify solutions in performing operations with rational numbers including negative numbers for • adding • subtracting • multiplying • dividing
M.O.7.1.4	justify the use of the commutative, associative, distributive, identity and inverse properties to simplify numeric expressions.
M.O.7.1.5	analyze and solve grade-appropriate real-world problems with whole numbers, integers, decimals, fractions and percents including problems involving • discounts, • interest, • taxes, • tips, • percent increase or decrease, and justify solutions including using estimation and reasonableness.
M.O.7.1.6	use inductive reasoning to find and justify the laws of exponents with numeric bases
M.O.7.1.7	solve problems using numbers in scientific notation (positive and negative exponents) with and without technology, and interpret

	from real life contexts.

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

Performance Descriptors (M.PD.7.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Seventh grade students at the distinguished level in mathematics: express a rule algebraically and extend in arithmetic and geometric sequences; simplify/evaluate algebraic expressions with whole numbers, fractions, integers, absolute value, and exponents using the order of operations; create input/output tables to predict values and state the rule algebraically in problem solving situations; solve multi-step linear equations and inequalities containing rational numbers and graph; plot lines in a coordinate plane, determine slope, and solve problem	Seventh grade students at the above mastery level mathematics: create/extend a rule in arithmetic and geometric sequences; evaluate algebraic expressions with whole numbers, fractions, integers, absolute value, and exponents using the order of operations; create input/output tables to predict values and state the rule in problem solving situations; solve one-step linear equations and inequalities containing rational numbers and graph; plot lines in a coordinate plane, determine slope, and solve problem	Seventh grade students at the mastery level in mathematics: find missing elements in arithmetic/geometric sequences; evaluate algebraic expressions with whole numbers, integers, absolute value and exponents using the order of operations; create input/output function tables to predict values in problem solving situations; solve one-step linear equations and inequalities containing rational numbers; plot lines in a coordinate plane, determine slope, and solve/justify problems	Seventh grade students at the partial mastery level in mathematics: identify operation used in sequence and identify as arithmetic or geometric; evaluate algebraic expressions using whole numbers/integers and the order of operations; complete input/output functions tables to make predictions; solve one-step linear equations and inequalities involving integers; plot lines in a coordinate plane, determine slope, and solve algebraically;	Seventh grade students a the novice level in mathematics: identify operation used to create a sequence; evaluate algebraic expressions using whole numbers and the order of operations; complete input/output function tables; solve one-step equations involving whole numbers; plot lines on a coordinate plane and identify slope as positive or negative;

algebraically and justify/explain the process in a clear, concise manner; distinguish between proportional/non-proportional situations and write, solve, and justify the solution.	algebraically and justify/explain the process; write and solve proportion for a proportional situation and justify.	algebraically; solve problems involving proportional situations.	recognize two equal ratios form a proportion.	solve proportions.

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:	Seventh grade students at the above mastery level in mathematics:	Seventh grade students at the mastery level in mathematics:	Seventh grade students at the partial mastery level in mathematics:	Seventh grade students at the novice level in mathematics:

identify/construct angle pairs, congruent segments/angles, perpendicular bisectors of segments and angle-bisector. Find missing measure in angle pair and identify corresponding, alternate interior/exterior angles;	identify/construct angle pairs, congruent segments/ angles, perpendicular bisectors of segments and angle-bisector. Find missing measure in an angle pair;	identify/construct angle pairs, congruent segments/ angles, perpendicular bisectors of segments and angle-bisectors;	identify/construct angle pairs, angles, congruent segments and bisectors of segments;	identify angle pairs, congruent segments and angles;
apply line/rotational symmetry and transformations;	apply line symmetry/ transformations and recognize rotational symmetry;	apply line symmetry and transformations;	identify line symmetry and transformations;	recognize line symmetry and transformations;
solve real world problems with compound geometric figures involving scale by writing proportions and creating scale model.	solve real world problems with compound geometric figures involving scale by writing a proportion.	solve real world problems with compound geometric figures involving scale.	solve ratio/proportion and real world problems involving geometric figures.	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 and compare and contrast the new figure with the original.
M.O.7.3.4	pose and solve ratio and proportion problems including scale drawings and similar polygons.
M.O.7.3.5	solve problems and explain the relationships among scale factor and area and volume including • square of a scale factor • cube of a scale factor
M.O.7.3.6	solve mathematical real-world problems using compound geometric figures.

Grade 7	**Mathematics**
Standard 4	Measurement
M.S.7.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will:

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

Performance Descriptors (M.PD.7.4)

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

Objectives	**Students will**
M.O.7.4.1	select and apply an appropriate method to solve (including, but not limited to, formulas) justify the method and the reasonableness of the solution, given a real-world problem solving situation involving • perimeter • circumference • area • surface area of prisms (rectangular and triangular) • volume of prisms and cylinders • distance and temperature (Celsius, Fahrenheit)
M.O.7.4.2	use the Pythagorean Theorem to find the length of any side of a right triangle and apply to problem solving situations.
M.O.7.4.3	convert units of measurement, linear, area and volume, within customary and metric systems.

Grade 7	**Mathematics**
Standard 5	Data Analysis and Probability

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

Performance Descriptors (M.PD.7.5)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Seventh grade students at the distinguished level in mathematics: determine theoretical probability of compound, independent events to make/test predictions and explain their thinking; create and solve problems involving combinations/ permutations; collect, organize, graph, analyze, interpret data and solve problems using measures of central tendency to interpret data with/without missing data.	Seventh grade students at the above mastery level in mathematics: determine theoretical probability of compound, independent events to make/test predictions; use appropriate technology to solve application problems involving combinations/permutations collect, organize, graph, analyze, interpret data and solve problems using measures of central tendency to interpret data.	Seventh grade students at the mastery level in mathematics: determine theoretical probability to make and test predictions; determine combinations/ permutations by constructing sample spaces; collect, organize, graph, analyze, interpret data and solve problems using measures of central tendency.	Seventh grade students at the partial mastery level in mathematics: predict and test the outcome of an event and identify the theoretical/ experimental probability; list combinations/ permutations of three items; collect, organize, graph and solve problems using measures of central tendency.	Seventh graded students at the novice level in mathematics: predict/test outcomes of an event given its probability; recognize a situation involving combinations/ permutations; collect/organize data and determine measures of central tendency.

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

Eighth Grade Mathematics Content Standards and Objectives

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

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

Performance Descriptors (M.PD.8.1)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Eight grade students at the distinguished level in mathematics: analyze, describe and compare characteristics of rational/irrational numbers and use to create/solve problems; create/solve problems using powers, radicals and numbers in scientific notation; analyze and solve application problems involving rational/irrational	Eight grade students at the above mastery level in mathematics: analyze, describe and compare characteristics of rational/irrational numbers and add, subtract, multiply and divide rational/irrational numbers; solve problems using powers, radicals and numbers in scientific notation; analyze and solve application problems involving rational/irrational	Eight grade students at the mastery level in mathematics: analyze, describe and compare characteristics of rational/irrational numbers; solve problems using powers, square roots and numbers in scientific notation; analyze and solve application problems involving rational numbers	Eight grade students at the partial mastery level in mathematics: describe and compare characteristics of rational/irrational numbers; evaluate powers of integers and solve problems using numbers in scientific notation; analyze and solve application problems involving no more than two	Eight grade students at the novice level in mathematics: compare and order rational/ irrational numbers by converting/comparing their decimal form; evaluate powers of integers and convert between numbers in scientific notation and standard form; solve application problems involving one operation evaluate powers of integers

numbers, verify solutions using estimation and explain process in a clear, concise manner.	numbers, verify solutions using estimation and explain process.	and verify solutions using estimation.	operations evaluate powers of integers and solve problems using numbers in scientific notation with whole numbers, integers, decimals, fractions, percents and verify solutions using estimation.	and solve problems using numbers in scientific notation with whole numbers, integers, decimals, fractions, percents and verify solutions using estimation.

Objectives	**Students will**
M.O.8.1.1	analyze, describe and compare the characteristics of rational and irrational numbers.
M.O.8.1.2	analyze and solve application problems with • powers, • squares, • square roots, • scientific notation, and verify solutions using estimation techniques.
M.O.8.1.3	analyze and solve grade-appropriate real-world problems with • whole numbers, • decimals, • fractions, • percents, percent increase and decrease, • integers, and including, but not limited to, rates, tips, discounts, sales tax and interest and verify solutions using estimation techniques.

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

Performance Descriptors (M.PD.8.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Eighth grade students at the distinguished level in mathematics:	Eighth grade students at the above mastery level in mathematics:	Eighth grade students at the mastery level in mathematics:	Eighth grade students at the partial mastery level in mathematics:	Eighth grade students at the novice level in mathematics:

solve multi-step linear/literal equations and solve/graph multi-step inequalities in one variable with variable on both sides; solve problems by creating/ simplifying/justifying polynomials to solve problems; formulate an algebraic expression from data in a table arithmetic, geometric or algebraic pattern and analyze to determine/ explain if a functional relationship exists; graph linear equations and inequalities, determine the slope given graph of line, two points or slope-intercept form and determine the equation of a line given a graph or table of values; identify a real-life problem involving change over time, make a hypothesis, develop/implement/justify a method to analyze data, generalize/ compare the results and present in a project.	solve multi-step linear equations and solve/graph multi-step inequalities in one variable with variable on both sides; add and subtract polynomials to solve problems; formulate an algebraic expression from data to generate an arithmetic, geometric or algebraic pattern and analyze to determine if a functional relationship exists; graph linear equations and inequalities, determine the slope given graph of line, two points or slope-intercept form and determine the equation of a line given a graph; identify a real-life problem involving change over time, make a hypothesis, develop/implement/justify a method to analyze data, generalize/ compare the results and present in a project.	solve two-step linear equations and solve/graph two-step inequalities with rational solutions; add and subtract polynomials to two variables and positive exponents; formulate a rule from data to generate an arithmetic, geometric or algebraic pattern and analyze to determine if a functional relationship exists; graph linear equations and inequalities, determine the slope given graph of line, two points or slope-intercept form; identify a real-life problem involving change over time, make a hypothesis, develop/implement/justify a method to analyze data, generalize/ compare the results and present in a project.	solve one/two-step linear equations and solve/graph one/two-step inequalities involving integers; add and subtract polynomials to two variables and no exponents; complete a table from data involving an arithmetic, geometric or algebraic pattern and analyze to determine if a functional relationship exists; create a table of values and graph linear equations and determine the slope of a line from a graph; identify a real-life problem involving change over time, make a hypothesis, develop/ implement a method to analyze data, generalize/compare the results and present in a project.	solve one/two-step linear equations and solve/graph one/two-step inequalities involving whole numbers; add and subtract polynomials to two variables and no exponents; complete a table to generate an arithmetic, geometric or algebraic pattern and analyze to determine if a functional relationship exists; complete a table of values and graph linear equations; identify a real-life problem involving change over time, make a hypothesis, implement a method to analyze data, and compare the results.

Objectives	**Students will**
M.O.8.2.1	use a variety of strategies to solve one and two-step linear equations and inequalities with rational solutions; defend the selection of the strategy; graph the solutions and justify the reasonableness of the solution.
M.O.8.2.2	identify proportional relationships in real-world situations, then find and select an appropriate method to determine the solution;

	justify the reasonableness of the solution.
M.O.8.2.3	add and subtract polynomials limited to two variables and positive exponents.
M.O.8.2.4	use systems of linear equations to analyze situations and solve problems.
M.O.8.2.5	apply inductive and deductive reasoning to write a rule from data in an input/output table, analyze the table and the rule to determine if a functional relationship exists.
M.O.8.2.6	graph linear equations and inequalities within the Cartesian coordinate plane by generating a table of values (with and without technology).
M.O.8.2.7	formulate and apply a rule to generate an arithmetic, geometric and algebraic pattern.
M.O.8.2.8	determine the slope of a line using a variety of methods including • graphing • change in y over change in x • equation
M.O.8.2.9	represent and solve real-world grade-appropriate problems using multiple strategies and justify solutions.
M.O.8.2.10	identify a real life problem involving change over time; make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the results of the investigation; present the project using words, graphs, drawings, models, or tables.

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

Performance Descriptors (M.PD.8.3)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Eight grade students at the distinguished level in mathematics: apply/justify the relationship among angles formed by parallel lines cut by a transversal; construct perpendicular	Eight grade students at the above mastery level in mathematics: apply the relationship among angles formed by parallel lines cut by a transversal; construct perpendicular	Eight grade students at the mastery level in mathematics: recognize the relationship among angles formed by parallel lines cut by a transversal; construct perpendicular	Eight grade students at the partial mastery level in mathematics: identify the classifications of angles formed by parallel lines cut by a transversal and recognize congruent angles formed; recognize perpendicular	Eight grade students at the novice level in mathematics: identify the classifications of angles formed by parallel lines cut by a transversal; recognize perpendicular or

and angle bisectors; use transformations to create Escher-like tessellations; create scale models of prisms and use ratio/proportions to determine scale factor in similar figures; make/test/justify/refine conjectures concerning relationship between the dimensions of geometric figures; classify polyhedrons according number/shape of faces and use inductive reasoning to determine/ algebraically state the relationship between vertices, faces and edges.	and angle bisectors; use transformations to create tessellations; create scale models of rectangular prisms and use ratio/proportions to determine scale factor in similar figures; make/test/justify/refine conjectures concerning regular polygons, cross sections of a solid or intersection of two or more geometric figures; classify polyhedrons according number/shape of faces and use reasoning to determine/state the relationship between vertices, faces and edges.	and angle bisectors; create geometric patterns/ transformations to predict results changing plane figures/solids; create scale models and use ratio/proportions to determine scale factor in similar figures; make/test/justify conjectures concerning regular polygons, cross sections of a solid or intersection of two or more geometric figures; classify polyhedrons according number/shape of faces and use reasoning to determine the relationship between vertices, faces and edges.	and angle bisectors; identify geometric patterns/ transformations to predict results changing plane figures/solids; create scale models of rectangles/right triangles and use ratio/proportions to determine scale factor in similar figures; make/test conjectures concerning regular polygons, cross sections of a solid or intersection of two or more geometric figures; classify polyhedrons according number/shape of faces and determine the number of vertices, faces and edges.	angle bisectors; identify geometric patterns/ transformations and results changing plane figures/ solids; create scale models of rectangles and use ratio/proportions to determine scale factor in similar figures; test conjectures concerning regular polygons, cross sections of a solid or intersection of two or more geometric figures; determine the number of vertices/faces/edges and distinguish between prisms/pyramids.

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

	• justify the results.

Grade 8	**Mathematics**			
Standard 4	Measurement			
M.S.8.4	Through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics, students will • demonstrate understanding of measurable attributes of objects and the units, systems, and processes of measurements, and • apply appropriate techniques, tools, and formulas to determine measurements.			
Performance Descriptors (M.PD.8.4)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Eight grade students at the distinguished level in mathematics: determine volume of prisms, pyramids, cylinders, cones, and spheres in real world problems and justify reasonableness of method and solution in a clear, concise manner; solve/justify in a clear, concise manner problems involving missing measurements in plane and solid geometric figures; create/solve/justify in a clear, concise manner problems involving the Pythagorean Theorem and indirect measurement in right triangle.	Eight grade students at the above mastery level in mathematics: determine volume of prisms, pyramids, cylinders, cones, and spheres in real world problems and justify reasonableness of method and solution; solve/justify problems involving missing measurements in plane and solid geometric figures; create/solve problems involving the Pythagorean Theorem and indirect measurement in right triangle.	Eight grade students at the mastery level in mathematics: determine volume of prisms, pyramids, cylinders, cones, and spheres in real world problems and justify method reasonableness of solution; solve problems involving missing measurements in plane and solid geometric figures; use Pythagorean Theorem, indirect measure, and definitions to solve right triangle application problems.	Eight grade students at the partial mastery level in mathematics: determine volume of prisms, cylinders, cones, and pyramid in real world problems and justify reasonableness; solve problems involving missing measurement in rectangular prisms and plane geometric figures; use Pythagorean Theorem to find unknown sides of right triangles.	Eight grade students at the novice level in mathematics: determine volume of prisms, cylinders, and pyramids in real world problems and justify reasonableness; solve problems involving missing measurement in plane geometric figures; use Pythagorean Theorem to find the hypotenuse of right triangle.

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

construct convincing arguments based on data analysis.	arguments based on data analysis.	based on data analysis.	analysis.	

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 will: formulate and simplify algebraic expressions for use in equations and inequalities, developing and justifying each step, derive and use the laws of integral exponents; create, solve, and concisely and clearly interpret solutions for multi-step equations; and solve literal equations; identify a real life situation with experiments to collect, organize, and analyze related data in a clear	Algebra I students at the above mastery level will: formulate and simplify algebraic expressions for use in equations and inequalities, derive and use the laws of integral exponents; create, solve, and interpret solutions for multi-step equations; and solve literal equations; identify a real life situation and collect, organize, and analyze related data in a clear concise manner for	Algebra I students at the mastery level will: formulate and simplify algebraic expressions for use in equations and inequalities, derive and use the laws of integral exponents; create, solve, and interpret solutions for multi-step equations; and solve literal equations; identify a real life situation; collect, organize, and analyze related data for display in multiple	Algebra I students at the partial mastery level will: formulate and simplify algebraic expressions with integer coefficients for use in equations and inequalities, and use the laws of integral exponents; create, solve, and interpret solutions for multi-step equations that contain only integral coefficients; and solve literal equations; identify a real life situation; collect and organize related data for display in multiple representations;	Algebra I students at the novice level will: formulate and simplify algebraic expressions with whole number coefficients for use in equations and inequalities, and use integral exponents; create, solve, and interpret solutions for multi-step equations that contain only whole number coefficients; and solve literal equations; identify a real life situation; collect and organize related data for display in multiple representations; make a

concise manner for display in multiple representations; formulate a conclusion; present the project with clarity and conciseness; model real-life situations involving exponential growth and decay equations and summarize the relationship in a clear, concise manner; develop and explain operations with and factoring of higher order polynomials, rational and radical expressions. Use intercepts on a graph in problem solving; use simulations and rules of probability to design experiments to solve problems justifying the reasonableness of the approach in a clear, concise manner.	display in multiple representations; formulate a conclusion; present the project; model real-life situations involving exponential growth and decay equations; develop and explain operations with and factoring of polynomials, rational and radical expressions. Use intercepts on a graph in problem solving; use simulations and rules of probability to design and interpret experiments to solve problems.	representations; make a conclusion; present the project; describe real-life situations involving exponential growth and decay equations; develop and explain operations with and factoring of polynomials, rational and radical expressions; use simulations and rules of probability to design experiments to solve problems.	make a conclusion; present the project; identify real-life situations involving exponential growth and decay equations; model and explain operations with and factoring of polynomials, rational and radical expressions; use simulations and rules of probability to conduct and interpret experiments to solve problems.	conclusion; prove the existence of a pattern; identify real-life situations involving exponential growth; model operations with and factoring of polynomials, rational and radical expressions; use simulations and rules of probability to conduct experiments to solve problems.

Objectives	**Students will**
M.O.A1.2.1	formulate algebraic expressions for use in equations and inequalities that require planning to accurately model real-world problems.
M.O.A1.2.2	create and solve multi-step linear equations, absolute value equations, and linear inequalities in one variable, (with and without technology); apply skills toward solving practical problems such as distance, mixtures or motion and judge the reasonableness of solutions.
M.O.A1.2.3	evaluate data provided, given a real-world situation, select an appropriate literal equation and solve for a needed variable.
M.O.A1.2.4	develop and test hypotheses to derive the laws of exponents and use them to perform operations on expressions with integral exponents.
M.O.A1.2.5	analyze a given set of data and prove the existence of a pattern numerically, algebraically and graphically, write equations from the patterns and make inferences and predictions based on observing the pattern.
M.O.A.1.2.6	determine the slope of a line through a variety of strategies (e.g. given an equation or graph).
M.O.A1.2.7	analyze situations and solve problems by determining the equation of a line given a graph of a line, two points on the line, the slope

	and a point, or the slope and y intercept.
M.O.A1.2.8	identify a real life situation that involves a constant rate of change; pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous linear function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra (with and without technology).
M.O.A1.2.9	create and solve systems of linear equations graphically and numerically using the elimination method and the substitution method, given a real-world situation.
M.O.A1.2.10	simplify and evaluate algebraic expressions • add and subtract polynomials • multiply and divide binomials by binomials or monomials
M.O.A1.2.11	create polynomials to represent and solve problems from real-world situations while focusing on symbolic and graphical patterns.
M.O.A1.2.12	use area models and graphical representations to develop and explain appropriate methods of factoring.
M.O.A1.2.13	simplify radical expressions • through adding, subtracting, multiplying and dividing • exact and approximate forms
M.O.A1.2.14	choose the most efficient method to solve quadratic equations by • graphing (with and without technology), • factoring • quadratic formula and draw reasonable conclusions about a situation being modeled.
M.O.A1.2.15	describe real life situations involving exponential growth and decay equations including $y=2^x$ and $y=(½)^x$; compare the equation with attributes of an associated table and graph to demonstrate an understanding of their interrelationship.
M.O.A1.2.16	simplify and evaluate rational expressions • add, subtract, multiply and divide • determine when an expression is undefined.
M.O.A1.2.17	perform a linear regression (with and without technology), • compare and evaluate methods of fitting lines to data. • identify the equation for the line of regression, • examine the correlation coefficient to determine how well the line fits the data • use the equation to predict specific values of a variable.
M.O.A1.2.18	compute and interpret the expected value of random variables in simple cases using simulations and rules of probability (with and without technology).
M.O.A1.2.19	gather data to create histograms, box plots, scatter plots and normal distribution curves and use them to draw and support conclusions about the data.
M.O.A1.2.20	design experiments to model and solve problems using the concepts of sample space and probability distribution.
M.O.A1.2.21	use multiple representations, such as words, graphs, tables of values and equations, to solve practical problems; describe advantages and disadvantages of the use of each representation.

Geometry Content Standards and Objectives

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

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

Performance Descriptors (M.PD.G.3)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Geometry students at the distinguished level: investigate, create arguments, justify, compare and contrast, make conjectures, critique arguments and apply relationships involving the properties of lines, polygons, measures of angles, circles, Pythagorean Theorem, transformational geometry, tessellating figures, trigonometric ratios, and the properties of Euclidean geometry with other	Geometry students at the above mastery level: investigate, justify, make conjectures, compare and contrast, critique arguments and apply relationships involving the properties of lines, polygons, measures of angles, circles, Pythagorean Theorem, transformational geometry, tessellating figures, trigonometric ratios, the properties of Euclidean geometry with other geometries, and concepts	Geometry students at the mastery level: investigate, make conjectures, compare and contrast, and/or apply relationships involving the properties of lines, polygons, measures of angles, circles, Pythagorean Theorem, transformational geometry, tessellating figures, trigonometric ratios, the properties of Euclidean geometry with other geometries, and concepts of analytical geometry;	Geometry students at the partial mastery level: investigate and apply relationships involving the properties of lines, polygons, measures of angles, circles, Pythagorean Theorem, transformational geometry, tessellating figures, trigonometric ratios, the properties of Euclidean geometry with other geometries, and concepts of analytical geometry;	Geometry students at the novice level: investigate relationships involving the properties of lines, polygons, measures of angles, circles, Pythagorean Theorem, transformational geometry, tessellating figures, concepts of analytical geometry trigonometric ratios, and use analytical geometry to apply formulas;

geometries concepts of analytical geometry; construct the parts of a triangle and develop and justify logical concepts to be used in solving real-world problems; draw and justify conclusions in real-world settings and construct proofs, counterexamples, and logical arguments; identify a real life situation involving similarity; pose a question; make a hypothesis; collect, organize, and analyze related data; make a conclusion; compare the hypothesis and the conclusion; and present the project.	of analytical geometry; construct the parts of a triangle and develop and justify logical concepts to be used in solving real-world problems; draw and justify conclusions in real-world settings and construct proofs, counterexamples, and logical arguments; identify a real life situation involving similarity; pose a question; make a hypothesis; collect, organize, and analyze related data; make a conclusion; compare the hypothesis and the conclusion; and present the project.	construct the parts of a triangle and develop logical concepts to be used in solving real-world problems; draw and justify conclusions in real-world settings and construct proofs and logical arguments; identify a real life situation involving similarity; pose a question; make a hypothesis; collect, organize, and analyze related data; make a conclusion; compare the hypothesis and the conclusion; and present the project.	construct the parts of a triangle and use logical concepts to solve real-world problems; draw and justify conclusions in real-world settings and construct informal proofs; identify a real life situation involving similarity; pose a question; make a hypothesis; collect and organize data; make a conclusion; compare the hypothesis and the conclusion.	identify corresponding parts of similar triangles; draw conclusions in real-world settings and construct informal proof; identify a real life situation involving similarity; pose a question; make a hypothesis; collect and organize data; make a conclusion; compare the hypothesis and the conclusion.

Objectives	**Students will**
M.O.G.3.1	represent geometric figures, such as points, lines, planes, segments, rays, and angles pictorially with proper identification and distinguish between undefined and defined terms.
M.O.G.3.2	differentiate and apply inductive and deductive reasoning, justify conclusions in real-world settings.
M.O.G.3.3	use the basic concepts of symbolic logic including identifying the converse, inverse, and contrapositive of a conditional statement and test the validity of conclusions with methods that include Venn Diagrams.
M.O.G.3.4	validate conclusions by constructing logical arguments using both formal and informal methods with direct and indirect reasoning.
M.O.G.3.5	construct formal and informal proofs by applying definitions, theorems, and postulates related to such topics as • complementary, • supplementary, • vertical angles, • angles formed by perpendicular lines, and justify the steps.
M.O.G.3.6	compare and contrast the relationships between angles formed by two lines cut by a transversal when lines are parallel and when they are not parallel, and use the results to develop concepts that will justify parallelism.

M.O.G.3.7	make conjectures and justify congruence relationships with an emphasis on triangles and employ these relationships to solve problems.
M.O.G.3.8	identify general properties of and compare and contrast the properties of convex and concave quadrilaterals • parallelograms • rectangles • rhombuses • squares • trapezoids
M.O.G.3.9	identify a real life situation that involves similarity in two or three dimensions; pose a question; make a hypothesis as to the answer, develop, justify, and implement a method to collect, organize, and analyze related data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra and geometry (with and without technology).
M.O.G.3.10	investigate measures of angles and lengths of segments to determine the existence of a triangle (triangle inequality) and to establish the relationship between the measures of the angles and the length of the sides (with and without technology).
M.O.G.3.11	verify and justify the basis for the trigonometric ratios by applying properties of similar triangles and use the results to find inaccessible heights and distances. Using the ratios of similar triangles to find unknown side lengths and angle measures, construct a physical model that illustrates the use of a scale drawing in a real-world situation.
M.O.G.3.12	apply the Pythagorean Theorem and its converse to solve real-world problems and derive the special right triangle relationships (i.e. 30-60-90, 45-45-90).
M.O.G.3.13	investigate measures of angles formed by chords, tangents, and secants of a circle and draw conclusions for the relationship to its arcs.
M.O.G.3.14	find angle measures of interior and exterior angles; given a polygon, find the length of sides from given data; and use properties of regular polygons to find any unknown measurements of sides or angles.
M.O.G.3.15	develop properties of tessellating figures and use those properties to tessellate the plane.
M.O.G.3.16	derive and justify formulas for area, perimeter, surface area, and volume using nets and apply them to solve real-world problems.
M.O.G.3.17	apply concepts of analytical geometry such as formulas for distance, slope, and midpoint and apply these to finding dimensions of polygons on the coordinate plane.
M.O.G.3.18	construct a triangle's medians, altitudes, angle and perpendicular bisectors using various methods; and develop logical concepts about their relationships to be used in solving real-world problems.
M.O.G.3.19	create and apply concepts using transformational geometry and laws of symmetry, of a • reflection, • translation, • rotation, • glide reflection, • dilation of a figure, and develop logical arguments for congruency and similarity.
M.O.G.3.20	compare and contrast Euclidean geometry to other geometries (i.e. spherical, elliptic) using various forms of communication such as development of physical models, oral or written reports.
M.O.G.3.21	approximate the area of irregularly shaped regions based on the approximations and the attributes of the related region, develop a

	formula for finding the area of irregularly shaped regions. Plan, organize and present results by justifying conclusions.

Algebra II Content Standards and Objectives

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

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

Performance Descriptors (M.PD.A2.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Algebra II students at the distinguished level: develop and analyze practical situations to determine, graph and solve various types of equations, inequalities, and systems and express answers using various formats; extend the techniques of factoring polynomials and explain their application; convert between the graphs and equations of functions and conic sections using an analysis of their properties and graphing techniques and describe their	Algebra II students at the above mastery level: analyze practical situations to determine, graph and solve various types of equations, inequalities, and systems and express answers using various formats; extend the techniques of factoring polynomials; convert between the graphs and equations of functions and conic sections using an analysis of their properties and graphing techniques and describe their	Algebra II students at the mastery level: determine, graph and solve various types of equations, inequalities, and systems and express answers using various formats; apply the appropriate method to factor polynomials; convert between the graphs and equations of functions and conic sections using an analysis of their properties and graphing techniques;	Algebra II students at partial mastery level: graph and solve various types of equations, inequalities, and systems and express answers using various formats; factor polynomials when given the appropriate method; convert between the graphs and equations of functions and conic sections;	Algebra II students at the novice level: graph and solve various types of equations, inequalities, and systems; factor most polynomials when given the appropriate method; graph functions and conic sections from the given equation;

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

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

M.O.A2.2.11	solve practical problems involving direct, inverse and joint variation.
M.O.A2.2.12	analyze the conic sections; identify and sketch the graphs of a parabola, circle, ellipse, and hyperbola and convert between graphs and equations.
M.O.A2.2.13	solve absolute value inequalities graphically, numerically and algebraically and express the solution set in interval notation.
M.O.A2.2.14	define a logarithmic function, transform between exponential and logarithmic forms, and apply the basic properties of logarithms to simplify or expand an expression.
M.O.A2.2.15	identify a real life situation that exhibits characteristics of change that can be modeled by a quadratic equations; pose a questions; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project numerically, analytically, graphically and verbally using the predictive and analytic tools of algebra (with and without technology).
M.O.A2.2.16	describe and illustrate how patterns and sequences are used to develop recursive and closed form equations; analyze and describe characteristics of each form.

Conceptual Mathematics Content Standards and Objectives

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

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

Performance Descriptors (M.PD.CM.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Conceptual Mathematics students at the distinguished level: research, create, apply, and compare a variety of problem-solving strategies to solve real-world problems and justify the reasonableness of the solutions; develop and solve applications problems involving functions and assess their usefulness in the real world; pose questions, make hypotheses, and implement appropriate	Conceptual Mathematics students at the above mastery level: create, apply, and compare a variety of problem-solving strategies to solve real-world problems and justify the reasonableness of the solutions; develop and solve application problems involving functions and interpret and analyze their graphs; pose questions, make hypotheses, and implement appropriate	Conceptual Mathematics students at the mastery level: apply and compare a variety of problem-solving strategies to solve real-world problems and justify the reasonableness of the solutions; solve application problems involving functions and interpret and analyze the graphs; pose questions, make hypotheses, and implement appropriate methods to	Conceptual Mathematics students at the partial mastery level: apply problem-solving strategies to solve real-world problems; solve application problems involving functions and read the graphs; implement appropriate methods to collect, organize, and present data	Conceptual Mathematics students at the novice level: apply problem-solving strategies to solve problems; recognize problems involving functions; collect, organize, and present data (with and without technology);

methods to collect, organize, analyze, draw conclusions, and present data (with and without technology); research and investigate real-world personal finance situations and differentiate between the types of personal finance functions in order to solve and make recommendations to optimize the situation.	methods to collect, organize, analyze, draw conclusions, and present data (with and without technology); research and investigate real-world personal finance situations and differentiate between the types of personal finance functions in order to solve the problem.	collect, organize, analyze, draw conclusions, and present data (with and without technology); differentiate between the types of personal finance functions in order to solve real-world problems.	(with and without technology); solve real-world problems when given the appropriate personal finance function.	compute using personal finance formulas.

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

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

Performance Descriptors (M.PD.CM.3)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Conceptual Mathematics students at the distinguished level:	Conceptual Mathematics students at the above mastery level:	Conceptual Mathematics students at the mastery level:	Conceptual Mathematics students at the partial mastery level:	Conceptual Mathematics students at the novice level:

design and implement a project which applies concepts of geometry to compute measures and analyze connections between geometric shapes and their real-world applications.	determine and apply concepts of geometry to compute measures and analyze connections between geometric shapes and their real-world applications.	apply concepts of geometry to compute measures and analyze connections between geometric shapes and their real-world applications.	use concepts of geometry to compute measures and model connections between geometric shapes and their real-world applications.	recognize concepts of geometry to compute measures and describe connections between geometric shapes and their real-world applications.

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

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

Performance Descriptors (M.PD CM.5)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Conceptual Mathematics students at distinguished level: research and relate mathematical content to its historical development and connect to other disciplines; design and conduct probability investigations using counting techniques,	Conceptual Mathematics students at above mastery level: research and relate mathematical content to its historical development and integrate other disciplines into the study of mathematics; design and conduct probability investigations using counting techniques,	Conceptual Mathematics students at mastery level: relate mathematical content to its historical development and integrate other disciplines into the study of mathematics; design and conduct probability investigations using counting techniques,	Conceptual Mathematics students at partial mastery level: recognize mathematical content as it relates to its historical development and relate how other disciplines are integrated into the study of mathematics; conduct probability investigations using counting techniques, and	Conceptual Mathematics students at novice level: recognize that mathematical content is related to its historical development and see how other disciplines are integrated into the study of mathematics; conduct probability investigations using counting techniques and

and determine, analyze and communicate the results and develop rules of probability; compare and contrast more than one set of data that they collect, summarize, and interpret numerically and graphically.	and determine, analyze and communicate the results and develop rules of probability; collect, summarize, and interpret data numerically and graphically to make predictions.	and determine, analyze and communicate the results; collect, summarize, and interpret data numerically and graphically to make predictions.	determine, analyze and communicate the results; collect and summarize data numerically and graphically.	communicate results; collect and summarize data numerically and graphically.

Objectives	**Students will**
M.O.CM.5.1	relate mathematical content to its historical development.
M.O.CM.5.2	integrate other disciplines into the study of mathematics through simulations, research, and projects.
M.O.CM.5.3	determine possible outcomes using tree diagrams and the counting principles of permutations and combinations, develop conclusions and offer solutions for new situations, using real-world data.
M.O.CM.5.4	design and conduct probability investigations and then determine, analyze, and communicate the results.
M.O.CM.5.5	collect and interpret data using various methods of displaying numerical data, including frequency distributions, graphs, histograms, stem-and-leaf plots, and box-and-whiskers plots, using technology when appropriate.
M.O.CM.5.6	relate the measures of central tendency and the measures of dispersion to a normal distribution.
M.O.CM.5.7	apply the measures of central tendency and the measures of dispersion to workplace situations.
M.O.CM.5.8	use statistical tools for workplace applications such as quality control, marketing and predicting trends.

Algebra III Content Standards and Objectives

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

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

Performance Descriptors (M.PD.A3.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Algebra III students at the distinguished level: research practical solutions to choose appropriate representations from the families of functions using characteristics of the functions; demonstrate, relate, and assess connections between functions and their inverses, justify restricting the domain to guarantee an inverse, and apply transformations, compositions, and operations;	Algebra III students at the above mastery level: analyze practical solutions to compare and apply multiple representations of families of functions using characteristics of the functions; recognize, demonstrate, and relate connections between functions and their inverses, appropriately restrict the domain to guarantee an inverse and apply transformations, compositions, and	Algebra III students at the mastery level: compare and apply multiple representations of families of functions using characteristics of the functions; recognize and demonstrate connections between functions and their inverses and apply transformations, compositions and operations;	Algebra III students at the partial mastery level: explore multiple representations of families of functions using characteristics of the function; recognize connections between functions and their inverses by performing transformations, compositions, and operations;	Algebra III students at the novice level: recognize multiple representations of families of functions using basic characteristics of the functions; recognize inverse functions and perform compositions and arithmetic operations;

	operations;			
use properties of analytic geometry to apply elements of equations, interpret rates of change, convert between forms of equations, develop and justify the use of the distance and midpoint formulas;	use properties of analytic geometry to determine equations, interpret rates of change, convert between forms of equations, and develop the distance and midpoint formulas;	use properties of analytic geometry to determine equations, their components and relationships and apply the distance and midpoint formulas;	use properties from analytic geometry to determine slope, equations of circles, and apply the distance and midpoint formulas;	recognize slope of a line, equations of circles, and calculate distance and midpoint using formulas;
collaborate to choose a real world problem that can be modeled using algebraic and graphical techniques, predict, justify, and explain the model, and screen for extraneous solutions explaining their existence.	create models of real world problems using algebraic and graphical techniques, screen for extraneous solutions, and explain their existence.	model real world problems using algebraic and graphical techniques and screen for extraneous solutions.	solve real world problems using algebraic and graphing techniques and recognize extraneous solutions.	confirm solutions of real world problems using algebraic and graphical techniques and recognize extraneous roots.

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 in circular functions; graph and evaluate them and their inverse functions; solve trigonometric equations and apply them to real-world problems; convert from degrees to radians (and vice versa) and test hypothesis or hypotheses to derive formulas to find applications of radian measure;	Trigonometry students at the above mastery level: define and relate the six trigonometric functions in right triangles and in circular functions; graph and evaluate them and their inverse functions; solve trigonometric equations and apply them to real-world problems; convert from degrees to radians (and vice versa) and test hypothesis to derive formulas to find applications of radian measure;	Trigonometry students at the mastery level: define and relate the six trigonometric functions in right triangles and in circular functions; graph and evaluate them and their inverse functions; solve trigonometric equations and apply them to real-world problems; convert from degrees to radians (and vice versa) and develop formulas to find applications of radian measure;	Trigonometry students at the partial mastery level: define and relate the six trigonometric functions in right triangles and in circular functions; graph and evaluate them and their inverse functions; solve trigonometric equations; convert from degrees to radians and develop formulas to find applications of radian measure;	Trigonometry students at the novice level: recognize the six trigonometric functions in right triangles and in circular functions, recognize the graphs and evaluate the functions and their inverses; solve trigonometric equations; recognize radians and formulas to convert from degrees to radians and recognize formulas to find applications of radian measure;

determine the appropriate use for the Law of Sines and the Law of Cosines; apply to real-world situations; solve triangles and figures of multiple shapes;	determine the appropriate use for the Law of Sines and the Law of Cosines and solve triangles and figures of multiple shapes;	determine the appropriate use for the Law of Sines and the Law of Cosines and solve triangles;	use for the Law of Sines and the Law of Cosines and solve triangles;	recognize the Law of Sines and the Law of Cosines and find the area of triangles;
perform graphical and algebraic addition of vectors; convert complex numbers to polar form and graph in the polar coordinate plane and compare the graph to real world situations; identify three-dimensional vectors and use graphs, tables and equations to model periodic data sets and to analyze real world problems;	perform graphical and algebraic addition of vectors; convert complex numbers to polar form and graph in the polar coordinate plane; compare the graph to real-world situations;	perform graphical and algebraic addition of vectors; convert complex numbers to polar form and graph in the polar coordinate plane;	perform graphical and algebraic addition of vectors; convert complex numbers to polar form and identify graphs in the polar coordinate plane;	recognize graphical and algebraic addition of vectors; recognize the conversion of complex numbers to polar form and identify graphs in the polar coordinate plane;
verify the basic identities and use them to verify and evaluate other identities.	verify the basic identities and use them to verify and evaluate other identities.	verify the basic identities and use them to verify other identities.	identify the basic identities and use them to verify other identities.	recognize the formulas for the basic identities.

Objectives	**Students will**
M.O.T.3.1	apply the right triangle definition of the six trigonometric functions of an angle to determine the values of the function values of an angle in standard position given a point on the terminal side of the angle. • determine the value of the other trigonometric functions given the value of one of the trigonometric functions and verify these values with technology. • using geometric principles and the Pythagorean Theorem, determine the six function values for the special angles and the quadrantal angles and use them in real-world problems. • compare circular functions and the trigonometric function values to draw inferences about coterminal angles and co-functions.
M.O.T.3.2	convert angle measures from degrees to radians (and vice versa) and apply this concept to • create a data set, analyze, and formulate a hypotheses to test and develop formulas for the arclength, area of a sector, and angular velocity and use the formula for application in the real-world. • compare and contrast the concepts of angular velocity and linear velocity and demonstrate by graphical or algebraic means

	relationship between them and apply to real-world problems.
M.O.T.3.3	using various methods, basic identities and graphical representation • verify trigonometric identities • prove the sum and difference to two angles, double-angles, and half-angle identities
M.O.T.3.4	justify and present the solutions of trigonometric equations that include both infinite and finite (over a restricted domain) solutions.
M.O.T.3.5	find the value of the inverse trigonometric functions using special angle trigonometric function values and technology. • draw inferences of restricted domain to recognize and produce a graph of the inverse trigonometric functions. • prove conjectures made about the solution of the equations such as x = sin (arcsin y), x = sin (arcos y) being sure to consider restrictions of the domain.
M.O.T.3.6	identify a real life problem utilizing graphs of trigonometric functions and/or the inverse functions; make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize, and analyze data; generalize the results to make a conclusion; compare the hypothesis and the conclusion; present the project using words, graphs, drawings, models, or tables.
M.O.T.3.7	model periodic data sets using graphs, tables, and equations and use them to analyze real-world problems such as electricity and harmonic motion.
M.O.T.3.8	investigate real-world problems within a project based investigation involving triangles using the trigonometric functions, the law of sines and the law of cosines, justify and present results.
M.O.T.3.9	develop and test a hypothesis to find the area of a triangle given the measures of two sides and the included angle or the measures of three sides (Heron's formula) and use these formulas to find total area of figures constructed of multiple shapes.
M.O.T.3.10	express complex numbers in polar form: • perform operations including adding, subtracting, multiplying, and dividing; • evaluate powers and roots of complex numbers using De Moivre's Theorem; and graph complex numbers. • graph complex numbers in the polar coordinate plane and make conjectures about some polar graphs and real-world situations such as the paths that the planets travel.
M.O.T.3.11	create graphical and algebraic representations for performing vector operations and analyze these to solve real-world problems such as force analysis and navigation.

Probability and Statistics Content Standards and Objectives

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

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

Performance Descriptors (M.PD.PS.3)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Probability and Statistics students at the distinguished level: distinguish between, justify and investigate types of probability using multiple counting principles and distributions; use proper sampling techniques to compare and contrast more than one set of data that they collect, summarize, and interpret numerically and graphically in both one-variable and two-variable	Probability and Statistics students at the above mastery level: distinguish between, justify and investigate types of probability using multiple counting principles and distributions; use proper sampling techniques to collect, summarize, and interpret data numerically and graphically in both one-variable and two-variable situations;	Probability and Statistics students at the mastery level: distinguish between types of probability using multiple counting principles and distributions; use proper sampling techniques to collect, summarize, and interpret data numerically and graphically in both one-variable and two-variable situations;	Probability and Statistics students at the partial mastery level: calculate probabilities given the type using multiple counting principles and distributions; use proper sampling techniques to collect and summarize data numerically and graphically in both one-variable and two-variable situations;	Probability and Statistics students at the novice level: recognize the types of probability using multiple counting principles and distributions; collect and summarize data numerically and graphically in both one-variable and two-variable situation;

situations; test the validity of a hypothesis in real-world situations by determining the appropriate inference technique to make a conclusion about the population of interest	test the validity of a hypothesis in real-world situations by determining the appropriate inference technique to make a conclusion about the population of interest	test the validity of a hypothesis in real-world situations by determining the appropriate inference technique to make a conclusion about the population of interest.	test the validity of a hypothesis in real-world situations using the provided inference technique to make a conclusion about the population of interest.	identify a hypothesis in real-world situations to recognize that an inference technique needs to be used in order to make a conclusion about the population of interest.

Objectives	**Students will**
M.O.PS.5.1	distinguish between experimental and theoretical probability.
M.O.PS.5.2	using a real-world problem solving investigation, create and interpret data using various methods of displaying circle graphs, histograms, and frequency curves, make predictions, include information concerning outliers, present and justify results.
M.O.PS.5.3	determine possible outcomes using tree diagrams and the counting principles of permutations and combinations.
M.O.PS.5.4	express the chances of events occurring either in terms of a probability or odds.
M.O.PS.5.5	use the normal distribution and the binomial distribution including Pascal's triangle, to determine probability of events.
M.O.PS.5.6	analyze measures of central tendency (mean, median, and mode) from data presented in a variety of forms such as charts, tables, and graphs or from data created through experimentation.
M.O.PS.5.7	interpret and calculate measures of dispersions (range and standard deviation) from data presented in a variety of forms such as charts, tables and graphs or from data created through experimentation.
M.O.PS.5.8	analyze individual performances in terms of percentiles, z-scores, and t- scores.
M.O.PS.5.9	analyze the role of sampling, randomness, bias, and sample size in data collection and interpretation.
M.O.PS.5.10	identify a real life situation that involves statistical concepts including a t-test, make a hypothesis as to the outcome; develop, justify, and implement a method to collect, organize and analyze data; generalize the results to make a conclusion, compare the hypothesis and the conclusion; present the project using predictive and analytic tools (with and without technology).
M.O.PS.5.11	determine the correlation values for given data or for data generated by students and use the results to describe the association of the variables within the given data. Identify whether this association is systematic or predictable.
M.O.PS.5.12	calculate the Chi-Square values for a given population.
M.O.PS.5.13	perform a regression analysis on a set of data, either given or created through experimentation, and use the results to predict specific values of a variable. Identify the regression equation.
M.O.PS.5.14	perform an analysis of variance (ANOVA) and interpret the results.

Pre-Calculus Content Standards and Objectives

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

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

Performance Descriptors (M.PD.PC.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Pre-Calculus students at the distinguished level: investigate and formulate a solution to a real-world problem involving higher-order polynomials, exponential and logarithmic equations; solve application problems involving sequences and series, and formulate a hypothesis for evaluating limits; consider and justify using induction to prove formulas and statements; differentiate between	Pre-Calculus students at the above mastery level: hypothesize and develop a plan to solve higher-order polynomials, exponential and logarithmic equations; solve application problems involving sequences and series and evaluate limits; devise a method for proving formulas and statements; expand binomials by	Pre-Calculus students at the mastery level: determine the reasonableness of the solutions of higher-order polynomials, exponential and logarithmic equations; evaluate sequences and series to find or estimate a limit; differentiate the process of proving formulas and statements; expand binomials by	Pre-Calculus students at the partial mastery level: examine the solutions of higher-order polynomials, exponential and logarithmic equations; differentiate sequences and series, and find or estimate a limit; find formulas and statements by applying induction; identify the various	Pre-Calculus students at the novice level: confirm the solutions of higher-order polynomials, exponential and logarithmic equations; recognize sequences and series, and find or estimate a limit; recognize induction as a process to prove statements and formulas; recognize the methods for

appropriate methods to expand binomials in relation to real-world problems; compare and contrast various graphs formulating a set of rules that produce and support a solution to a real-world problem; design and execute a method to solve a real-world problem involving vectors.	applying appropriate methods and relate the expansion to real-world situations; identify and justify their solutions to real-world problems which require various graphs; recognize the application of vectors to practical problems and perform operations on vectors to solve them.	applying appropriate methods; interpret the techniques of curve sketching to graph functions of real-world situations; analyze and perform operations on vectors to solve practical problems.	methods for expanding binomials; graph various functions; perform operations on vectors to solve practical problems.	expanding binomials; identify the graphs of various functions; perform operations on 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, determine and explain the justification for the solutions to real-world problems involving conic sections and their transformations.	Pre-Calculus students at the above mastery level: analyze, interpret, and graph the conic sections along with their transformations, and apply to real-world situations.	Pre-Calculus students at the mastery level: analyze, interpret, and graph conic sections and their transformations.	Pre-Calculus students at the partial mastery level: graph conic sections and their transformations.	Pre-Calculus students at the novice level: identify the graphs of conic sections and their transformations.

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

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: relate and defend a solution to a developed	Pre-Calculus students at the above mastery level: summarize the analysis of developed regression	Pre-Calculus students at the mastery level: investigate, hypothesize, and develop a regression	Pre-Calculus students at the partial mastery level: investigate and hypothesize regarding a	Pre-Calculus students at the novice level: investigate and select a regression equation.

real-world situation that involves use of regression equations.	equations.	equation.	regression equation.	

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

Calculus Content Standards and Objectives

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

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

Performance Descriptors (M.PD.C.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Calculus students at the distinguished level: closely connect all representations of a function; recognize real life situations that involve limits and interpret these limits using multiple representations and evaluate them using appropriate limit properties; relate the Intermediate Value Theorem, continuity, and root finding;	Calculus students at the above mastery level: explain connections among algebraic notation, graphical analysis and tabular data; explain limits using multiple representations and evaluate limits using appropriate limit properties; determine if a function is continuous at a point over an interval;	Calculus students at the mastery level: manipulate algebraic notation to study functions and relate the results to graphs and tables; determine limits algebraically, graphically and numerically, using appropriate limit properties; decide about continuity at a point and over an interval;	Calculus students at the partial mastery level: use algebraic notation for functions and confirm results using graphs; determine limits graphically or numerically and evaluate limits using limit properties; determine if a function is continuous at a point numerically and graphically;	Calculus students at the novice level: recognize functions expressed algebraically and graphically and use functional notation correctly; given a graph or table, recognize a limit and evaluate limits using limit properties; determine graphically if a function is continuous at a point;

apply the various forms of the definition of the derivative of a function at a point; interpreted as the slope of the tangent line to the graph of the function at any x, and as the instantaneous rate of change. They recognize the tangent line slope as a limit of the converging secant line slopes, and apply the limit definition to find a general form for f'(x);	apply the definition of the derivative of a function at a point; interpret this as the slope of the tangent line and as the instantaneous rate of change. They recognize the tangent line slope as a limit of the converging secant line slopes and apply the limit definition to find a general form for f'(x);	interpret the derivative of a function as the slope of the tangent line to the graph of the function at any x, or as the instantaneous rate of change. They apply the limit definition to find the derivative at a point;	apply the definition of the derivative of a function at a point to find the slope of the tangent line to the graph of the function, interpreting the derivative as an instantaneous rate of change;	construct the tangent line to a curve at a given point and use derivatives to aid in graphing functions;
compare the average rate of change and the instantaneous rate of change in real-world applications. They prove that differentiability implies continuity and give examples of continuous functions that are not differentiable. They combine and apply the rules of differentiation to various types of functions as appropriate. They use Rolle's Theorem to derive the Mean Value Theorem;	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 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;	investigate the average rate of change and instantaneous rate of change in real-world applications. They relate differentiability and continuity and combine and apply the algebraic rules of differentiation and theoretical results;	investigate the average rate of change and instantaneous rate of change graphically. They recognize that differentiable functions are also continuous. They apply the rules of differentiation to various types of functions;	calculate the average rate of change and the instantaneous rate of change;
use mathematical models to solve applied problems;	construct and apply mathematical models to solve applied problems;	construct and apply mathematical models to solve applied problems;	solve applied problems about motion, area, and volume;	solve simple optimization problems;
efficiently calculate indefinite or definite	find definite and indefinite integrals that may involve	calculate definite and indefinite integrals for	calculate definite and indefinite integrals for	calculate definite and indefinite integrals for

integrals. They calculate a definite integral of a polynomial function using an infinite limit of a Riemann sum and apply the Fundamental Theorem of Calculus.	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.	integrable elementary functions. They calculate definite integrals using both Riemann sums and the Fundamental Theorem of Calculus.	integrable elementary functions. They apply the Fundamental Theorem of Calculus to evaluate a definite integral.	polynomials. They apply the Fundamental Theorem of Calculus to evaluate a definite integral.

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	$\lim_{x\to 0}\frac{1-\cos x}{x}=0$ 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 $\lim_{x\to 0}\left(\frac{\sin x}{x}\right)=1$
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 to categorize discontinuities of functions presented algebraically and graphically; use asymptotes to explain end behavior of functions, and describe asymptotic behavior using multiple representations, develop tangent lines as best linear approximations to functions near specific points and apply this concept to Newton's Method; investigate and explain the relationships among the graphs of a function and its	Calculus students at the above mastery level: recognize continuous and discontinuous functions using limits; use limits to find and justify the existence of asymptotes of functions, develop tangent lines as best linear approximations to functions near specific points, construct these tangent lines and apply this concept to Newton's Method; investigate and explain the relationships among the graph of a function and its	Calculus students at the mastery level: recognize continuous and discontinuous functions graphically; apply limits to recognize asymptotes, use tangent lines to locally approximate functions, and apply Newton's Method to approximate zeroes of functions; extract information about the graph of a function from its derivative and limiting	Calculus students at the partial mastery level: distinguish between continuous and discontinuous functions graphically; apply limits to find asymptotes, use a tangent line to approximate a function at a point and can apply Newton's Method to approximate zeroes of functions; use derivatives to aid in graphing functions;	Calculus students at the novice level: identify a discontinuous function graphically; given a graph, identify the location of asymptotes; use information from derivatives to aid in graphing functions;

derivatives; anticipate whether the left, right, or midpoint rule will yield the best approximation to a definite integral using a Riemann Sum with a finite number of sub-intervals. They propose better methods for approximating the actual area.	derivatives; approximate the area under a curve using a Riemann sum implementing left, right, or midpoint rules, and determine whether the left hand and right hand approximations over-estimate or under-estimate the actual area.	values; approximate the area under a curve via a Riemann sum using left, right, or midpoint rules.	approximate the area under a curve by constructing a Riemann sum implementing left, right, or midpoint rules.	approximate the area under a curve by applying a finite Riemann sum implementing left, right, or midpoint rules, given the subdivision.

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

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

Performance Descriptors (M.PD.C.5)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Calculus students at the distinguished level: apportion individual tasks in small groups to identify a real life situation that involves modeling change;	Calculus students at the above mastery level: in small groups, identify a real life situation that involves modeling change; pose a question; make a	Calculus students at the mastery level: working in small groups, identify a real life situation that involves modeling change; pose a question;	Calculus students at the partial mastery level: working in teacher facilitated groups, solve a real life problem using given data that involves	Calculus students at the novice level: working in teacher facilitated groups, solve a real life problem using provided data that involves

pose a question; make a hypothesis as to the answer; develop, justify, and implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make predictions to test their model; compare the hypothesis and the conclusion. They present the project numerically, analytically, graphically and verbally.	hypothesis as to the answer; implement a method to collect, organize, and analyze related data; extend the nature of collected, discrete data to that of a continuous function that describes the known data set; generalize the results to make predictions to test their model; compare the hypothesis and the conclusion. They collaborate using concepts from calculus to present the project numerically, analytically, graphically and verbally.	implement a method to collect, organize, and analyze related data; find a continuous function that describes the known data set; make predictions to test their model. They collaborate using concepts from calculus to present the project numerically, analytically, graphically and verbally.	modeling change. They organize and analyze the data; find a continuous function that describes the known data set. They collaborate using concepts from calculus to present the projects numerically, analytically, graphically and verbally.	modeling change. They extend collected, discrete data to values of a continuous function that describes the known data set. They present the projects numerically, analytically, graphically and verbally.

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

126CSR44B

POLICY 2520.2: Next Generation Content Standards and Objectives for Mathematics in West Virginia Schools

COMMENT PERIOD ENDS:

COMMENT RESPONSE FORM

The following form is provided to assist those who choose to comment on Policy 2520.2: Next Generation Content Standards and Objective for Mathematics in 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	□ School System Staff	□ Parent/Family
□ Principal	□ Teacher	□ Business/Industry
□ Professional Support Staff	□ Service Personnel	□ Community Member

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

§126-44B-3. Incorporation by Reference.
§126-44B-4. Summary of the Content Standards and Objectives.

Please direct all comments to:

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