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OFFICE WEST VIRGINIA SECRETARY OF STATE

NOTICE OF A COMMENT PERIOD ON A PROPOSED RULE

AGENCY: West Virginia Board of Education TITLE NUMBER: 126

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

AMENDMENT TO AN EXISTING RULE: YES X NO ____

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

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

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

TITLE OF RULE BEING PROPOSED: _____

IN LIEU OF A PUBLIC HEARING, A COMMENT PERIOD HAS BEEN ESTABLISHED DURING WHICH ANY INTERESTED PERSON MAY SEND COMMENTS CONCERNING THESE PROPOSED RULES. THIS COMMENT PERIOD WILL END ON September 2, 2006 AT 4:45 p.m. . ONLY WRITTEN COMMENTS WILL BE ACCEPTED AND ARE TO BE MAILED TO THE FOLLOWING ADDRESS:

Keith Butcher, Executive Director
Office of Federal Progams and Accountability
West Virginia Department of Education
Capitol Building 6, Room 330
1900 Kanawha Boulevard, East
Charleston, West Virginia 25305-0330

COMMENTS TO BE CONSIDERED ARE LIMITED TO THIS PROPOSED RULE.

Jack McClanahan
Deputy State Superintendent of Schools

ATTACH A **BRIEF** SUMMARY OF YOUR PROPOSAL

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

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

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

- The original effective date of Policy 2520 (Instructional Goals and Objectives for West Virginia Schools) was July 1997.
- The West Virginia Board of Education approved initial work on Mathematics content standards in December 2001. The revision placed on comment in November 2002 created a separate policy for each content area, expanded the number of performance levels from 3 to 5, and made minor editorial changes.
- Policy 2520.2 was filed February 25, 2003 and became effective July 1, 2003.

Major Revisions or Reasons for New Policy: A repeal and replace of Policy 2520.2 is being recommended due to the format changes. A crosswalk from the 2003 mathematics standards and this revision has been provided.

- The format of the science CSOs has been redesigned to facilitate easier use by West Virginia educators.
- The science CSOs have been revised to
    - incorporate higher levels of critical thinking skills and problem solving skills,
    - establish an improved alignment with national assessments (NAEP, ACT, and SAT), and
    - incorporate 21st century knowledge and skills that West Virginia students will need to be successful in the global world of the 21st century.

Impact:

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

TITLE 126
LEGISLATIVE RULE
BOARD OF EDUCATION

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

§126-44B-1. General.

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

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

1.3. Filing Date. -.

1.4. Effective Date. -.

1.5. Repeal of former rule. - This legislative rule repeals and replaces W. Va. 126CSR44B "Mathematics Content Standards and Objectives for West Virginia Schools (2520.2)" filed February 25, 2003 and effective July 1, 2003.

§126-44B-2. Purpose.

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

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

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

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

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

West Virginia Department of Education

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

Steven L. Paine
State Superintendent of Schools

Foreword

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

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

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

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

Steven L. Paine
State Superintendent of Schools

Explanation of Terms

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Abbreviations

Content Area

M	Mathematics

High School Courses

Mathematics

A1	Algebra
A2	Algebra II
AGP	Algebra/Geometry Preparation
AM1	Applied Mathematics I
AM2	Applied Mathematics II
CM	Conceptual Mathematics
G	Geometry and Applied Geometry
PC	Pre-calculus
PS	Probability and Statistics
T	Trigonometry

Other Abbreviations

O	Objective
PD	Performance Descriptors
S	Standard (Content Standard)

MATHEMATICS – POLICY 2520.2

Mathematics standards have been written in response to the need to better prepare students for college, other post-secondary education, and gainful employment in the 21st Century. 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. See http://www.nctm.org to access the NCTM document. The curriculum is designed to be ambitious and rigorous at all grade levels. This rigor is required to achieve a society that has the capability to think and reason mathematically.

The standards describe what each student of mathematics should be able to accomplish in K-12. The objectives spiral upward through the grade levels, eliminating repetition of content and increasing in rigor throughout the student's academic career. It is important that all students value mathematics, become confident in their ability to do mathematics, become mathematical problem solvers, communicate mathematically, make connections to other content areas and to the real world application of mathematics, and learn to reason mathematically.

West Virginia's vision for education includes the integration of technology throughout the curriculum so that all West Virginia students have the opportunity to develop technology skills that support learning. Successful learning environments provide opportunities for students to use technology interwoven with relevant curricular content. West Virginia teachers are responsible for integrating technology appropriately in the students' learning environment.

The content and character of school mathematics provide a vision to guide educators as they strive for continual improvement of mathematics education. The following six principles for school mathematics are the major influences on the improvement of classrooms, schools and educational systems.

1. Equity: High expectations and strong support for all students.
2. Curriculum: Coherent, focused on important mathematics, and 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 furnish 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 five major content standards have defined objectives that explain what the student should know. The objectives move from the literal level of identifying and recognizing information to the more complex skills of analyzing and evaluation. The abbreviation e.g. indicates examples for teaching the objectives. Furthermore the teacher is strongly encouraged to review the objectives of the previous grade level to serve as a starting point for review and maintenance in the spiraling curriculum.

Mathematics Content Standards K-12

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

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

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

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

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

Kindergarten Mathematics Content Standards and Objectives

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

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

Performance Descriptors (M.PD.K.1)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
The student counts forward to 100 with and without objects. The student reads, writes, orders, and compares numbers to 100. The student estimates numbers of objects to 100 and can model and identify place value through 99 using standard and expanded form. The student models and writes addition and subtraction sentences using whole numbers to 18 and solves two step problems using pictures, numbers and words.	The student counts forward to 50 and backward from 20 with and without objects. The student reads, writes, orders, and compares numbers to 50. The student estimates numbers of objects to 50. The student groups objects to 50 and can identify place value though 50. The student models and identifies place value using standard and expanded form through 50. The student models and writes addition and subtraction sentences using	The student counts forward to 20 and backward from 10 with and without objects. The student reads writes, orders, and compares, numbers to 20. The student estimates numbers of objects to 20. The student identifies halves and wholes, and ordinal positions to 10^{th}. The student groups objects by ones, fives and tens. The student models and identifies place value using standard and expanded form through 20 and models	The student counts forward to 20 and backward from 10. The student reads, writes, and orders numbers to 20. The student estimates objects to 10. The student recognizes halves and wholes and ordinal positions to 5^{th}.The student groups objects by ones and tens and identifies place value using standard form through 20. The student identifies operations and the relationship between addition and subtraction of numbers to 10. The student	The student counts objects to 10. The student matches halves and wholes and recognizes ordinal numbers to 5^{th}. The student copies place values of numbers using standard form. The student models addition and subtraction sentences using numbers to 10. The student solves one step problems using pictures.

	whole numbers to 15 and solves two step problems using pictures.	meanings of operations and relationships between addition and subtraction of numbers to 10. The student models and writes addition and subtraction sentences using whole numbers to 10. The student solves one step problems using pictures, numbers or words.	models addition and subtraction sentences using whole numbers to 10. The student solves one-step problems using numbers and pictures.	

M.O.K.1.1	count forward to 20 and backward from 10 with and without objects.
M.O.K.1.2	read, write, order, and compare numbers to 20.
M.O.K.1.3	group and count concrete items by ones, fives, and tens.
M.O.K.1.4	model and identify place value of each digit utilizing standard and expanded form through 20.
M.O.K.1.5	identify ordinal positions $1^{st} - 10^{th}$ and directionality.
M.O.K.1.6	estimate the number of objects in a group of 20 or less and count to determine reasonableness.
M.O.K.1.7	identify and name halves and wholes using concrete items.
M.O.K.1.8	model addition and subtraction of whole numbers using 10 or less items and write the corresponding number sentence.
M.O.K.1.9	model meanings of operations and the relationship between addition and subtraction (e.g., identity element of addition, commutative property).
M.O.K.1.10	solve grade level appropriate problems using a variety of strategies.

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

Performance Descriptors (M.PD.K.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
The student sorts and classifies by any attribute and models and identifies multiple patterns of	The student sorts and classifies by more than one attribute and models and identifies patterns of	The student sorts and classifies objects by one attribute and models and identifies patterns of	The student sorts objects by one attribute and models patterns of counting by 5's. The student identifies and	The student sorts objects and identifies patterns of counting by 10's. The student identifies a

counting. The student creates repeating patterns.	counting by 2's, 5's and 10's.The student analyzes repeating patterns.	counting by 5's and 10's.The student identifies, describes, and extends a repeating pattern.	describes a repeating pattern.	repeating pattern.

M.O.K.2.1	sort and classify objects by one attribute.
M.O.K.2.2	identify, describe, and extend a repeating pattern found in common objects, sound, and movement.
M.O.K.2.3	model and identify patterns of counting by 5's and 10's.

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

Performance Descriptors (M.PD.K.3)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
The student creates pictures using the basic geometric plane shapes, determines the number of shapes used and writes about the picture using numbers and/or words.	The student compares the basic geometric plane shapes and models and writes about spatial relationships. The student describes the separate parts used to make a whole object.	The student constructs, identifies and classifies basic geometric plane shapes and recognizes those shapes in the environment. The student models and describes spatial relationships and identifies the separate parts used to make a whole object.	The student identifies and classifies basic geometric plane shapes and recognizes shapes in the environment. The student identifies spatial relationships.	The student names basic geometric plane shapes. The student examines spatial relationships.

M.O.K.3.1	use physical materials to construct, identify, and classify basic geometric plane shapes: circle, square, rectangle, triangle, and oval.
M.O.K.3.2	recognize basic geometric shapes in the environment.
M.O.K.3.3	model and describe spatial relationships: inside/outside, top/bottom, before/after.
M.O.K.3.4	identify the separate parts used to make a whole object.

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

Performance Descriptors (M.PD.K.4)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
The student compares and orders objects in nonstandard units of measure according to length, height, and weight. The student locates a day of the week on a calendar and identifies what day is next. The student differentiates between the seasons. The student reads time to half hour on an analog and digital clock. The student determines a value of a set of coins, pennies, nickels and dimes, up to 20.	The student compares objects in nonstandard units of measure according to length, height and weight. The student locates a day of the week on a calendar. The student describes a season. The student reads time to the half hour on an analog clock. The student determines the value of a set of coins, pennies, nickels and dimes, up to 15.	The student estimates size, compares and orders objects by size with respect to a given attribute. The student uses standard and nonstandard units of measure to find length and compares two objects in non standard units of measure according to length, height and weight. The student names the days of the week and seasons in order. The student reads time to the hour with analog and digital clocks. The student identifies and models the value of penny, nickel, and dime and determines the value of a set of pennies up to 20.	The student estimates size of an object and identifies objects with respect to an attribute. The student uses standard and nonstandard units of measure to find length and orders objects by length, height and weight. The student names the days of the week and the seasons. The student can read time to the hour on an analog clock. The student identifies the penny, nickel, and dime and determines a value of a set of pennies up to 10.	The student estimates size of an object and orders objects with respect to an attribute. The student uses standard units of measure to find length. The student repeats days of the week and repeats the seasons. The student matches the penny, nickel, and dime and determines a set of pennies up to 5.

M.O.K.4.1	estimate the size of an object and compare and order objects with respect to a given attribute.
M.O.K.4.2	use standard and nonstandard units of measure to find the length of an object.
M.O.K.4.3	compare two objects in nonstandard units of measure, according to one or more of the following attributes: length, height, weight.
M.O.K.4.4	name the days of the week and the seasons of the year.
M.O.K.4.5	read time to the hour using analog and digital clocks.

M.O.K.4.6	identify the name and value of a penny, nickel, and dime.
M.O.K.4.7	determine the value of a collection of pennies with a total value less than twenty cents.

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

Performance Descriptors (M.PD.K.5)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
The student organizes and analyzes data on a graph. The student creates simple probability experiments, records results with tallies and interprets results.	The student collects, sorts, and organizes data into a graph using objects and pictures. The student analyzes the data on a bar graph. The student creates simple probability experiments and uses tallies to record results in a table.	The student collects, sorts and organizes data into a graph using objects and pictures. The student interprets data represented on a bar graph. The student conducts simple probability experiments and uses tallies to record results in a table.	The student collects and sorts data in a graph with objects and pictures. The student describes the data represented on a bar graph. The student conducts simple probability experiments.	The collects and sorts data in a graph using objects. The student counts the data represented on a bar graph. The student labels simple probability experiments.

M.O.K.5.1	collect, sort and organize data into a graph using objects and pictures.
M.O.K.5.2	read data represented on a pictograph and a bar graph.
M.O.K.5.3	conduct a simple probability experiment and use tallies to record results in a table.

First Grade Mathematics Content Standards and Objectives

The 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; knowing 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.

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
The student reads, writes, orders, compares and counts numbers to 1000. The student identifies any number as odd/even. The student models place value to 1000 in standard and expanded form, The student creates and models fractions of a whole and of a set (1/6, 1/8). The student explains and justifies the use of the relationship between addition and subtraction in solving problems. The student uses concrete objects to solve	The student reads, writes, orders and compares numbers to 200. The student identifies any ordinal number. The student models even/odd numbers to 100. The student identifies place value to 1000 in standard form and rounds numbers to the nearer 100. The student creates models for fractions of a whole and of a set (1/2, 1/3, ¼). The student uses the relationship between addition and subtraction to solve problems. The student	The student reads, writes, orders, compares, counts and estimates numbers to 100 and identifies ordinal numbers to 20th. The student models even and odd numbers to 20. The student models and identifies place value to 100 using standard and expanded form and rounds to the nearer 10. The student uses models to represent fractions (halves, thirds, fourths) as part of a set and part of a whole. The student models meanings of	The student reads, writes, and counts numbers to 100 and recognizes ordinal numbers to 10th. The student identifies odd and even numbers to 20, and identifies place value to 100 using standard form. The student identifies fractions (halves, fourths) as part of a whole. The student recognizes the relationship between addition and subtraction of numbers to 18. The student recalls basic addition facts to 10. The student models addition	The student counts to 100 and recites ordinal numbers to 10th. The student identifies odd and even numbers to 10 and reads and writes place value to 20 using standard form. The student identifies halves and wholes. The student identifies operations of addition and subtraction.

addition and subtraction of two digit numbers requiring regrouping.	uses concrete models to solve addition problems of two digit numbers with regrouping,	operations and relationship between addition and subtraction of numbers to 18. The student demonstrates fluency with basic addition and subtraction facts to 10, models and solves 2 digit addition and subtraction without regrouping and addition of 3 numbers with sums less than 18. The student solves one step problems using multiple strategies.	of three numbers with sums of 10 or less.	

M.O.1.1.1	count forward to 100 and backward from 20 with and without objects.
M.O.1.1.2	read, write, order, and compare numbers to 100.
M.O.1.1.3	model and identify odd and even numbers to 20 with and without objects.
M.O.1.1.4	group and count concrete items by ones 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 nearer 10 to better understand place value.
M.O.1.1.7	identify and read ordinal numbers 1^{st} - 20^{th}.
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 and name halves, thirds, and fourths as part of a whole and as part of a group using models.
M.O.1.1.10	model addition and subtraction of whole numbers using 18 or less items and write the corresponding number sentence.
M.O.1.1.11	model meanings of operations and the relationship between addition and subtraction (e.g., identity element of addition, commutative property, fact families, inverse operations).
M.O.1.1.12	demonstrate fluency with basic addition facts with sums to 10 and corresponding subtraction facts.
M.O.1.1.13	model and solve addition of three numbers with a sum of 18 or less.
M.O.1.1.14	model and solve 2-digit addition and subtraction without regrouping.
M.O.1.1.15	solve grade level appropriate picture and story problems using multiple strategies.

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
The student identifies the sorting rule used by another student. The student identifies non-examples of the rule. The student creates and input/output model.	The student provides a sorting rule and evaluates correctness of resulting sorting by another student. The student extends a repeating pattern. The student determines the input when given the rule and function of an input/output model.	The student sorts and classifies objects by more than one attribute. The student analyzes, creates and represents repeating patterns. The student determines the rule given an input/output model using addition or subtraction. The student demonstrates the equivalency of both sides of a number sentence.	The student sorts and classifies objects by one attribute. The student represents repeating patterns. The student supplies the output when given the input and function of an input/output model. The student recognizes the equivalency of both sides of a number sentence.	The student sorts objects by one attribute, creates a repeating pattern and identifies the two sides of a number sentence.

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	analyze and create a repeating pattern using common objects and numbers.
M.O.1.2.3	given an input/output model using addition or subtraction, determine the rule or give the output.
M.O.1.2.4	identify and write number patterns by 2's, 5's, and 10's.
M.O.1.2.5	identify and represent number patterns using words, AB form, and T-charts.
M.O.1.2.6	model to demonstrate that the quantities on both sides of a number sentence are equivalent.

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
The student compares and contrasts three dimensional figures. The student identifies similar shapes.	The student compares and contrasts plane shapes. The student identifies congruent shapes that have been rotated/reflected. The student models spatial relationships. The student constructs and labels a grid.	The student draws and describes plane shapes. The student constructs, identifies and classifies three-dimensional figures. The student identifies and draws open and closed figures and lines of symmetry. The student identifies congruent plane shapes. The student describes spatial relationships. The student finds and names locations on a grid.	The student draws plane shapes. The student identifies and constructs three-dimensional figures. The student identifies open and closed figures and lines of symmetry. The student matches congruent shapes. The student gives an example of a spatial relationship. The student finds locations on a grid.	The student names plane shapes and three dimensional figures. The student identifies parts of a grid (rows, columns, title)

M.O.1.3.1	describe and draw a triangle, square, circle, and rectangle according to number of 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, and cylinder.
M.O.1.3.3	recognize three-dimensional shapes in the environment.
M.O.1.3.4	identify and draw open and closed figures.
M.O.1.3.5	identify and draw a line of symmetry.
M.O.1.3.6	identify and draw plane shapes that are congruent.
M.O.1.3.7	describe spatial relationships: over/under, left/right.
M.O.1.3.8	find and name locations on a one-quadrant grid.
M.O.1.3.9	describe the shape created by combining two or more two-dimensional shapes.

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
The student measures length to the nearest half unit. The student estimates height and weight and checks for accuracy. The student determines past and future dates on a calendar. The student counts and models amounts of money to $1.00.	The student uses a ruler to draw given lengths in inches and centimeters. The student measures and orders 3 or more objects according to weight or height. The student reads time to the quarter hour and calculates elapsed time to the half hour. The student identifies specific landmark dates on the calendar. The student counts and trades pennies, nickels, dimes and quarters to 100 cents and makes change to a quarter.	The student estimates, measures, compares and orders length using customary and nonstandard units to the nearest whole unit. The student models and compares measurements of height, weight, temperature and volume. The student reads time to the half hour, and calculates elapsed time to the hour. The student names months and finds dates on a calendar. The student identifies and models the values of quarter and dollar. The student counts and trades pennies, nickels and dimes to 100 cents and makes change to a dime. The student selects appropriate measurement tools .	The student compares and orders length using customary and nonstandard units, compares measurements of height and weight. The student reads time to the hour and names the months of the year. The student identifies and models the value of a quarter.	The student measures length in both nonstandard and customary units, and measures height and width with nonstandard units. The student recognizes the names of the months. The student identifies and models the value of pennies, nickels and dimes.

M.O.1.4.1	estimate, measure, compare and order using customary, metric, and nonstandard units to determine length to nearest whole unit.
M.O.1.4.2	model and compare two objects or events according to one or more of the following attributes: length, height, weight, temperature and volume, choosing the appropriate unit of measure.
M.O.1.4.3	name the months of the year and find a date on a monthly calendar.
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	calculate elapsed time to the hour.
M.O.1.4.7	identify and model the value of quarter and dollar.
M.O.1.4.8	count and trade a collection of pennies, nickels, and dimes with a total value of 100 cents or less.
M.O.1.4.9	role-play making change up to a dime.
M.O.1.4.10	select the appropriate tools of measurement to determine length, weight, volume and temperature.

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
The student creates graphs, tables and charts. The student conducts probability experiments with more than two outcomes. The student designs and conducts surveys to gather data.	The student creates pictographs. The student designs simple probability experiments. The student formulates questions to analyze data.	The student reads and interprets pictographs, charts, bar graphs and tables. The student conducts simple probability experiments to discuss and predict events as likely/unlikely. Students tally by ones, organize, graph and analyze the data.	The student sorts and organizes data. The student reads bar graphs. The student predicts events as likely/unlikely in simple probability experiments. The student tallies by ones, organizes and graphs the resulting data.	The student collects data. The student reads pictographs. The student summarizes results of simple probability experiments. The student tallies by ones.

M.O.1.5.1	collect, sort and organize data into a bar graph.
M.O.1.5.2	interpret a pictograph with each picture representing a single unit.
M.O.1.5.3	conduct simple experiments and use the data to predict which of the events is more likely or less likely to occur if the experiment is repeated.
M.O.1.5.4	read and interpret a tally chart/table.

Second Grade Mathematics Content Standards and Objectives

The second grade objectives help a student to become a more independent problem solver through concrete and technology related experiences which explore new problem solving strategies, everyday use of mathematical language, and reasonableness and interrelationships of mathematics. These concepts include: place value through thousands, estimation, introduction of properties of mathematics, and measurement that includes 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.

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
The student orders and compares numbers above 1000, using concrete models, and expresses them in expanded form. The student adds and subtracts three digit numbers with regrouping. The student solves problems requiring repeated addition and repeated subtraction. The student compares and contrasts common fractions.	The student reads and writes numbers above 1000 and expresses them in standard form. The student rounds four digit numbers to nearer 1000, 100, and 10. The student adds and subtracts two digit numbers with regrouping. The student explains the use of relationships between addition and subtraction to solve problems and the use of multiple strategies. The student creates representations of fractions of a whole/set.	The student orders and compares numbers to 1000 using concrete models, and represents them in standard and expanded form. The student demonstrates fluency with addition facts to 18 and corresponding subtraction facts. The student identifies ordinal numbers and identifies any number as odd/even. The student rounds three digit numbers to nearer 100 and 10 to analyze reasonableness of sums and differences. The student uses models to add and subtract three digit numbers with regrouping. The student utilizes the relationship between addition and subtraction utilizing properties and fact families. Using multiple strategies the student solves problems that require two step solutions involving whole numbers. The student uses concrete models to represent fractions as part of a whole and set/group.	The student reads and writes numbers to 1000, and expresses them in standard form. The student is developing fluency with addition facts to 18. The student identifies ordinal numbers to 20thth and recognizes odd/even numbers to 20. The student rounds any 2 digit numbers to the nearer 10. The student adds and subtracts 3 digit numbers without regrouping. The student identifies the relationship between addition and subtraction. The student names and identifies fractions (1/2,1/4,1/3) as part of a whole and part of a set. The student solves problems with whole numbers.	The student reads numbers to 1000. The student models and solves problems involving addition and corresponding subtractions facts to 18. The student rounds numbers less than 50 to the nearer 10. The student adds and subtracts 2 digit numbers without regrouping. The student identifies like models of fractions. The student solves problems using concrete models.

M.O.2.1.1	read, write, order, and compare numbers to 1,000.
M.O.2.1.2	identify any number as odd or even.
M.O.2.1.3	count and group concrete items by 1's, 10's, and 100's 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.
M.O.2.1.6	round any 3-digit number to both the nearer 10 and 100.
M.O.2.1.7	identify and name 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	memorize 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.
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	solve story problems that require one or two-step procedures.

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
The student creates a pattern to represent a given rule. The student represents a variable using a symbol.	The student writes the rule represented in a pattern. The student writes equivalent numerical expressions.	The student analyzes, describes, extends and creates growing patterns. The student models and identifies patterns of counting. Given the rule, the student completes the pattern. Given an input/output model, using addition or subtraction, determine the rule, output or input. The student demonstrates equivalency of two numerical expressions.	The student extends and creates growing patterns. The student models a pattern of counting and completes patterns. The student determines the rule, given an input/output model using addition and subtraction. The student demonstrates equivalency of both sides of a numerical expression.	The student identifies growing and counting patterns. The student completes a growing pattern. The student recognizes the purpose of an input/output model and identifies the operation being used. The student recognizes the equivalency of both sides of a number sentence.

M.O.2.2.1	analyze, describe, extend and create a growing pattern.
M.O.2.2.2	given an input/output model determine the rule, input or output.
M.O.2.2.3	model and identify a variety of counting patterns.
M.O.2.2.4	given the rule, complete the pattern.
M.O.2.2.5	use models to demonstrate equivalency of two numerical expressions written as a number sentence.

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
The student describes and classifies three dimensional solids according to number of edges and vertices. The student draws right angles. The student plots a path between locations on a grid.	The student describes and classifies three dimensional solids according to the number of faces. The student creates mirror images. The student identifies right angles. The student follows a path between locations on a grid.	The student describes three dimensional solids and compares and contrasts them with plane figures. Given a design, the student draws the mirror image. The student models line segments and angles. The student identifies and draws similar shapes. The student identifies congruent shapes that have been rotated and/or reflected. The student plots locations on a grid.	The student describes three dimensional solids. The student identifies mirror images. The student identifies line segments and angles. The student identifies similar and congruent shapes. The student finds a location on a grid.	The student identifies three dimensional solids. The student names locations on a grid.

M.O.2.3.1	identify and describe a cube, rectangular solid, cylinder, cone, and pyramid according to the number of faces and edges.
M.O.2.3.2	compare and contrast plane and solid geometric shapes.

M.O.2.3.3	given a design, draw the mirror image.
M.O.2.3.4	model line segments and angles.
M.O.2.3.5	identify the congruent shape that has been rotated and/or reflected.
M.O.2.3.6	plot a path between locations on a grid.
M.O.2.3.7	identify similar shapes.

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
The student estimates units of length and measures to determine accuracy. The student estimates the perimeter of a polygon and measures to determine accuracy. The student reads time to the minute. The student orders dates on a calendar. The student reads, writes, and models amounts of money to $100.00. The student orders measures of temperature in Fahrenheit degrees.	The student draws lengths to the nearer half unit. The student compares and orders measurements of mass/weight. The student reads time to 5 minute intervals. The student compares dates on a calendar. The student writes and models amounts of money to $10.00. The student compares measures of temperature in Fahrenheit degrees.	The student uses appropriate units of length and mass/weight using metric and standard systems. The student determines the perimeter of a polygon and the area of a given shape. The student orders events, reads time to the nearest quarter hour and calculates elapsed time to half hour. The student identifies specific dates on a calendar and determines past and future dates. The student reads, writes and makes change for amounts of money to a dollar. The student reads Celsius and Fahrenheit thermometers.	The student measures length in customary and nonstandard units to the nearest half unit. The student determines perimeter of a polygon. The student reads time to the half hour and calculates elapsed time to the hour. The student finds a given date on the calendar. The student reads, writes and makes change to 25 cents. The student reads a Fahrenheit thermometer.	The student measures length to the nearest whole unit. The student reads time to the hour. The student reads dates on a calendar. The student reads, writes and makes change for amounts of money to 10 cents.

M.O.2.4.1	use a ruler to draw and compare lengths in centimeters and inches.
M.O.2.4.2	estimate and determine the perimeter of a squares, rectangles and triangles.

M.O.2.4.3	estimate and count the number of square units needed to cover a given area.
M.O.2.4.4	estimate and determine weight/mass of familiar objects in pounds and kilograms.
M.O.2.4.5	order events in relation to time.
M.O.2.4.6	given a calendar, determine past and future days of the week and identify specific dates.
M.O.2.4.7	read time to the quarter hour using an analog and digital clock.
M.O.2.4.8	calculate elapsed time to the half hour.
M.O.2.4.9	read, write, count, and model amounts of money to a dollar.
M.O.2.4.10	model making change to a dollar.
M.O.2.4.11	read Celsius and Fahrenheit thermometers.

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
The student creates timelines. The student creates probability experiments.	The student describes and summarizes the information represented on pictographs, bar graphs, tables and charts. The student reads and summarizes data displayed on a timeline.	The student creates pictographs, bar graphs, charts and tables. The student conducts probability experiments with more than two possible outcomes and uses data to predict the likeliness of outcomes if experiment is repeated. The student collects, organizes and displays and analyzes data.	The student interprets pictographs, bar graphs, charts and tables. The student conducts simple probability experiments. The student collects and organizes data in the form of tallies.	The student reads pictographs, bar graphs, charts and tables. The student summarizes the data resulting from a simple probability experiment. The student tallies by ones.

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 level 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

The 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; 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.

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
The student adds and subtracts decimals to the hundredths. The student orders and compares fractions of unlike denominators without models. The student demonstrates the use of equivalent, proper, improper fractions and mixed numbers without models to add and subtract. The student analyzes word problems to determine the operation needed to solve and justifies use.	The student reads, writes, orders, and compares decimals to thousandths without models. The student compares and orders fractions with unlike denominators using pictorial representation. The student illustrates equivalent, proper, improper fractions, and mixed numbers. The student uses multiplication and division of 2- and 3-digit by one digit numbers to solve story problems and uses estimation to	The student reads, writes, orders, compares and identifies the place value of numbers to 10,000 using standard and expanded forms. The student reads, writes, orders and compares decimals to hundredths using models. The student orders and compares fractions with unlike denominators using concrete models. The student models equivalent proper, improper, and mixed numbers using concrete	The student reads, writes and identifies place value of numbers to 10,000 using standard and expanded forms. The student reads and writes decimals to hundredths using models. The student uses concrete model to order fractions with like and unlike denominators. The student identifies equivalent, proper and improper fractions with a concrete model. The student uses concrete models to recognize	The student reads numbers to 10,000 in standard form. The student reads and writes numbers to the tenths using models. The student orders and compares fractions with like denominators using concrete models. The student uses concrete models to identify equivalent and proper fractions. The student adds two-digit numbers with regrouping.

	determine reasonableness.	models. The student recognizes fractions as being part of a whole and part of a set using pictorial representations. The student adds and subtracts like and unlike fractions using pictorial representations. The student adds and subtracts three digit whole numbers with regrouping. The student demonstrates and models multiplication (e.g. repeated addition, arrays) and division (e.g. repeated subtraction, partitioning) utilizing properties. The student develops fluency of multiplication and corresponding division facts. The student models the distributive property in multiplication of two and three digit numbers by a one digit number. The student uses models to demonstrate division of two and three digit numbers by a one digit number. The student solves story problems using multiple strategies and uses estimation to determine reasonableness.	fractions as part of a whole and part of a set. The student adds and subtracts like fractions with pictorial models and unlike fractions with concrete models. The student adds and subtracts two-digit whole numbers.	

M.O.3.1.1	read, write, order, and compare numbers to 10,000.
M.O.3.1.2	read, write, order, and compare decimals to hundredths, with models.
M.O.3.1.3	identify place value of each digit utilizing standard and expanded form to 10,000.
M.O.3.1.4	apply estimation skills (rounding, benchmarks, compatible numbers) to evaluate reasonableness of an answer.

M.O.3.1.5	recognize fractions as part of a whole/one and as part of a set/group using models and pictorial representations.
M.O.3.1.6	compare and order fractions with like and unlike denominators using concrete models.
M.O.3.1.7	add and subtract fractions with like denominators using concrete models and pictorial representations.
M.O.3.1.8	recognize equivalent fractions using concrete models.
M.O.3.1.9	recognize proper and improper fractions and mixed numbers using concrete models.
M.O.3.1.10	add and subtract 2- and 3-digit whole numbers and money with and without regrouping.
M.O.3.1.11	demonstrate and model multiplication (repeated addition, arrays) and division (repeated subtraction, partitioning).
M.O.3.1.12	recognize 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.3.1.13	develop fluency with basic multiplication facts and the corresponding division facts.
M.O.3.1.14	model the distributive property in multiplication of 2- and 3-digit numbers by a 1-digit number.
M.O.3.1.15	use models to demonstrate division of 2- and 3-digit numbers by a 1-digit number.
M.O.3.1.16	solve story problems involving any of the four operations using multiple strategies.

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
The student creates and justifies increasing or decreasing numerical patterns. The student develops a rule using two operations and uses input/output table to show possible solutions. The student uses equivalent expressions to solve word problems for a missing element/quantity.	The student designs a geometric pattern that meets given criteria. The student determines the rule which uses two operation when given the input/output. Student solves equations with equivalent numerical expressions. The student represents an unknown with a letter.	The student analyzes and completes patterns with geometric figures. The student creates an input/output model using addition, subtraction, multiplication and division. The student analyzes patterns and writes rules. The student writes equivalent numerical expressions and uses a variable. The student uses a symbol as an unknown quantity and determines value.	The student interprets and completes patterns with geometric figures. The student uses simple input/output models with rules for addition, subtraction and multiplication. The student recognizes patterns and writes rules. The student identifies equivalent numerical expressions and recognizes that a variable represents an unknown quantity.	The student reproduces patterns with geometric figures. The student identifies input/output models with rules for addition and subtraction. The student identifies numerical expressions and variables.

M.O.3.2.1	analyze and complete patterns with geometric figures.
M.O.3.2.2	create an input/output model using addition, subtraction, multiplication or division.
M.O.3.2.3	identify, continue and write number patterns.
M.O.3.2.4	analyze a given pattern and write the rule.
M.O.3.2.5	write equivalent numerical expressions.
M.O.3.2.6	represent the idea of a variable as an unknown quantity using a symbol and determine value.

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
The student justifies the use of various polygons to create given solids in a plane drawing. The student identifies and draws polygons classified as quadrilaterals. The student compares and contrasts lines and rays. The student creates a design using given polygons that incorporate flips, turns, and slides. The student graphs/plots ordered pairs on a one-quadrant grid.	The student specifies the polygons needed to create a plane drawing of a solid figure. The student uses lines of symmetry to draw a symmetrical design. The student classifies given examples as lines and rays. The student categorizes a given picture as a flip, turn, or slide.	The student identifies and describes polygons, constructs and identifies solid figures from a plane drawing, and determines and draws lines of symmetry and angles. The student models and describes lines and rays and given a model, draws examples of transformations. The student names the location of a point on a grid.	The student names polygons when given examples. The student determines whether a line is a line of symmetry from a given example. The student uses concrete model to show a flip, turn, or slide.	The student matches given polygons with appropriate names. The student draws a line of symmetry on a given shape. The student identifies lines and rays when given examples.

M.O.3.3.1	identify polygons, including triangles, through decagons.
M.O.3.3.2	identify and describe a cube, rectangular solid, cylinder, cone and pyramid according to the number of faces, edges and vertices.
M.O.3.3.3	from a plane drawing, construct and identify the solid figure.
M.O.3.3.4	identify and draw lines of symmetry.
M.O.3.3.5	model and describe lines and rays.
M.O.3.3.6	identify and draw right, obtuse and acute angles.
M.O.3.3.7	given a model, draw an example of a flip, slide and turn (reflection, translation, and rotation).
M.O.3.3.8	name the location of a point on a one-quadrant grid.

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
The student measures,	The student creates a	The student estimates,	The student estimates,	The student estimates and

compares, and orders lengths using appropriate units of measurement for the given problem. The student examines the relationship between the perimeter and area of a rectangle. The student creates word problems using elapsed time and money.	design using given measurements of length. The student describes how to find perimeter and area of a rectangle. The student solves word problems using time and money.	measures, compares, orders and draws lengths to the nearest ½ inch, feet, yards, centimeters and meters. The students estimates and determines perimeter and area of a rectangle. The student estimates and measures mass/weight with appropriate units. The student reads time to five minutes intervals and calculates elapsed time to quarter hour. The student reads and writes values to 100 dollars and makes change to $10. The student estimates and recognizes common temperatures.	measures, compares, and orders given lengths to nearest ½ in. or cm. The student uses a concrete model to determine the perimeter and area of a given rectangle. The student measures mass/weight with appropriate units. The student reads time to the nearest five-minutes and uses a concrete model to calculate elapsed time to the quarter hour. The student uses concrete models to count money to $100 and make change to $10.	measures given lengths to the nearest ½ in. or cm. The student uses a concrete model to find the perimeter of a given rectangle. The student orders items by mass/weight. The student reads time to the quarter hour and calculates elapsed time to the nearest ½ hour using a concrete model. The student uses a concrete model to make change to $1.

M.O.3.4.1	estimate, measure, compare, order and draw lengths using inches (to the nearest ½ inch), feet, yards, centimeters and meters.
M.O.3.4.2	estimate and count the number of cubes in a rectangular solid to determine volume.
M.O.3.4.3	discover through modeling the formula for determining the area of a rectangle.
M.O.3.4.4	estimate and measure results of mass/weight in ounces, pounds, grams, and kilograms.
M.O.3.4.5	read time to 5-minute intervals using analog and digital clocks.
M.O.3.4.6	calculate elapsed time to quarter-hour.
M.O.3.4.7	read and write amounts of money to $100.00.
M.O.3.4.8	use coins and bills to make change up to $10.00.
M.O.3.4.9	estimate, read, and recognize common temperatures of Celsius and Fahrenheit.
M.O.3.4.10	estimate and determine the perimeter of any polygon.

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
The student compares and contrasts data, draws conclusions, and makes predictions based on the data.	The student constructs, labels, and interprets data from a variety of graphs. The student compares and contrasts graphs. The student makes predictions based on the results of probability experiments.	The student collects data from observations, surveys and experiments and constructs and labels a graph. The student uses a timeline to determine a sequence of events. The student conducts probability experiments and lists all possible outcomes. The student analyzes data represented on a graph.	The student constructs and labels a graph from given data. The student uses a concrete model of a timeline to place events in a sequence. The student uses given data from a probability experiment to show likely outcomes. The student answers question using a given graph.	The student uses a given form to make a graph of given data. The student identifies various events on a given timeline using pictures. The student lists outcomes of a probability experiment using two coins. The student identifies important information on a given graph.

M.O.3.5.1	collect data from observation, surveys, and experiments, and construct and label a graph.
M.O.3.5.2	use a timeline to determine a sequence of events.
M.O.3.5.3	conduct experiments to determine the likeliness of events and list all outcomes.
M.O.3.5.4	analyze data represented on a graph using grade level appropriate questions.

Fourth Grade Mathematics Content Standards and Objectives

The 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: 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 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.

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
The student adds and subtracts fractions with unlike denominators. The student characterizes and explains any number up to 100 as prime, composite, or square. Using multiple strategies, the student solves word problems using whole numbers, fractions, and decimals. The student applies the distributive property of multiplication over addition in mental	The student adds and subtracts mixed numbers using pictorial representations. The student converts common fractions to decimal form without using a calculator. The student plots fractions on the number line.	The student reads, writes, orders, and compares numbers from thousandths to the millions in standard form. The student writes numbers through millions in expanded form using multiples of ten. The student adds and subtracts whole numbers and decimals through thousandths. The student rounds decimals to the nearest whole, tenth, and hundredth. The student	The student reads and writes numbers from thousandths to millions in standard form. The student multiplies two-digit numbers by two-digit numbers and divides three-digit numbers by one- and two-digit numbers. The student is developing fluency in the basic multiplication and division facts. The student uses arrays to model prime and composite numbers.	The student reads numbers from thousandths to millions in standard form. The student adds and subtracts whole numbers and decimals. The student multiplies and divides two- and three-digit numbers by one-digit numbers. The student models square numbers. The student rounds decimals to the nearest whole number.

computation.		has memorized the basic multiplication and division facts and identifies square, prime, and composite numbers. The student multiplies and divides three digit numbers by two digit numbers. The student compares and orders fractions and identifies and writes equivalent fractions. The student adds and subtracts fractions with unlike denominators using pictorial representations and models addition and subtraction of mixed numbers with regrouping. The student demonstrates the relationship of fractions to decimals with pictorial representation. The student applies estimation skills to evaluate reasonableness of an answer. The student calculates products using the distributive property. Using multiple strategies, the student solves word problems using whole numbers and decimals.	The student rounds decimals to the nearest whole number and tenth.	

M.O.4.1.1	read, write, order, and compare numbers to the millions place.
M.O.4.1.2	read, write, order, and compare decimals to thousandths with and without models and pictorial representations.
M.O.4.1.3	identify 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.4.1.4	apply estimation skills (rounding, benchmarks, compatible numbers, over and under estimates) to evaluate reasonableness of an answer.
M.O.4.1.5	compare and order fractions with like and unlike denominators using benchmark fractions and the number line.
M.O.4.1.6	add and subtract fractions with like and unlike denominators using pictorial representations and concrete models.

M.O.4.1.7	recognize and model equivalent fractions using pictorial representations.
M.O.4.1.8	model both addition and subtraction of mixed numbers with and without regrouping.
M.O.4.1.9	demonstrate the relationship of fractions to decimals using concrete objects and pictorial representations.
M.O.4.1.10	round decimals to the nearest whole, 10th, or 100th place.
M.O.4.1.11	add and subtract whole numbers and decimals to the 1000th place.
M.O.4.1.12	apply the distributive property as it relates to multiplication over addition.
M.O.4.1.13	memorize basic multiplication facts and corresponding division facts.
M.O.4.1.14	divide 2-and 3-digit numbers by 1-and 2-digit numbers.
M.O.4.1.15	solve grade level appropriate story problems using multiple strategies including simple ratios.
M.4.1.16	model and identify square, prime, and composite numbers.

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
The student creates and solves input/output problems involving two-step functions. The student applies proportional reasoning to change the values in a given relationship.	The student solves input/output problems involving two-step functions. The student uses variables and order of operations to write expressions to describe situations.	The student determines the rule given an input/output model using 2 operations. The student describes a relationship in which quantities change proportionally. The student uses a letter to represent an unknown and writes an expression using a variable to describe a situation. The student solves problems and writes expressions incorporating the order of operations.	The student solves input/output problems involving one operation. The student solves one-step equations with variables. The student simplifies expressions using the order of operations.	The student gives the output or input given problems involving one operation. The student identifies a relationship in which the quantities change proportionally. The student uses a letter to represent an unknown. The student simplifies expressions with parentheses.

M.O.4.2.1	given an input/output model using two operations, determine the rule.
M.O.4.2.2	recognize and describe a relationship in which quantities change proportionally.
M.O.4.2.3	represent the idea of a variable as an unknown quantity using a letter.
M.O.4.2.4	write an expression using a variable to describe a situation.
M.O.4.2.5	incorporate the order of operations (parentheses and four operations) in solving problems and writing expressions.

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
The student draws polygons that meet a given set of criteria. The student draws three-dimensional objects from different perspectives.	The student describes the differences between various quadrilaterals and differentiates between intersecting, parallel, and perpendicular lines. The student estimates and measures angles. The student creates a figure with multiple lines of symmetry.	The student identifies and classifies plane figures and compares and contrasts quadrilaterals. The student describes three-dimensional objects from different perspectives. The student draws intersecting, parallel, and perpendicular lines. The student draws, labels, compares, and classifies acute, right, obtuse, and straight angles. The student creates figures with a line of symmetry. The student plots ordered pairs on a one-quadrant grid and specifies location and describes path. The student identifies the	The student identifies plane figures including types of quadrilaterals. The student recognizes three-dimensional objects from different perspectives. The student identifies intersecting, parallel, and perpendicular lines. The student draws, labels, and classifies acute, right, obtuse, and straight angles. The student identifies figures with a line of symmetry. The student plots ordered pairs on a one-quadrant grid and specifies location. The student identifies the center and	The student draws intersecting, parallel, and perpendicular lines. The student draws, and classifies acute, right, and obtuse angles. The student plots ordered pairs on a one-quadrant grid.

		center, radius, and diameter of a circle.	diameter of a circle.	

M.O.4.3.1	identify and classify plane figures and their components.
M.O.4.3.2	compare and contrast quadrilateral shapes.
M.O.4.3.3	recognize and describe three-dimensional objects from different perspectives.
M.O.4.3.4	identify and draw intersecting, parallel, and perpendicular lines.
M.O.4.3.5	draw, label, compare, and classify acute, right, obtuse and straight angles.
M.O.4.3.6	create a design with one line of symmetry.
M.O.4.3.7	graph/plot ordered pairs on a one-quadrant grid and use the coordinate system to specify location and describe path.
M.O.4.3.8	draw and identify parts of a circle: center point, diameter, and radius.
M.O>4.3.9	identify the images of figures after reflections, translations and rotations.

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 units, 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
The student designs and solves problems involving the calculation of elapsed time. The student solves one-and two-step problems involving money.	The student estimates and compares length using metric and customary units to 1/8 inch. The student demonstrates and compares the relationship between area and perimeter of plane figures. The student applies the formulas for area of rectangles and the volume of a rectangular prism.	The student estimates and compares length using customary and metric units. The student demonstrates the relationship between area and perimeter of plane figures. The student applies the formula for area of rectangles and discovers through modeling the formula for the volume of a rectangular prism. The student selects appropriate tools and units to measure capacity, volume, length and temperature and makes	The student measures and compares length using customary and metric units. The student examines the relationship between area and perimeter of plane figures. The student calculates the area of rectangles and discovers through modeling the formula for the volume of a rectangular prism. The student selects appropriate tools and units to measure capacity, volume, length and temperature and makes	The student measures length using customary and metric units. The student identifies the formula for area of a rectangle and models the formula for volume of a rectangular prism. The student selects appropriate tools to measure capacity, volume, length and temperature. The student reads time to the minute. The student counts coins and bills.

		conversions within the system of measurement. The student reads time to the minute and calculates elapsed time in a 24-hour period. The student counts coins and bills and determines correct change.	conversions within the system of measurement. The student reads time to the minute. The student counts coins and bills and determines correct change up to $10.	

M.O.4.4.1	estimate, measure, compare, order and draw lengths using customary (to the nearest one-fourth inch) and metric units.
M.O.4.4.2	determine and compare areas of rectangles and squares by multiplying length and width.
M.O.4.4.3	discover through modeling the formula for volume of a rectangular prism.
M.O.4.4.4	demonstrate conversions within a system of measure, in relation to capacity and volume.
M.O.4.4.5	read scales of weight, capacity, and temperature and select appropriate unit.
M.O.4.4.6	read time to the minute.
M.O.4.4.7	determine elapsed time in hours/ minutes within a 24-hour period.
M.O.4.4.8	count coins and bills and determine correct change.
M.O.4.4.9	given the perimeter of a polygon, determine the missing length of a side.
M.O.4.4.10	select appropriate customary and metric units and the tools for measuring to desired degree of precision.

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
The student designs a situation with possible combinations and lists all the combinations using a tree diagram. The student summarizes and interprets data based on the mean, mode, median, and range.	The student gives examples of the use and misuse of statistics in our society. The student analyzes information on a circle graph. The student analyzes and compares sets of data. The student predicts the number of possible combinations from a given situation. The student states the outcomes of an experiment as a ratio. The student calculates and compares the mean, median, mode and range from collected data.	The student reasons about the use and misuse of statistics in our society. The student interprets information on a circle graph. The student collects, organizes, displays, reads, and interprets data and compares sets of data. The student examines and lists all combinations from a given situation using a tree diagram. The student states the outcomes of an experiment as a ratio. The student models mean, median, mode and range from collected data.	The student reasons about the use and misuse of statistics in our society. The student collects, organizes, reads, and displays data. The student reads information from a circle graph. The student lists possible combinations from a given situation using s tree diagram. The student identifies the median, mode, and range from a set of data.	The student collects, organizes, reads, and displays data. The student reads information from a circle graph. The student lists possible combinations from a given situation. The student identifies the mode and range from a set of data.

M.O.4.5.1	understand and reason about the use and misuse of statistics in our society.
M.O.4.5.2	read and interpret information represented on a circle graph.
M.O.4.5.3	collect, organize, read, display and interpret data and compare sets of data from a problem solving situation.
M.O.4.5.4	examine and list all possible combinations in a given situation using a tree diagram.
M.O.4.5.5	identify and calculate median, mode and range from collected data.
M.O.4.5.6	represent the outcomes of a simple experiment as a ratio.

Fifth Grade Mathematics Content Standards and Objectives

Building on mastery of the basic facts of addition, subtraction, multiplication, and division, the fifth grade objectives place emphasis on developing proficiency in using whole numbers, fractions, and decimals to solve problems. Students will collect, display and analyze data in a variety of ways and solve probability problems. Students will solve problems involving area and perimeter, will classify polygons, and write a number sentence using a variable to solve problems. Students should be actively engaged, continuing to use concrete materials and appropriate technologies such as calculators and computers. 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.

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
The student creates problems involving operations with fractions, decimals, percents and ratios. Student determines the prime factorization of numbers less than 100. Student determines an equivalent fraction for any rational number. Student summarizes the result of multiplying or dividing any whole number	The student evaluates equivalencies among fractions, decimals and percents. The student justifies operations used to solve problems involving fractions and decimals, percents and ratios. Student generalizes the divisibility rule of 6. Student identifies the GCF and LCM of 3 numbers.	Student orders a list of given whole numbers, fractions or decimals. The student is fluent in place value and can write expanded notation using powers of ten. Student is fluent in operations with whole numbers. The student can add and subtract fractions and justify solutions. The student can model and calculate multiplication and division of	Student is fluent in place value of whole numbers and decimals. Student is fluent in whole number operations. Student adds and subtracts fractions. Student solves word problems involving whole numbers and decimals. Student identifies equivalent fractions from models. Student identifies benchmark equivalencies among fractions, decimals and percents. Student	Student can identify place value for any digit in a whole number. Student determines divisibility of a number by 2, 5, or 10. Student solves word problems involving whole numbers and money.

by ½.		fractions and decimals and models equivalence of fractions, decimals, percents, and ratios. Student uses divisibility rules of 2, 3, 5, 9, and 10 to determine factors. Student can identify the LCM and GCF of 2 numbers. Student solves word problems involving whole numbers, decimals and fractions.	determines divisibility of a number by 2, 3, 5, 9, or 10.	

M.O.5.1.1	read, write, order and compare all whole numbers, fractions, mixed numbers and decimals.
M.O.5.1.2	identify place value of each digit utilizing standard and expanded form in any whole number using powers of 10 [(3 X 10^5) + (4 X 10^3) + 7 X 10^2) + (1 X 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	identify and use the divisibility rules of 2, 3, 5, 9 and 10.
M.O.5.1.5	Identify greatest common factor and lowest common multiple of two numbers.
M.O.5.1.6	model and write equivalencies of fractions, decimals, percents, and ratios.
M.O.5.1.7	add and subtract fractions and mixed numbers.
M.O.5.1.8	model and calculate multiplication and division of fractions and mixed numbers.
M.O.5.1.9	model and calculate multiplication of decimals and division of decimals by a whole number divisor.
M.O.5.1.10	demonstrate fluency in addition, subtraction, multiplication and division of whole numbers.
M.O.5.1.11	solve word problems involving whole numbers, decimals and fractions using multiple strategies.

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
Student extends patterns and predicts the nth term. Student evaluates functions. Student solves proportion problems involving maps.	Student translates word phrases into algebraic or numeric expressions or equations. Student identifies like terms to simplify expressions.	The student will explore a variety of patterns to determine missing terms (e.g., square numbers, arithmetic sequences, input/output function model). The student models then writes an expression with a variable and evaluate the expression given a value. Given a rule involving 2 operations and the input or output, student will determine the missing value.	Student determines the rule from an input/output model. Student uses a variable to write an equation from a word problem. Student simplifies numerical expressions using order of operations.	Student determines the missing input or output from a model. Student extends number patterns.

M.O.5.2.1	explore and identify a variety of patterns with missing elements (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	model, then write an expression using a variable to solve problems.
M.O.5.2.4	evaluate an expression given a value for the variable.

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
Student creates the 2D representation of a 3D block	Student determines the interior angle measure of	The student classifies triangles by sides and	Student classifies triangles by sides and recognizes a	Student identifies an equilateral and a right

model from different perspectives.	regular polygons that tessellate the plane. Student draws an angle of a given measure.	angles. Student constructs a three dimensional figure form different views. The student uses a protractor to measure angles. The student can draw a design with more than one line of symmetry. The student constructs a circle of a given radius or diameter. Student draws a similar figure from a given scale.	right triangle. Student classifies angles as acute, obtuse or right. Student creates a design with one line of symmetry. Student identifies parts of a circle and states the radius from a given diameter or a diameter from a given radius. Student identifies the 2D representation of a 3D figure.	triangle. Student draws a right, obtuse or acute angle. Student identifies lines of symmetry. Student identifies the radius and diameter of a circle.

M.O.5.3.1	classify and compare triangles by sides and angles.
M.O.5.3.2	construct a 3-dimensional figure from different views (orthogonal drawings).
M.O.5.3.3	measure angles using a protractor.
M.O.5.3.4	create a design with more than one line of symmetry.
M.O.5.3.5	construct a circle with a given radius or diameter.
M.O.5.3.6	draw a similar figure using a scale.

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
The student creates problems using area, perimeter, circumference, volume, and surface area. The student creates problems involving weight/mass using metric and customary units.	The student determines the area and perimeter of a given shape. The student solves problems involving circumference area, perimeter, volume and surface area of prisms and pyramids. The student	Student draws a length to a given precision of $1/8^{th}$ inch or millimeter. The student describes the relationship between area and perimeter. Student solves problems involving volume of rectangular	Student draws lengths to a given precision of $1/4^{th}$ or centimeter. Student calculates volume of rectangular prisms. Student calculates elapsed time within 24 hours.	Student reads a ruler to the nearest $1/4^{th}$ inch or centimeter. Student determines area and perimeter of rectangles. Student determines volume of rectangular prisms, given the formula V = lwh.

Student determines the greatest area from a given perimeter.	solves application problems involving weight/mass using metric and customary units.	prisms and application problems requiring conversions within a system of measurement. Calculate elapsed time and actual measurement from scale drawing. Evaluate weight/mass of real objects.		

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 appropriate formulas.
M.O.5.4.3	solve problems using the formula for determining volume of a rectangular prism.
M.O.5.4.4	investigate and describe the relationship between perimeter and area of polygons.
M.O.5.4.5	solve application problems requiring conversions within a system of measurement.
M.O.5.4.6	evaluate and/or measure the weight/mass of real objects in ounces, pounds, grams, and kilograms.
M.O.5.4.7	calculate elapsed time to solve problems.
M.O.5.4.8	calculate actual measurement from scale drawings.

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
Student designs surveys , collects data and creates circle graph to display. Student selects best measure of central tendency (mean, median, or mode) to support data and justifies selection. Student creates problems	Student justifies appropriate graph (stem and leaf graph, line, bar or circle) to display data and support information . Student uses probability to support a predicted outcome in a given situation.	The student interprets data to construct stem and leaf chart and constructs a circle graph from given data. The student uses sample spaces to solve problems of probability. Student uses appropriate tables charts and graphs to	Student organizes , displays and interpret data in a line or bar graph. Student reads a stem and leaf chart. Student solves problems involving combinations. Student solves problems of simple probability. Student calculates median,	Student reads line, bar, stem and leaf, and circle graphs. Student calculates range from a data set. Student identifies outcomes from a probability experiment.

involving probability.		solve problems, to draw inferences and verify predictions. The student calculates and compares mean, median, and mode and range from collected data.	mode and range.	

M.O.5.5.1	collect, organize, display, read and interpret data from a problem-solving situation in a stem and leaf plot.
M.O.5.5.2	solve problems involving the probability of an event by construction of a sample space representing all possible results.
M.O.5.5.3	construct, read, and interpret tables, charts, and graphs to draw reasonable inferences or verify predictions.
M.O.5.5.4	construct a circle graph from given data.
M.O.5.5.5	calculate and compare mean, median, mode and range from collected data.

Sixth Grade Mathematics Content Standards and Objectives

The sixth grade objectives place continued emphasis on the study of whole numbers, decimals and fractions. However, students need opportunities to apply their skills to real life applications including those skills developed with integers. Calculators and computers may be used to solve problems. Decreased attention should be given to paper and pencil computations. Sixth graders will continue to use manipulatives whenever new material is introduced or whenever it is needed to review previously taught material. The areas of probability, statistics, geometry, and pre-algebra will be stressed. Students will use ratios to compare data sets, make geometric constructions of three-dimensional figures, explore thoroughly the algebra strand, and solve problems involving circles, volume and surface area. 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.

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
The student creates problems and expressions using the distributive, commutative, associative, and identity properties. The student creates problems using fractions, decimals, and percents, justifying the operation used. The student explains and writes the effect of multiplying and dividing a number by a number equal to or between -1 and 1. The student uses multiple expressions for	The student uses prime factorization to determine GCF and LCM of more than two numbers. The student uses the distributive, commutative, associative, identity properties to solve problems. The student solves problems using fractions, decimals and percents, justifying operations used. The student concludes the effects of multiplying and dividing numbers by	The student uses prime factorization to determine GCF and LCM. The student identifies definitions and examples of the distributive, commutative, associative and identities properties of multiplication and addition. The student can state equivalencies among fractions, decimals, and percents. The student calculates the percent of a number. The student estimates solutions to	Student can determine prime factorization of a number. Student identifies examples of distributive, commutative, associate, and identity properties of multiplication and addition. The student can identify equivalencies among fractions, decimals, and percents. Student calculates benchmark percents such as 10%, 25%, 50%, and 75%. Student can add using	Student lists prime numbers and gives prime factorization of numbers less than 100. Student can determine equivalent fractions and decimals. Student can calculate benchmark percents of 25% and 50% of numbers less than 100.

comparing and ordering integers.	numbers equal to or between -1 and 1. The student solves real world problems using integers. Calculate the missing part of a percentage problem.	problems, justify operations used, solve problem involving fractions and decimals. The student can interpret the effect of multiplying and dividing whole numbers and fractions equal to and between zero and one. The student models real world situations involving operations using integers.	integers.	

M.O.6.1.1	read, write, order, and compare numbers using scientific notation.
M.O.6.1.2	use prime factorization to determine the greatest common factor and least common multiple.
M.O.6.1.3	represent integers on a number line.
M.O.6.1.4	analyze and solve problems in context involving addition, subtraction, multiplication and division of whole numbers, fractions, mixed numbers and decimals and justify the reasonableness by estimation.
M.O.6.1.5	identify, demonstrate and apply the distributive, commutative and associative and identify properties.
M.O.6.1.6	convert between fractions, mixed numbers, decimals and percents.
M.O.6.1.7	compute the percent of a number to solve problems.
M.O.6.1.8	interpret the effect of multiplying and dividing rational numbers, whole numbers, fractions and decimals by numbers equal to 0 and 1 and between 0 and 1.
M.O.6.1.9	model and develop the rules for addition, subtraction, multiplication and division of integers.

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

Students create an input / output table and test it to determine if it is a function. Simplify algebraic expressions involving one or more variables of any degree. Students can determine the relationship between two variables as direct or inverse by investigating the graph.	Student simplifies algebraic expressions with variables of the 2nd degree. Student will create a geometric or arithmetic sequence. Students can determine any term in a sequence.	The student writes algebraic expressions for word phrases and simplifies expressions with variables in the first degree. The student predicts the nth term of patterns. The student evaluates functions using an input/output model. Students can plot points on the Cartesian plane. Students analyze, solve and justify proportion problems. Students analyze and find solutions to problems that can be represented by a linear equation and graph the results. .	Student can simplify a numerical expression using order of operations. Students can extend an arithmetic or geometric sequence. Student can write an algebraic expression representing addition or multiplication. Student can supply the input or output given the rule. Solve a proportion problem involving mph.	Student can plot points in the first quadrant. Simplify numerical expressions of 3 terms. Given the rule and the input, student can determine the output. Solve a proportion between equivalent fractions.

M.O.6.2.1	simplify algebraic and numerical expressions using order of operations.
M.O.6.2.2	identify and combine like terms and monomials.
M.O.6.2.3	explore and extend patterns to predict the nth term (e.g., powers and triangular numbers).
M.O.6.2.4	translate word phrases into algebraic expressions to solve problems.
M.O.6.2.5	use input/output models and spreadsheets to evaluate functions.
M.O.6.2.6	use cross multiplication to solve proportion problems involving rates, statistics and measurements.
M.O.6.2.7	locate and plot points within the four quadrants.
M.O.6.2.8	use linear equations to represent and solve real world problems.

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
The student will generalize the formula for the sum of interior angles of polygons algebraically. Students will rotate a quadrilateral or triangle in a coordinate plane about a point not on the polygon. Students will construct angles and bisect an angle, and construct parallel and perpendicular lines.	The student will create a design with rotational symmetry and/or line symmetry. Students will apply transformations to polygons in a coordinate plane. Students will construct an angle and bisect it. Students will solve problems from pictorial representations of geometric models.	The student will draw geometric figures from written descriptions and angles of a given measure. Students will bisect line segments and classify relationships among distinct lines. Students derive the formula to determine the sum of interior polygon angles. Students identify rotational symmetry of plane figures.	Students will determine the measure of an interior angle or regular polygons an/or polygons with interior angles that are a factor of 360. Students will identify rotational symmetry. Students will recognize angles of given measures.	Students will identify geometric figures and recognize pairs of lines as parallel or perpendicular or intersecting. Students will identify lines of symmetry. Students will classify angles as acute, right or obtuse.

M.O.6.3.1	classify lines as parallel, intersecting, perpendicular or skew.
M.O.6.3.2	explore the measures of interior angles in polygons and derive the formula to determine the sum.
M.O.6.3.3	bisect a line segment using a compass and straightedge.
M.O.6.3.4	draw an angle of a given measure.
M.O.6.3.5	create designs using line and rotational symmetry.
M.O.6.3.6	define and sketch similar and congruent plane geometric figures.
M.O.6.3.7	solve real world problems involving geometric representations.

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
The student designs and solves problems involving the calculation of elapsed time. The student solves one-and two-step problems involving money.	The student estimates and compares length using metric and customary units to 1/8 inch. The student demonstrates and compares the relationship between area and perimeter of plane figures. The student applies the formulas for area of rectangles and the volume of a rectangular prism.	The student estimates and compares length using customary and metric units. The student demonstrates the relationship between area and perimeter of plane figures. The student applies the formula for area of rectangles and discovers through modeling the formula for the volume of a rectangular prism. The student selects appropriate tools and units to measure capacity, volume, length and temperature and makes conversions within the system of measurement. The student reads time to the minute and calculates elapsed time in a 24-hour period. The student counts coins and bills and determines correct change.	The student measures and compares length using customary and metric units. The student examines the relationship between area and perimeter of plane figures. The student calculates the area of rectangles and discovers through modeling the formula for the volume of a rectangular prism. The student selects appropriate tools and units to measure capacity, volume, length and temperature and makes conversions within the system of measurement. The student reads time to the minute. The student counts coins and bills and determines correct change up to $10.	The student measures length using customary and metric units. The student identifies the formula for area of a rectangle and models the formula for volume of a rectangular prism. The student selects appropriate tools to measure capacity, volume, length and temperature. The student reads time to the minute. The student counts coins and bills.

M.O.6.4.1	derive approximation for pi using actual measurements.
M.O.6.4.2	derive formulas to determine perimeter, circumference and/or area of plane figures including composite figures.
M.O.6.4.3	investigate, model and describe surface area of rectangular prisms and cylinders.
M.O.6.4.4	solve application problems involving volume of rectangular prisms and cylinders.
M.O.6.4.5	construct scale drawings.

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
Students will design an experiment involving either fair or unfair probability. Students will compare and contrast combinations and permutations. Students will create a data set for a specific mean, median and mode and range.	Students will recognize and explain how additional data in a set would affect the measures of central tendency. Students will create a data set that would have a specific mean, median or mode. Students will create a bar graph to illustrate misleading interpretations. Students will create an example of a permutation and a combination.	Student collects, organizes, displays, and interprets data in bar, line and circle graphs, stem and leaf plots, and frequency tables. Student interprets data and formulates questions using measures of central tendency including outliers. Student predicts outcomes of events and expresses probability as a ration, decimal, and/or percent and models permutations and combinations from given data.	Student will organize and display data in bar, line, and circle graphs, stem and leaf plots, and frequency tables. Students can determine mean, median, mode, median and range. Student can determine probability of an event and express it as a fraction. Students can list combinations of simple data.	Students display data in bar and line graphs. Students determine median, mode and range from a set of data. Student identifies probability of an event from pictorial representations.

M.O.6.5.1	collect, organize, display, read, interpret and analyze data using appropriate graphs and tables.
M.O.6.5.2	interpret data and formulate questions using mean, median, mode, and range and determine the effect of outliers on the data.
M.O.6.5.3	predict the outcome of a given event using its probability and express that probability as a ratio, decimal or percent.
M.O.6.5.4	model combinations and permutations of given situations by creating lists.

Seventh Grade Mathematics Content Standards and Objectives

The seventh grade year is an introduction to high school subjects such as algebra, geometry, probability and statistics. With less emphasis on paper/pencil computation, calculators are emphasized in all facets of the mathematics daily work as well as test situations. Students should, by this time, have a mastery of general mathematics topics; however, review of all basic mathematics skills occurs in a relevant context. Problem solving is embedded in the curriculum utilizing a variety of new concepts, while 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.

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
The student creates problems with whole numbers, integers, decimals, fractions, percents and justifies solutions. The student creates application problems involving any ration numbers e.g. rates, tips, discounts, sales tax, and interest) and verifies solutions using estimation techniques. Students defend the use of the commutative, associative, distributive, identity and	The student analyzes and solves application problems involving any rational numbers (e.g. rates, tips, discounts, sales tax, and interest) and verifies solutions using estimation techniques. The student compares and orders rational and irrational numbers and compares and contrasts the properties thereof.	The student analyzes and solves problems with whole numbers, integers, decimals, fractions, percents and justifies solutions. Students use multiple representations for comparing and ordering integers, decimals and fractions. The student evaluates powers, squares and square roots. Student applies the commutative, associative, distributive, identity and inverse property and the effects of the	The student solves problems with whole numbers, integers, decimals, fractions and percents. A student compares and orders integers, decimals and fractions. Students identify the commutative, associative, distributive, identity and inverse property and the effects of the absolute value on a number in an expression. Students define a rational and an irrational number.	The student solves problems with whole numbers, decimals, fractions and percents. Students compare integers, decimals and fractions.

inverse property in solving problems.		absolute value on a number or in an expression. Student differentiates between rational and irrational numbers.		

M.O.7.1.1	compare and order integers, decimals, and fractions using multiple representations (e.g., symbols, manipulatives, graphing on a number line).
M.O.7.1.2	evaluate powers, squares, and square roots.
M.O.7.1.3	define absolute value and determine its effect on a number or expression.
M.O.7.1.4	differentiate between rational and irrational numbers.
M.O.7.1.5	apply the commutative, associative, distributive, identity and inverse properties.
M.O.7.1.6	analyze and solve application problems with whole numbers, integers, decimals, fractions and percents and justify solutions including using estimation and reasonableness.

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 contexts.

Performance Descriptors (M.PD.7.2)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
The student will formulate a rule from data in a function table to generate arithmetic or geometric sequences. Determine the slope of a line given the slope intercept equation. The student solves muti-step linear equations and inequalities.	The student extends the sequence in arithmetic and geometric sequences. The student graphs linear inequalities. The student determines the slope of a line given two points. The student solves two step linear equations. The student creates algebraic expressions with whole numbers, fractions, integers, absolute value,	The student will find missing elements in arithmetic and geometric sequences. The student will justify the rules of exponents and use scientific notation with positive and negative exponents. Students will plot lines on a coordinate plane, determine the slope, and solve problems algebraically justifying solutions. The student will	The student will identify arithmetic and geometric sequences. The student will use the rules of exponents and use scientific notation with positive exponents. Students will plot lines on a coordinate plane, determine the slope, and solve problems algebraically. The student will simplify and evaluate algebraic expressions with	The student will write numbers in scientific notation with positive exponents. Students will plot lines on a coordinate plane. The student will simplify algebraic expressions. The student will solve one-step linear equations involving whole numbers.

	and exponents, using order of operations and exponent rules. The student generates and applies expressions and equations including proportions.	simplify and evaluate algebraic expressions with numbers, fractions, integers, absolute value, and exponent rules. The student will perform operations on monomials, create function tables and solve problems using ratio and proportion. The student solves one-step linear equations containing rational numbers and will solve basic inequalities.	numbers, fractions and integers. The student will solve one-step linear equations involving integers.	

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	simplify and evaluate numerical and algebraic expressions with whole numbers, integers, absolute value and exponents using the order of operations and exponential rules.
M.O.7.2.3	add, subtract, multiply and divide monomials with no more than two variables and no exponent greater than two.
M.O.7.2.4	justify the rules of working with exponents.
M.O.7.2.5	use a spreadsheet to create input/output function tables.
M.O.7.2.6	use ratios and proportions to represent and solve application problems.
M.O.7.2.7	use and apply scientific notation containing positive and negative exponents.
M.O.7.2.8	solve one-step linear equations containing rational numbers with integer solutions.
M.O.7.2.9	solve basic inequalities using inverse operations and graph solutions.
M.O.7.2.10	plot lines within the Cartesian coordinate plane from a table of values and solve mathematical real world problems.
M.O.7.2.11	determine the slope of a line from its graphical representation.
M.O.7.2.12	represent algebraically and solve real world application problems and justify solutions.

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
The student will create scale models and use coordinate geometry to examine properties of similar figures and graph transformations. Describe the cross-section of a solid and the intersection of two or more planar figures. Make and test conjectures about regular polygons.	The student will recognize relationships among angles formed by parallel lines cut by a transversal and will construct perpendicular and angle bisectors. Create geometric patterns transformations and predict results of changing shapes of plane figures and solids. Create scale models and use coordinate geometry to examine properties of similar figures and graph transformations. Describe the cross-section of a solid and the intersection of two or more planar figures.	The student will identify and construct angle-pairs, congruent segments and angles, perpendicular bisectors of segments, and angle-bisectors. The student will apply line symmetry and transformations. The student will solve ratio and proportion and real world problems using composite geometric figures.	The student will identify and construct angle-pairs, angles, congruent segments and angle-bisectors. The student will identify line symmetry and transformations. The student will solve ratio and proportion and real world problems involving geometric figures.	The student will identify angle-pairs, congruent segments and angles. The student will identify line symmetry and transformations. The student will solve simple ratio and proportion problems with simple geometric figures.

M.O.7.3.1	identify and construct angle-pairs (e.g., adjacent, complementary, supplementary, vertical).
M.O.7.3.2	identify and construct congruent segments and angles, perpendicular bisectors of segments and angle-bisectors.
M.O.7.3.3	apply and demonstrate line symmetry.
M.O.7.3.4	apply transformations (rotations, reflections, translations) to plane figures using graph paper.
M.O.7.3.5	develop and solve ratio and proportion problems including scale drawings and similar polygons.
M.O.7.3.6	solve mathematical real world problems using compound geometric figures.

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

Performance Descriptors (M.PD.7.4)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
The student will apply the formulas for volume of cone, pyramids and spheres to solve problems. The student will create problems involving the Pythagorean Theorem and indirect measurement in right triangles and will create problems involving missing measurements in plane and solid figures.	The student will solve problems involving missing measurements in plane and solid geometric figures. The student will use the Pythagorean Theorem, indirect measure, and definitions to solve right-triangle application problems. The student will determine the volume of pyramids, cones, and spheres.	The student will apply formulas involving perimeter, circumference, area, surface area, distance and temperature and volume of prisms and cylinders. The student will use the Pythagorean theorem to find the length of any side of a right triangle. The student will convert within and between customary and metric systems and explore the differences between accuracy and precision.	The student will apply formulas involving perimeter, circumference, area, surface area, distance and temperature. The student will convert within customary and metric systems. The student will use the Pythagorean theorem to find the length of the hypotenuse of a right triangle.	The student will solve problems using formulas involving perimeter, circumference, area and, surface area. The student will convert within customary and metric systems.

M.O.7.4.1	use and apply formulas in problem solving situations involving perimeter, circumference, area, surface area, distance and temperature (Celsius, Fahrenheit).
M.O.7.4.2	determine the volume of prisms and cylinders.
M.O.7.4.3	use the Pythagorean Theorem to find the length of any side of a right triangle and apply to problem solving situations.
M.O.7.4.4	convert units of measurement within and between customary and metric systems.
M.O.7.4.5	explore the difference between accuracy and precision in problem solving situations.

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
The student creates problems involving combinations and permutations. The student compares and contrasts simple probability with compound probability and dependent events with independent events.	The student will extrapolate information from multiple data displays and construct convincing arguments based on data analysis. The student will use appropriate technology to solve application problems involving combinations and permutations and investigation compound probability of dependent and independent events.	The student will determine experimental and theoretical probability of an event and will determine combinations and permutations by constructing sample spaces. The student will collect, organize graphically represent, analyze, and interpret data displays and solve problems using measures of central tendency.	The student will collect, organize graphically represent data displays and solve problems using measures of central tendency. The student predicts the outcome of an event given its probability.	The student will find the experimental and theoretical probability of an event. The student will collect and organize data and determine measures of central tendency.

M.O.7.5.1	determine experimental and theoretical probability of an event.
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

Pre-Geometry with Algebra provides an alternative course for students who do not elect to take Algebra I in the eighth grade or who have not successfully mastered the new skills from *Pre-Algebra with Geometry* in the seventh grade. In addition to reinforcing the concepts presented in *Pre-Algebra with Geometry*, this course extends problem solving to a more sophisticated level. Students will continue to apply integer operations, properties, expressions and equations so as to reinforce these concepts in varied applications. Lessons involving cooperative learning, manipulatives, or technology will strengthen students' 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.

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
The student will create problems involving properties of rational and irrational number, radicals, and powers.	The student uses properties of rational and irrational numbers to solve problems. The student solves problems involving powers and radicals. The student analyzes and solves application problems involving rational and irrational numbers and verifies solutions using estimation techniques.	The student orders rational and irrational numbers and compares and contrasts the properties thereof. The student solves problems using powers and square roots. The student analyzes and solves application problems involving any rational numbers (e.g. rates, tips, discounts, sales tax, and interest) and verifies solutions using estimation techniques.	The student compares and orders rational numbers and makes conversions among the different forms of rational numbers. The student analyzes and solves problems involving whole numbers, integers, decimals, fractions, and percents. The student applies the commutative, associative, distributive, identity, and inverse properties to simplify	The student solves problems involving whole numbers, decimals, fractions, and percents. The student performs operations with integers and identifies examples of the commutative, associative, distributive, identity, and inverse properties. The student interprets the effects of multiplying and dividing numbers by numbers equal to, or

			numerical expressions.	between, -1 and 1. The student compares and orders integers.

M.O.8.1.1	compare and order rational and irrational numbers.
M.O.8.1.2	compare and contrast the properties of terminating, repeating, and non-repeating decimals, and conversions between fractions, mixed numbers, and decimals.
M.O.8.1.3	use powers, squares, and square roots to solve problems.
M.O.8.1.4	analyze and solve application problems with whole numbers, decimals, fractions, percents and integers including, but not limited to, rates, tips, discounts, sales tax and interest and verify solutions using estimation techniques.

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
The student solves literal equations and inequalities for any variables. The student determines the equation of a line given the slope and a point on a line or two points on the line. The student creates problems to be solved using arithmetic, geometric, or algebraic patterns. The student creates and solves problems involving expressions, equations and addition and subtraction of polynomials.	The student solves multi-step linear equations and inequalities in one variable with variables on both sides. The student determines the equation of a line, given the graph or a table of value. The student formulates a rule to generate an arithmetic, geometric, or algebraic pattern to solve problems. The student adds and subtracts polynomials to solve problems. The student generates and applies	The student will formulate a rule from data in a function table or to generate an arithmetic, geometric, or algebraic pattern. The student will solve two-step linear equations and inequalities with rational solutions. The student will graph linear equations and inequalities and determine the slope of a line given two points or the slope/intercept equation. The student will add and subtract polynomials limited to two	The student solves one-step linear equations and inequalities and performs operations with monomials. The student finds missing elements in algebraic, geometric, and arithmetic patterns. The student plots lines from a table of values and determines slope of a line from its graph. The student simplifies algebraic expressions with whole numbers, integers, rational numbers, absolute value, and exponents using order	The student simplifies algebraic expressions involving whole numbers and integers using order of operations. The student plots points in the Cartesian plane. The student writes algebraic expressions for word phrases, solves proportions, and identifies like terms in monomials.

	expressions and equations, including proportions, to solve problems and justifies solutions.	variables. The student will generate and apply expressions and equations, including proportions, to solve real-world problems.	of operations.	

M.O.8.2.1	solve one and two step linear equations and inequalities with integers, fractions, and decimal solutions.
M.O.8.2.2	use ratio and proportion to create and solve equations.
M.O.8.2.3	add and subtract polynomials limited to two variables and positive exponents.
M.O.8.2.4	generate and apply algebraic equations and expressions to solve application problems using multiple strategies.
M.O.8.2.5	apply inductive and deductive reasoning to write a rule from data in a function table.
M.O.8.2.6	graph linear equations and inequalities within the Cartesian coordinate plane using ordered pairs, table of values and appropriate 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 given two-points or slope/y-intercept equation (y=mx+b).
M.O.8.2.9	represent and solve real world problems appropriate for 8th grade using multiple strategies and justify solutions.

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 transformations 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
The student creates problems involving transversals, perpendicular and angle bisectors. The student solves problems involving intersections and unions of plane and solid figures. The student proves	The student applies relationships among angles formed by parallel lines cut by a transversal and constructs perpendicular and angle bisectors to solve problems and justify solutions. The student uses	The student will recognize relationships among angles formed by parallel lines cut by a transversal and will construct perpendicular and angle bisectors. Create geometric patterns transformations and predict	The student recognizes congruent angles pairs formed by parallel lines cut by a transversal. The student solves problems involving perpendicular and angle bisectors. The student uses coordinate	The student finds the sum of the interior angles of polygons and identifies regular polygons, parallel lines, perpendicular bisectors, and angle bisectors. The student determines if two or more

congruency and similarity in plane figures.	transformations to create Escher-like tessellations. The student predicts results of changing shapes of plane and solid figures, and creates scale models to solve problems. The student describes the intersections of planar with solid figures. The student proves conjectures involving regular polygons and uses coordinate geometry to solve problems involving similar figures and transformations.	results of changing shapes of plane figures and solids. Create scale models and use coordinate geometry to examine properties of similar figures and graph transformations. Describe the cross-section of a solid and the intersection of two or more planar figures. Make and test conjectures about regular polygons.	geometry to find the scale factor between two similar figures and applies transformations to plane figures. The student solves problems involving compound geometric figures and uses the properties of regular polygons to solve problems.	figures are similar. The student identifies angle pairs (supplementary, complementary, adjacent, vertical, etc.). The student identifies figures with line and rotational symmetry

M.O.8.3.1	recognize the relationships among corresponding, alternate interior, and alternate exterior angles when parallel lines are cut by a transversal using models, pencil/paper and graphing calculator.
M.O.8.3.2	classify polyhedrons according to the number and shape of faces; determine the relationship between vertices, faces and edges.
M.O.8.3.3	identify, apply, and construct perpendicular and angle bisectors.
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	use coordinate geometry to represent and examine properties of similar and congruent figures and graph transformations.
M.O.8.3.6	create scale models using ratio, proportion and similar figures using pencil/paper and dynamic geometry software to determine the proportionality.
M.O.8.3.7	describe the intersection of two or more geometric figures in the plane (e.g., intersection of a circle and a line).
M.O.8.3.8	describe the cross section of a solid such as a cylinder, cone, and pyramid.
M.O.8.3.9	make and test a geometric conjecture about regular polygons.

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

Performance Descriptors (M.PD.8.4)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
The student will explain the relationship between volume of prisms and pyramids, and among cones, cylinders and spheres.	The student will apply the formulas for volume of cone, pyramids and spheres to solve problems. The student will create problems involving the Pythagorean Theorem and indirect measurement in right triangles and will create problems involving missing measurements in plane and solid figures.	The student will solve problems involving missing measurements in plane and solid geometric figures. The student will use the Pythagorean Theorem, indirect measure, and definitions to solve right-triangle application problems. The student will determine the volume of pyramids, cones, and spheres.	The student solves problems using formulas involving area, perimeter, circumference, surface area, distance, temperature, and volume of prisms and cylinders to solve problems. The student uses the Pythagorean Theorem to find unknown sides of right triangles.	The student determines perimeter, area, circumference, surface area of geometric figures. The student draws scale drawings.

M.O.8.4.1	develop and apply the formulas for volume of cones, pyramids and spheres.
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 using the Pythagorean Theorem and indirect measurement in problem solving situations.

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
The student designs experiments involving compound probability, dependent events, or independent events.	The student creates problems involving combinations and permutations. The student compares and contrasts simple probability with	The student will create and extrapolate information from multiple data displays and construct convincing arguments based on data analysis. The student will	The student creates and extrapolates data from multiple displays and draw conclusions based on data analysis. The student determines combinations	The student extrapolates information from data displays and predicts the outcome of an event, given its probability.

	compound probability and dependent events with independent events.	use appropriate technology to solve application problems involving combinations and permutations and investigation compound probability of dependent and independent events.	and permutations by constructing sample spaces and determines experimental and theoretical probability of compound events.	

M.O.8.5.1	use appropriate technology to solve application problems involving combinations and permutations.
M.O.8.5.2	interpret the experimental and theoretical probability, 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, including misuses of statistical or numeric information, based on data analysis of same and different sets of data.

Algebra/Geometry Preparation Content Standards and Objectives

Algebra/Geometry preparation is an elective course designed to be a bridge between the concrete elementary curriculum and the more formal mathematics curriculum. Students will explore algebraic concepts in an informal way to build a foundation for formal study of algebra. Informal explorations should emphasize physical models, data, graphs, and other mathematical representations rather than facility with formal algebraic manipulations. The study of geometry is to assist students in representing and making sense of the world. Geometric models will provide a perspective from which students are to analyze and solve problems, and geometric interpretations will help make abstract representations more easily understood. The study of geometry at this level should provide increased opportunities for students to engage in more systematic explorations. An emphasis of this course will be the disciplinary connections between algebra 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.

M.S.AGP.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.AGP.1)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
The students can identify practical situations where integers, fractions and decimals can be applied. The students will understand how subsets of real numbers are related. The student will be able to develop and justify a computation using real number properties.	The student will be able to determine equivalent forms of integers, fractions, and decimals and be able to demonstrate an understanding of the relationship among the operations on these sets. Given a series of steps, the student will be able to justify a computation by using real number properties.	The student will compare, order, or locate whole numbers, integers, fractions, and decimals on a number line. The student will compute and estimate the accuracy of their computations using decimals, integers, and fractions and their related number properties.	The student will compare, order, or locate whole numbers, integers, and decimals on a number line. The student will compute and estimate the accuracy of their computations using whole numbers, integers, and decimals.	The student will be able to locate whole numbers on the number line. The student will be able to compute using whole numbers and integers.

M.O.AGP.1.1	examine and develop fluency with properties of numbers (commutative, associative, distributive, etc).

M.O.AGP.1.2	add, subtract, multiply, and divide decimals, integers, fractions and mixed numbers and judge the reasonableness of numerical computations and their results.
M.O.AGP.1.3	use order relations to compare, order, or locate whole numbers, integers, fractions, and decimals on a number line.

M.S.AGP.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.AGP.2)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
The student will solve an application by constructing and labeling a diagram, writing the relevant equation, solving the equation and interpreting the results. The student will solve literal equations for any variable. The student will represent patterns using variable expressions or equations.	The student will solve equations with multiple operations, variables on both sides, and a solution check. The student will be able to recognize patterns. The student will distinguish between functions and relations.	The student will solve equations that use at least two operations and a solution check. The student will evaluate and use variable expressions and formulas to solve applications. The student will use function notation.	The student will add and subtract binomials with integer coefficients. The student will solve one step equations.	The student will add and subtract monomials with whole number coefficients. The student will substitute and evaluate variable expressions and formulas.

M.O.AGP.2.1	evaluate expressions involving variables, and calculate formulas to solve application problems using function notation.
M.O..AGP.2.2	solve equations with at least two operations and confirm the solution.

M.S.AGP.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.AGP.3)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
The student will use constructions to make diagrams and to develop conjectures. The student will make and justify conjectures that involve angle relationships, parallel lines, similar and congruent triangles, circles, and three-dimensional figures. The student will solve and interpret the results of real world problems involving the surface area and volume of three-dimensional figures.	The student will construct parallel and perpendicular lines. The student will solve and interpret the results of real world problems involving the area of polygons, composite polygons, and circles.	The student will estimate and calculate the circumference and area of a circle, the area of polygons, and the surface area and volume of three-dimensional figures. The student will construct congruent angles and bisect angles and segments. The student will solve problems by investigating angle relationships, parallel lines, similar and congruent triangles and circles.	The student will develop area formulas for other polygons from the area of a rectangle and be able to explain the relationship among the areas of quadrilaterals. The students will be able to apply this understanding to finding the surface area of three-dimensional figures.	The students can distinguish among different types of angles. The students can identify pairs of congruent triangles or similar triangles when the triangles are oriented differently. The student will use formulas to find the areas of polygons.

M.O.AGP.3.1	use a compass to construct congruent angles, bisect angles, and bisect line segments.
M.O.AGP.3.2	estimate and calculate the circumference and area of a circle.
M.O.AGP.3.3	estimate and calculate the area and perimeter of polygons, including those with unknown side lengths.
M.O.AGP.3.4	estimate and calculate the surface area and the volume of three-dimensional figures.
M.O.AGP.3.5	explore angle relationships: complementary, supplementary, vertical, and adjacent.
M.O.AGP.3.6	explore angle relationships involving parallel lines and apply in solving problems (corresponding angles, alternate interior angles, and alternate exterior angles).
M.O.AGP.3.7	investigate congruent and similar triangles and apply proportions in problem solving situations.

M.O.AGP.3.8	develop and explore circle relationships, emphasizing the vocabulary of circles.

M.S.AGP.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.AGP.4)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
The student will use a protractor to develop and investigate conjectures. The student will solve real world problems that involve simple unit analysis.	The student will construct models using a protractor. The student will be able to convert between customary and metric measures of length, mass, and capacity. The student will solve real world problems that involve determining the appropriate unit of measure for the solution.	The student will measure and draw angles using a protractor. The student will use customary and metric units to estimate, measure, and perform operations involving length, mass, and capacity.	The student will use customary units to estimate, measure, and perform operations involving mass and capacity.	The student will use customary and metric units to estimate, measure, and perform operations involving length.

M.O.AGP.4.1	estimate, measure, and perform operations involving length, mass, and capacity using customary and metric units.
M.O.AGP.4.2	use a protractor to measure and draw angles.

M.S.AGP.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.AGP.5)

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
The student will formulate questions that can be addressed by measures of central tendency and dispersion. The student will design experiments involving the probability of simple events and interpret the results.	The student will formulate questions that can be addressed by measures of central tendency, collect and organize data, and interpret the results. The student will be able to use probability to predict the outcomes of simple events and to explain and evaluate inferences.	The student will use data to determine mean, median, mode, and range and to make predictions by constructing and interpreting graphs. The student will determine the probability of complementary and mutually exclusive events.	The student will use data to construct graphs. Given the event and sample space the student will determine the probability.	Given the graph the student will use the graph to answer questions about the data set. Given the probability, the student will make predictions about the outcome of the event.

M.O.AGP.5.1	construct and interpret graphs to analyze data and make predictions.
M.O.AGP.5.2	use data to determine mean, median, mode, and range.
M.O.AGP.5.3	determine the probability of complementary events and mutually exclusive events.

Algebra I Content Standards and Objectives

Algebra I is a course that provides 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. In planning for instruction, consideration should be given to the student's readiness for abstract concepts. Manipulatives, such as Algeblocks, should 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.

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

The student develops and justifies the algebraic steps in an evaluation or simplification that uses order of operations, properties of real numbers, and laws of integral exponents. The student articulates in both verbal and written forms the relationship among the factored forms of polynomial equations, x-intercepts on a graph, and entries in a table. The student can write the linear factors of a higher order polynomial by examining a graph. The student identifies practical situations where linear functions are used to solve problems, poses a problem, develops a solution using multiple representations, and justifies the solution and process in a clear concise manner. The student recognizes the domain values that make sense for the problem, and is able to use those values to estimate a solution. The student designs investigations or experiments and collects, organizes, and interprets data and predicts outcomes using measures of central	The student justifies each of a given series of algebraic steps that use order of operations, properties of real numbers, and laws of integral exponents. The student provides clear, concise mathematical reasoning and justifications when solving linear, literal, absolute value, and quadratic equations, linear inequalities, and systems of linear equations. The student recognizes how factored forms of quadratic equations are related to x-intercepts on a graph, is able to multiply higher order polynomials, and can determine where rational expressions are undefined. The student converts among representations of a linear function and can generalize about the usefulness of each representation in solving problems. The student provides examples of both functions and non-functions and explains the difference between the two types of relations. The student collects, organizes, and interprets data and predicts outcomes using measures of central tendency and dispersion,	The student evaluates and simplifies algebraic expressions using order of operations, properties of real numbers, and laws of integral exponents. The student solves linear, literal, absolute value, and quadratic equations, linear inequalities, and systems of linear equations. The student develops and explains methods of factoring through the use of area models and adds, subtracts, multiplies, and divides polynomials and rational expressions. The student determines the slope of a line, graphs linear equations, and determines equations of lines, including linear regressions. The student determines if a relation is a function and uses function notation. The student collects, organizes, and interprets data and predicts outcomes using measures of central tendency and dispersion, linear regressions, correlation coefficients, multiple graphical representations and probability. The student models and solves practical problems using multiple representations and judges	The student evaluates and simplifies algebraic expressions with integer coefficients using order of operations, properties of real numbers, and laws of integral exponents. When integer coefficients are involved, the student solves linear, and literal equations, quadratic equations in factored form, and one-step linear inequalities where multiplication and division by negative numbers is not needed. Systems of 2 equations are solved graphically when given a graph and algebraically when the coefficients are the same for one of the variables in each of the equations. The student can match a factored form with both an equation and a model and can add, subtract, and multiply 2 binomials. The student can identify two points in order to determine the slope of a line and can convert among linear representations. Given a graph, the student determines if the graph represents a relation or a function. The student collects, organizes, and interprets	The student evaluates algebraic expressions with whole number coefficients using order of operations, and properties of real numbers. The student solves 2-step linear equations with positive integer coefficients, verify a solution to a quadratic equation, and given a graph can identify a solution to a system of 2 linear equations. The student adds and subtracts monomials with integer coefficients. Given two points with integer coordinates, the student determines the slope of a line and given a table can plot points and determine if the trend is linear. Given a set of ordered pairs, the student determines if the set is a relation or a function. The student collects data and calculates the mean, mode and range and can substitute values into and solve a linear regression equation. The student uses a scatter plot to interpret data. The student reads a practical problem and makes and labels an appropriate diagram.

tendency and dispersion, linear regressions, correlation coefficients, multiple graphical representations and probability and can justify steps and summarize results in a clear concise manner. When solving problems, the student defends a chosen solution method when more than one method may be used, and compares and contrasts various solutions when more than one solution exists.	linear regressions, correlation coefficients, multiple graphical representations and probability and can justify steps and summarize results in a clear concise manner. The student determines a solution to a practical problem where more than one solution may exist and is able to defend the problem solving process in a clear concise manner with a justification of the appropriateness of the solution.	the reasonableness of exact and approximate solutions.	data, and predicts outcomes using measures of central tendency and dispersion, scatter plots, and histograms. The student makes predictions when given a linear regression formula and computes a probability when the event and sample space are known. Given the equation, the student solves a practical problem and gives solutions in an approximate form.	

M.O.A1.2.1	simplify and evaluate algebraic expressions using order of operations and properties of real numbers with justification of steps.
M.O.A1.2.2	solve multi-step linear equations in one variable, apply skills toward solving practical problems and judge the reasonableness of solutions.
M.O.A1.2.3	solve multi-step linear inequalities in one variable, interpret the results on a number line, apply the skills toward solving practical problems, and judge the reasonableness of solutions.
M.O.A1.2.4	solve literal equations for a given variable, apply the skills toward solving practical problems and judge the reasonableness of solutions.
M.O.A1.2.5	analyze a given set of data for the existence of a pattern numerically, algebraically and graphically; determine the domain and range; and determine if the relation is a function using function notation when appropriate.
M.O.A1.2.6	solve absolute value equations in one variable and interpret the results on a number line.
M.O.A1.2.7	investigate the laws of exponents and perform operations on expressions with integral exponents.
M.O.A1.2.8	determine the slope of a line given an equation of a line, the graph of a line and two points.
M.O.A1.2.9	graph linear equations using slope-intercept, point slope, and x- and y-intercepts.
M.O.A1.2.10	determine the equation of a line given a graph of a line, two points on the line, the slope and a point, and the slope and y-intercept.
M.O.A1.2.11	solve systems of linear equations graphically and numerically using the elimination method and the substitution method.
M.O.A1.2.12	add and subtract polynomials.
M.O.A1.2.13	multiply and divide binomials by binomials or monomials.
M.O.A1.2.14	use area models and graphical representations to develop and explain appropriate methods of factoring.
M.O.A1.2.15	simplify square roots into both exact and approximate forms.
M.O.A1.2.16	solve quadratic equations by graphing, factoring and quadratic formula and draw reasonable conclusions about a situation being

	modeled.
M.O.A1.2.17	examine situations that can be modeled by a rational expression; add, subtract, multiply and divide simple rational expressions and determine when an expression is undefined.
M.O.A1.2.18	collect, organize, interpret data and predict outcomes using the mean, mode, median, and range including problems with missing data values.
M.O.A1.2.19	perform a linear regression, identify the equation for the line of regression, examine the correlation coefficient to determine how well the line fits the data and use the equation to predict specific values of a variable.
M.O.A1.2.20	compute and interpret the expected value of random variables in simple cases using simulations and rules of probability.
M.O.A1.2.21	understand histograms, box plots, scatter plots and normal distribution curves and use them to display and interpret data.
M.O.A1.2.22	compute a probability when the event and/or sample space are not given or obvious.
M.O.A1.2.23	use multiple representations, such as words, graphs, tables of values and equations, to solve practical problems; explain how the representations are related to each other as well as to the problems.

Applied Mathematics I and Applied Mathematics II Content Standards and Objectives

Applied Mathematics I and Applied Mathematics II reflect the content of a complete course in Algebra I. One credit will be given for the successful completion of the Applied Mathematics I course. An Algebra I credit will be given upon successful completion of both courses. Tools such as manipulatives, data collection devices, graphing calculators, computers, and interactive utilities will be used to construct multiple representations that will develop algebraic fluency. Working in groups will be used to develop the collaborative problem solving skills needed in the workplace. 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.

M.S.AM1.2	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.AM1.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice

The student develops and justifies the algebraic steps in an evaluation or simplification that uses order of operations, properties of real numbers, and laws of integral exponents. The student solves practical problems involving linear, literal, and absolute value equations and linear inequalities and interprets the results. The student identifies practical situations to pose a problem that involves the use of computation, estimation, scientific notation, precision, measuring instruments, rational numbers and vectors, develops a solution, and justifies the solution and process in a clear concise manner. The student designs investigations or experiments and collects, organizes, and interprets data and predicts outcomes using measures of central tendency and dispersion and probability.	The student justifies each of a given series of algebraic steps that use order of operations, properties of real numbers, and laws of integral exponents. The student provides clear, concise mathematical reasoning and justifications when solving linear, literal, absolute value equations, and linear inequalities. The student determines a solution to a practical problem that involves the use of computation, estimation, scientific notation, precision, measuring instruments, rational numbers and vectors where more than one solution may exist and is able to defend the problem solving process in a clear concise manner with a justification of the appropriateness of the solution. The student collects, organizes, and interprets data and predicts outcomes using measures of central tendency and dispersion, and probability and can justify steps and summarize results in a clear concise manner.	The student evaluates and simplifies algebraic expressions using order of operations, properties of real numbers, and laws of integral exponents. The student solves linear, literal, and absolute value equations with justification and solves linear inequalities. The student translates words into expressions and equations, models and solves practical problems that involve the use of computation, estimation, scientific notation, precision, measuring instruments, rational numbers and vectors, and judge the reasonableness of solutions. The student simplifies square roots to both exact and approximate forms. The student collects, organizes, and interprets data, and predicts outcomes using measures of central tendency, dispersion and probability.	The student evaluates and simplifies algebraic expressions with integer coefficients using order of operations, properties of real numbers, and laws of integral exponents. When integer coefficients are involved, the student solves linear and literal equations and one-step linear inequalities where multiplication and division by negative numbers is not needed. The student matches words to translated expressions and equations and given the steps, solves practical problems that involve the use of computation, estimation, scientific notation, and rational numbers. The student simplifies square roots to approximate forms. The student collects, organizes, and interprets data, and predicts outcomes using measures of central tendency, dispersion and probability if given a formula.	The student inconsistently evaluates algebraic expressions with whole number coefficients using order of operations, properties of real numbers. The student solves 2-step linear equations with positive integer coefficients. The student matches words to translated expressions and equations and given the steps, solves practical problems that involve the use of computation and estimation. The student collects data and calculates the mean, mode and range.

M.O.AM1.2.1	solve practical problems involving computation using estimation.
M.O.AM1.2.2	write numbers in scientific notation and combine numbers written in scientific notation to solve practical problems.
M.O.AM1.2.3	distinguish between counting and measuring using precision measurement tools.
M.O.AM1.2.4	solve practical problems and interpret results using rational numbers and vectors.
M.O.AM1.2.5	simplify and evaluate algebraic expressions using order of operations and properties of real numbers with justification of steps.
M.O.AM1.2.6	translate word phrases into algebraic expressions or word sentences into equations and inequalities.
M.O.AM1.2.7	justify steps in the solving of equations based on the properties of real numbers.
M.O.AM1.2.8	solve literal equations for a given variable and apply the skills toward solving practical problems and judge the reasonableness of solutions.
M.O.AM1.2.9	solve practical problems using a four-step problem solving approach.
M.O.AM1.2.10	solve multi-step linear equations in one variable, apply skills toward solving practical problems, and judge the reasonableness of solutions.
M.O.AM1.2.11	solve multi-step linear inequalities in one variable, interpret the results on a number line, apply the skills toward solving practical problems and judge the reasonableness of solutions.
M.O.AM1.2.12	solve absolute value equations in one variable and interpret the results on a number line.
M.O.AM1.2.13	collect, organize, interpret data and predict outcomes using the mean, mode and range including problems with missing data values.
M.O.AM1.2.14	simplify square roots into both exact and approximate forms.
M.O.AM1.2.15	investigate the laws of exponents and perform operations on expressions with integral exponents.
M.O.AM1.2.16	compute and interpret the expected value of random variables in simple cases using simulations and rules of probability.
M.O.AM1.2.17	compute a probability when the event and/or sample space are not given or obvious.

M.S.AM2.2	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.AM2.2)				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice

The student articulates in both verbal and written form the relationship among the factored forms of polynomial equations, x-intercepts on a graph, and entries in a table. The student can write the linear factors of a higher-order polynomial by examining a graph. The student identifies practical situations where linear functions are used to solve problems, poses a problem, develops a solution using multiple representations, and justifies the solution and process in a clear concise manner. The student recognizes the domain values that make sense for the problem, and is able to use those values to estimate a solution. The student designs investigations or experiments and collects, organizes, and interprets data and predicts outcomes using measures of central tendency and dispersion, linear regressions, correlation coefficients, multiple graphical representations, and probability and can justify steps and summarize results in a clear and	The student provides clear, concise mathematical reasoning and justifications when solving quadratic equations and systems of linear equations. The student recognizes how factored forms of quadratic equations are related to x-intercepts on a graph, is able to multiply higher order polynomials, and can determine where rational expressions are undefined. The student converts among representations of a linear function and can generalize about the usefulness of each representation in solving problems. The student provides examples of both functions and non-functions and explains the difference between the two types of relations. The student collects, organizes, and interprets data and predicts outcomes using measures of central tendency and dispersion, linear regressions, correlation coefficients, multiple graphical representations and probability and can justify steps and summarize results in a clear concise manner.	The student solves quadratic equations and systems of linear equations. The student develops and explains methods of factoring through the use of area models, and adds, subtracts, multiplies, and divides polynomials and rational expressions. The student determines the slope of a line, graphs linear equations, and determines equations of lines, including linear regressions. The student determines if a relation is a function and uses function notation. The student collects, organizes, and interprets data and predicts outcomes using linear regressions, correlation coefficients, multiple graphical representations, and probability. The student models and solves practical problems using multiple representations and judges the reasonableness of exact and approximate solutions.	When integer coefficients are involved, the student solves quadratic equations in factored form. Systems of 2 linear equations are solved graphically when given a graph and algebraically when the coefficients are the same for one of the variables in each of the equations. The student can match a factored form with both an equation and a model and can add, subtract, and multiply 2 binomials. The student can identify two points in order to determine the slope of a line and can convert among linear representations. Given a graph, the student determines if the graph represents a relation or a function. The student collects, organizes, and interprets data and predicts outcomes using scatter plots and histograms, makes predictions when given a linear regression formula and computes a probability when the event and sample space are known. Given the steps, the student solves a practical problem and gives solutions in an approximate form.	The student can verify a solution to a quadratic equation and given a graph can identify a solution to a system of 2 linear equations. The student adds and subtracts monomials with integer coefficients. Given two points with integer coordinates, the student determines the slope of a line and given a table can plot points and determine if the trend is linear. Given a set of ordered pairs, the student determines if the set is a relation or a function. The student collects data, substitutes values into and solves a linear regression equation, and uses a scatter plot to interpret data. The student reads a practical problem and make and labels an appropriate diagram.

concise manner. When solving problems, the student defends a chosen solution method when more than one method may be used, and compares and contrasts various solutions when more than one solution exists.	The student determines a solution to a practical problem where more than one solution may exist and is able to defend the problem solving process in a clear concise manner with a justification of the appropriateness of the solution.			

M.O.AM2.2.1	analyze a given set of data for the existence of a pattern numerically, algebraically and graphically; determine the domain and range; and determine if the relation is a function using function notation when appropriate.
M.O.AM2.2.2	determine the slope of a line given an equation of a line, the graph of a line and two points.
M.O.AM2.2.3	graph linear equations using slope-intercept, point slope and x- and y-intercepts.
M.O.AM2.2.4	write an equation of a line given graph of a line, two points on the line, the slope and a point and the slope and y-intercept.
M.O.AM2.2.5	solve systems of linear equations graphically and numerically using the elimination method and the substitution method.
M.O.AM2.2.6	add and subtract polynomials.
M.O.AM2.2.7	multiply and divide binomials by binomials or monomials.
M.O.AM2.2.8	use area models and graphical representations to develop and explain appropriate methods of factoring.
M.O.AM2.2.9	solve quadratic equations by graphing, factoring and the quadratic formula and draw reasonable conclusions about a situation being modeled.
M.O.AM2.2.10	examine situations that can be modeled by a rational expression, add, subtract, multiply and divide simple rational expressions and determine when an expression is undefined.
M.O.AM2.2.11	understand box plots, histograms, scatter plots and use them to display and interpret data.
M.O.AM2.2.12	perform a linear regression, identify the equation for the line of regression, examine the correlation coefficient to determine how well the line fits the data and use the equation to predict specific values of a variable.

Geometry and Applied Geometry Content Standards and Objectives

Geometry and Applied Geometry are designed for students who have completed the objectives for Algebra I. Upon completion of either course, a geometry credit will be given. The study of geometry should include experiences and activities that foster in students a feeling for the value of geometry in their lives. Students should be encouraged to develop 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. Due to the emphasis on formal proof, students pursuing the Professional Pathway are strongly advised to enroll in the Geometry course. 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.

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
The student will create arguments involving parallel and perpendicular lines, right triangles, congruent and similar figures, convex and concave quadrilaterals, other polygons, tessellating figures, and circles. The student will transfer the principles of formal and informal proof to situations that integrate geometry with other disciplines.	The student will critique arguments involving parallel and perpendicular lines, right triangles, congruent and similar figures, convex and concave quadrilaterals, other polygons, tessellating figures and circles. The student will use inductive reasoning to make a conjecture and then use deductive reasoning to find a counterexample or prove	The student will investigate, make conjectures, justify, and apply relationships involving the properties of parallel and perpendicular lines, right triangles, congruent and similar figures, convex and concave quadrilaterals, other polygons, tessellating figures, and circles. The student will use symbolic logic to construct	The student will investigate and apply relationships involving the properties of parallel and perpendicular lines, right triangles, congruent and similar figures, convex and concave quadrilaterals, other polygons, tessellating figures, and circles. The student will use symbolic logic to construct arguments. The student will	The student will investigate relationships involving the properties of parallel and perpendicular lines, right triangles, congruent and similar figures, convex and concave quadrilaterals, other polygons, tessellating figures, and circles. The student will apply undefined terms, definitions, postulates, and theorems To solve problems and will

The student will construct a problem that can be solved using the properties of similar triangles, the Pythagorean Theorem, or trigonometric ratios, solve it, and interpret the results. The student will apply principles of transformational geometry to families of algebraic functions. The student will solve problems and prove, both formally and informally, conjectures using properties of geometric solids. The students will develop arguments about basic properties of non-Euclidean geometries like finite, hyperbolic, or spherical geometries.	the conjecture. The student will apply the Pythagorean Theorem and the trigonometric ratios to create and label a diagram, write and solve a related equation, and interpret the results. The student will analyze transformations that will lead to successful tessellations of plane figures and will create an original tessellation. The student will analyze geometric situations in the plane using coordinate geometry, develop conjectures, and prove the conjectures. The student will apply knowledge of plane figures to develop conjectures about geometric solids. The student will research applications of Euclidean and non-Euclidean geometries in other areas such as art, architecture, music, engineering, and nature and present the findings in oral or written form.	logical arguments and test the validity of conclusions. The student will apply undefined terms, definitions, postulates, and theorems to construct formal and informal proofs and will distinguish between inductive and deductive reasoning. The student will use the properties of similar triangles to derive the trigonometric ratios and apply the results to construct scale drawings and determine the measure of inaccessible angles or distances. The student will use transformational geometry to construct transformations and explore congruencies and similarities. The student will use analytical geometry to develop and apply formulas, to construct arguments, and to solve practical problems. The student will compare and contrast the properties of Euclidean geometry with other geometries.	apply undefined terms, definitions, postulates, and theorems to construct informal proofs and will distinguish between inductive and deductive reasoning. The student will use the properties of similar triangles to construct scale drawings. The student will use transformational geometry to construct transformations and explore congruencies. The student will use analytical geometry to apply formulas and to verify properties of geometric figures. The student will explain the similarities and differences of basic geometric forms in Euclidean and spherical geometry.	distinguish between inductive and deductive reasoning. The student will identify corresponding parts of similar triangles. The student will use transformational geometry to construct transformations. The student will use analytical geometry to apply formulas. The student will investigate basic properties of segments, lines, parallel lines, and triangles in spherical geometry.

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 between and apply inductive and deductive reasoning.
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	construct logical arguments using both formal and informal methods with direct and indirect reasoning.

M.O.G.3.5	apply definitions, theorems, and postulates related to such topics as angles formed by perpendicular lines, and complementary, supplementary, and vertical angles to construct formal and informal proofs.
M.O.G.3.6	compare and contrast the relationships between angles formed by two lines cut by a transversal when lines are and are not parallel, and use the results to develop methods to show parallelism.
M.O.G.3.7	investigate and justify congruence relationships with an emphasis on triangles.
M.O.G.3.8	explore and identify general properties of convex and concave quadrilaterals; develop, compare and contrast the properties of parallelograms, rectangles, rhombuses, squares, and trapezoids.
M.O.G.3.9	using similar figures, apply proportions in problem solving situations that include two and thee dimensions.
M.O.G.3.10	investigate measures of angles and lengths of segments to determine the existence of a triangle (triangle inequality) and establish the relationship between the order of sides and angles.
M.O.G.3.11	derive the basis for the trigonometric ratios by applying properties of similar triangles with justification and using the results to construct scale drawings and find unknown side lengths, angle measures and inaccessible heights and distances.
M.O.G.3.12	apply the Pythagorean Theorem and its converse in solving practical problems and deriving the special right triangle relationships.
M.O.G.3.13	investigate measures of angles formed by chords, tangents, and secants of a circle and the relationship to its arcs.
M.O.G.3.14	given a polygon, find angle measures of interior and exterior angles; find the length of sides from given data; and use properties of regular polygons to find missing data.
M.O.G.3.15	develop properties of tessellating figures and use those properties to tessellate the plane.
M.O.G.3.16	use nets and other manipulatives to develop and apply formulas for area, perimeter, surface area, and volume and apply them in the modeling of practical problems.
M.O.G.3.17	develop and 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	using various methods, construct a triangle's medians, altitudes, angle and perpendicular bisectors; identify conjectures and develop mathematical arguments about their relationships.
M.O.G.3.19	using transformational geometry, create a reflection, translation, rotation, glide reflection and dilation of a figure; and apply transformations and use symmetry to analyze mathematical situations such as congruency and similarity.
M.O.G.3.20	compare and contrast Euclidean geometry to other geometries such as spherical.
M.O.G.3.21	find or approximate the area of irregularly shaped regions.
M.O.G.3.22	using the Cartesian coordinate system, find the dimensions of a polygon given the coordinates of the polygon.

Algebra II Content Standards and Objectives

Algebra II is intended for students who have mastered the concepts of Algebra I. Emphasis will be placed on the investigation of more advanced functions and using them to solve real world problems. When solving problems, students will use multiple representations to develop conjectures and then test and justify their 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.

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
Design problems using equations of parallel, perpendicular, horizontal and vertical lines. The student designs an investigation, and collects, organizes, and interprets data to make predictions using quadratic regressions. Evaluates multiple solution strategies to select the most effective, provides justification for the choice, and transfers this knowledge to other disciplines. Write the factors of a polynomial given its roots or	Develop and use equations of parallel, perpendicular, horizontal and vertical lines in the solution of practical applications. Collect, organize, interpret data and make predictions using quadratic regressions. Given a mathematical model, solves and interprets the results relative to the model. Provides mathematically sound explanations for the steps in a solution process. Apply factoring techniques to determine roots of polynomial equations or	The student determines the equations of parallel, perpendicular, horizontal, and vertical lines and quadratic regressions. Solve problems involving variations, quadratic equations over the set of complex numbers, systems of linear equations using matrices, quadratic inequalities, systems of linear inequalities, absolute value inequalities, and radical, logarithmic and exponential equations. Solutions will be expressed in numerical, graphical, and	Given sets of points determine the equations of parallel, perpendicular, horizontal, and vertical lines. Generate tables of values to graph and analyze quadratic functions. Solve problems involving direct and inverse variations, quadratic equations over the set of real numbers, systems of two linear equations with integral coefficients using matrices, radical and exponential equations, and systems of two linear inequalities. Solutions will	Given a graph determine the equation of horizontal, vertical, parallel, and perpendicular lines. Solve problems involving direct variation, quadratic equations over the set of rational numbers, systems of two linear equations with integral coefficients using substitution or elimination, systems of two linear inequalities, and absolute value equations. Solutions will be expressed in numerical form. Factor polynomials using greatest common factor.

zeros and apply factoring techniques to expressions that are not polynomials. Solve a practical problem by writing and solving a matrix equation and interpreting the results. Given a determinant, generate equivalent determinants. Use fractional exponents to complete operations with radicals having different indices. Solve higher-order polynomial equations over the set of complex numbers. Model and solve a real-world situation using conic sections, and exponential and logarithmic equations. Make connections between linear programming and matrices and use these connections to solve practical problems. Given the graph of two functions, predict the graph of the function resulting from an operation on the two functions. Design investigations in which quadratic regressions and recursive models are used to make predictions about data values and patterns and sequences. The student develops a practical problem, solves the problem, and presents the solution using multiple representational formats.	zeros of polynomial functions. The student will solve matrix equations and state if determinants are equivalent. Use fractional exponents to multiply two radicals having different indices. Solve third degree equations over the set of complex numbers. Use graphing utilities to investigate symmetry of conic sections. Use exponential and logarithmic equations to solve practical problems and interpret the results. Given a practical problem, write the linear inequalities and use linear programming to determine the optimum value of a function. Justify the inverse of a function graphically and by composition. Apply quadratic regressions and recursive models to solve practical problems and interpret the results. The student can identify strengths and weaknesses of a given representational strategy and defend choice of format when solving practical problems.	interval forms. Extend techniques of factoring by applying the methods of grouping, graphical representation, and the sum and difference of two cubes. The student will develop fluency with the operations and properties of matrices, expressions with fractional exponents, and complex numbers. Simplify and expand expressions using properties of logarithms. Convert between graphs and equations of conic sections and between exponential and logarithmic functions. Determine the constraints and the feasible region of solution for a system of linear inequalities and then use linear programming to determine the optimum value of a function. Explore and use functions by finding zeros and inverses, expressing domain and range in interval notation, performing basic function operations including composition, and generating and extending families of functions using transformations. Develop quadratic regressions and recursive	be expressed in both numerical and graphical forms. Factor quadratic trinomials when the coefficient of the quadratic term is greater than one, and the sum or difference of cubes. The student will simplify radical expressions, find the determinant of a 3 X 3 matrix, multiply square matrices, multiply complex numbers, and simplify powers of "i". Given an equation in standard form, sketch the graph of an ellipse, identifying the major and minor axes. Identify the base and exponent of a logarithmic equation. Given the constraints for a system of linear inequalities determine the feasible region and the optimum value of a function. Explore and use functions by finding zeros. Express the domain and range in interval notation, and determine the domain of functions resulting from function operations. Given a recursive model, make predictions about data values and patterns and sequences. The student will convert among graphs, equations,	Factor binomials and trinomials using area models. Factor the difference of two squares and trinomials into two binomials when the coefficient of the quadratic term is one. The student will convert between fractional exponents and radical form of a monomial, add and subtract matrices, multiply a matrix by a scalar, find the determinant of a 2 X 2 matrix , and add and subtract complex numbers. Given an equation in standard form, determine the conic type and sketch a parabola and a circle. Identify the base and exponent of an exponential expression. Given the graph of a feasible region determine the optimum value for a function. Determine the domain and range of a function and add, subtract, multiply, and divide functions. Identify a quadratic pattern using a table of data values or a recursive sequence. The student will convert between graphs and tables of values to solve practical problems.

		models to make predictions about data values and patterns and sequences. The student will convert among words, graphs, equations, and tables of values to solve practical problems.	and table of values to solve practical problems.	

M.O.A2.2.1	determine equations of lines including parallel, perpendicular, vertical and horizontal lines.
M.O.A2.2.2	factor higher order polynomials by applying various methods, including factoring by grouping, the sum and difference of two cubes and graphical representation.
M.O.A2.2.3	develop the complex number system and simplify powers of 'i'.
M.O.A2.2.4	perform basic operations with complex numbers and give answers as complex numbers in simplest form.
M.O.A2.2.5	simplify radicals and expressions involving fractional exponents and convert between the two forms.
M.O.A2.2.6	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; confirm the solutions numerically and graphically; and apply to practical problems.
M.O.A2.2.7	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.A2.2.8	solve equations containing radicals and exponents.
M.O.A2.2.9	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.A2.2.10	explore families of functions and their transformations; recognize linear, quadratic, radical, absolute value, step, piece-wise and exponential functions; convert among words, graphs, tables and equations in practical problems.
M.O.A2.2.11	solve quadratic inequalities, graph their solution sets and express this solution using interval notation.
M.O.A2.2.12	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.A2.2.13	solve practical problems involving direct, inverse and joint variation.
M.O.A2.2.14	explore the conic sections; recognize, identify and sketch the graphs of a parabola, circle, ellipse and hyperbola and convert between graphs and equations.
M.O.A2.2.15	solve absolute value inequalities graphically, numerically and algebraically and express the solution set in interval notation.
M.O.A2.2.16	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.A2.2.17	perform a quadratic regression, determine the regression equation and use the results to predict specific values of a variable.
M.O.A2.2.18	develop recursive models for representing and investigating patterns and sequences.

Conceptual Mathematics Content Standards and Objectives

Conceptual Mathematics is intended for students who have successfully completed the objectives for geometry. This course will include major topics from algebra and geometry and will extend these ideas to practical usage. Basic ideas of probability and statistics and the mathematics of finance will be included. Concepts will be presented in the context of their historical development. Students will be expected to be active learners in cooperative groups and as individuals. It is the purpose of this course to expose students to topics in mathematics that are relevant to any educated person. 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.

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.
M.O.CM.2.1	develop a variety of problem solving strategies (e.g., draw a diagram, look for a pattern, work backwards).
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	use appropriate formulas to solve workplace problems.
M.O.CM.2.5	calculate costs, simple and compound interest, finance charges, loan payments and taxes.
M.O.CM.2.6	compare various methods of investing money.

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.
M.O.CM.3.1	apply concepts of geometry including the Pythagorean Theorem, similar triangles, and right triangle trigonometry.
M.O.CM.3.2	solve workplace problems involving perimeter, area, surface area and volume.
M.O.CM.3.3	investigate the applications of various geometric shapes and patterns to art, architecture, and nature.

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.
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.
M.O.CM.5.4	apply the basic probability rules in expressing the chances of events occurring using technology when appropriate.
M.O.CM.5.5	create 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.

Trigonometry Content Standards and Objectives

Trigonometry is designed for students who have successfully completed Algebra II. Connections between right triangle trigonometry and circular functions should be emphasized. Calculators, computers, and interactive utilities will be used to enhance student learning and to aid in finding the values of trigonometric 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.

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
The student will be able to prove identities. The students will be able to transfer their knowledge of trigonometric functions to other disciplines by identifying and posing their own problems. The student will be able to collect data, determine an appropriate trigonometric model, solve the problem using the model, apply and interpret the result in terms of the experimental situation, and justify their choice of	The student will be able to provide an informal argument to justify an identity. The student will be able to determine when a practical problem can be modeled with a trigonometric function, write and solve a relevant equation, and interpret the solution. The student will be able to recognize the graphs of trigonometric inverses with multiple transformations. The student will be able to	The student will define the six trigonometric functions in terms of a right triangle and circular functions, and will determine the functions of an angle in standard position. The student will be able to state the unit circle values of the six trigonometric functions of special angles, will find the values of the trigonometric functions and their inverses for any angle, and will convert between degree and radian measure in any	The student will define the six trigonometric functions in terms of a right triangle and will determine the functions of an angle in standard position. In the first quadrant the student will convert between degree and radian measure and be able to state the unit circle values of the six trigonometric functions of special angles. The students will find the values of the trigonometric functions and their inverses	The student will define the six trigonometric functions in terms of right triangles. The student will be able to read a completed diagram or table, or use a calculator to convert between degree and radian measure and to find the inverse values of a given angle. Given an identity the student will be able to substitute and evaluate to determine a value. The student will be able to recognize the graphs of sine, cosine and

procedures. The student will be able to graph and interpret trigonometric inverses with multiple transformations. The student will apply vectors to three-dimensional situations.	recognize vectors in three-dimensions.	quadrant. The student will verify identities, develop and use formulas (sum and difference, double and half-angles), and solve trigonometric equations. The student will graph the six trigonometric functions and their inverses using amplitude, period, and transformations, as well as modeling periodic data using multiple representations. The student will solve practical problems using the trigonometric functions, the Laws of Sines and Cosines, Heron's Formula, and vectors. Using complex numbers, the student will express them in polar form, perform arithmetic operations, represent them graphically, and apply De Moivre's Theorem.	for any angle in the first quadrant. The student will use identities to solve basic trigonometric equations. Given a graph the student will be able to identify the period and amplitude. The student will be able to graph sine, cosine, and tangent with a change in amplitude. The student will be able to use the Laws of Sine and Cosine to solve right triangles. Given a completed diagram the student will be able to solve simple practical problems. The students can perform operations with complex numbers.	tangent. Given the Law of Sines and Cosines and Heron's formula, the student will be able to substitute and evaluate to determine a value. The student will recognize complex numbers.

M.O.T.3.1	apply and connect the right triangle definition of the six trigonometric functions of an angle to the circular functions and determine the values of the functions of an angle in standard position given a point on the terminal side of the angle.
M.O.T.3.2	determine the values of the other trigonometric functions, given the value of one trigonometric function.
M.O.T.3.3	develop fluent recall of the values of the six trigonometric functions of special angles as related to the unit circle.
M.O.T.3.4	use a calculator to determine the values of the trigonometric functions for any angle and to determine the measure of an angle given the value of one of its trigonometric functions.
M.O.T.3.5	convert angle measures from radians to degrees and vice versa.
M.O.T.3.6	verify trigonometric identities using various methods including basic identities and graphical representation.
M.O.T.3.7	solve trigonometric equations that include both infinite solutions and solutions with a restricted domain.
M.O.T.3.8	find the value of inverse trigonometric functions.
M.O.T.3.9	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).
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.
M.O.T.3.11	solve practical problems involving triangles using the trigonometric functions, the Law of Sines, and the Law of Cosines.
M.O.T.3.12	graph and recognize the graph of the six trigonometric functions. Given an equation in the form of y=aSin(bx+c)+d, identify the domain and range; determine the period, phase shift, amplitude and vertical shift; and sketch at least one period of the graph.
M.O.T.3.13	model periodic data sets using graphs, tables, and equations.
M.O.T.3.14	recognize and graph the inverse of trigonometric functions. Restrictions on the domain will be included.
M.O.T.3.15	develop and use formulas such as sum or difference of two angles, double-angle, and half-angle.
M.O.T.3.16	perform mathematical operations with vectors and apply vectors to solve practical problems.

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 students' 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.

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.
M.O.PS.5.1	distinguish between experimental and theoretical probability.
M.O.PS.5.2	create and interpret data using various methods of displaying circle graphs, histograms, and frequency curves, and make predictions outliers.
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	interpret and calculate measures of central tendency (mean, median, and mode) from data presented in a variety of forms such as 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 tables and graphs or from data created through experimentation.
M.O.PS.5.8	describe individual performances in terms of percentiles, z-scores, and t- scores.
M.O.PS.5.9	describe the role of sampling, randomness, bias, and sample size in data collection and interpretation.
M.O.PS.5.10	test the validity of a hypothesis using statistical concepts including a t-test.
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 is intended for students who have mastered the concepts of Algebra II. Trigonometry is a prerequisite or co-requisite for this course. Pre-calculus will extend students' knowledge of functions and equations (i.e. higher-order functions, exponential, and logarithmic) as well as provide preparation for a calculus course. Calculators, computers, and interactive utilities will be used by students as tools for solving and verifying equations as well as for investigating relations, 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.

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.
M.O.PC.2.1	investigate and sketch the graphs of polynomials and rational functions 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	expand binomials with positive integral exponents by the use of Pascal's triangle and the Binomial Theorem.
M.O.PC.2.4	establish 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	examine 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, logarithmic, exponential, polynomial, rational, radical, problems; explain how the representations are related to each other, as well as to the problem.

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.
M.O.PC.3.1	graph functions and conic sections using transformations.
M.O.PC.3.2	investigate properties and solve practical problems of the conic sections.

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

FORM HD 201
(10-66)

FISCAL NOTE WORKSHEET
(Submit 4 Copies)

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

SUBJECT: State Board Policy 2520.2: Mathematics Content Standard and Objectives for West Virginia Schools FUND _____

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

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

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

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

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

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

No additional current or future cost is expected due to the revision of the content standards and objectives.

DATE: 5/15/04

AGENCY: West Virginia Department of Education

AUTHORIZED REPRESENTATIVE: Steven L. Paine

126CSR44B

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

COMMENT PERIOD ENDS: September 2, 2006

COMMENT RESPONSE FORM

The following form is provided to assist those who choose to comment on Policy 2520.2: 21st Century Mathematics Content Standards and Objectives for West Virginia Schools. Additional sheets may be attached, if necessary.

Name : _____ Organization: _____

Title: _____

Street Address: _____

City: _____ State: _____ Zip: _____

Please check the box below that best describes your role.

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

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

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

Please direct all comments to:

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