WEST VIRGINIA
SECRETARY OF STATE

JOE MANCHIN III

ADMINISTRATIVE LAW DIVISION

Form #2

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OFFICE OF 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. Const., Article XII, § 2; W.Va. Code §18-2-5 and §18-9A-22

AMENDMENT TO AN EXISTING RULE: YES ____ NO X

IF YES, SERIES NUMBER OF RULE BEING AMENDED: _____

TITLE OF RULE BEING AMENDED: _____

IF NO, SERIES NUMBER OF NEW RULE BEING PROPOSED: 44B

TITLE OF RULE BEING PROPOSED: Mathematics Content Standards and Objectives for West Virginia Schools (2520.2)

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 January 10, 2003 AT 4:45 p.m. . ONLY WRITTEN COMMENTS WILL BE ACCEPTED AND ARE TO BE MAILED TO THE FOLLOWING ADDRESS:

Larry Lamb, Coordinator
Office of Instructional Services
West Virginia Department of Education
Capitol Building 6, Room 330
1900 Kanawha Boulevard, East
Charleston, West Virginia 25305

THE ISSUES TO BE HEARD WILL BE LIMITED TO THIS PROPOSED RULE

William J. Luff, Jr.
Deputy State Superintendent of Schools

ATTACH A **BRIEF** SUMMARY OF YOUR PROPOSAL

$14.90

EXECUTIVE SUMMARY

POLICY 2520.2
MATHEMATICS CONTENT STANDARDS AND OBJECTIVES FOR WEST VIRGINIA SCHOOLS

Background:
Policy 2520 defines the content standards and objectives for the programs of study required by Policy 2510 and establishes a standardized format for such. The original effective date of the policy was July, 1997. In October, 2001, a revision of the Policy incorporating the Content Standards and Objectives for Mathematics, Reading and English Language Arts, Science, Social Studies and Technology was presented to the West Virginia Board of Education. It was placed on public comment and was approved by the Board on December 13, 2001, to be effective July 1, 2003. A second revision incorporating content standards and objectives for adult and technical courses was approved by the Board on July 11, 2002, to be effective July 1, 2003.

Purpose:
The purpose of this Board item is to seek approval for Policy 2520.2 to be placed on comment as it has been revised to designate a separate policy for this content area, and to include content standards, objectives, performance descriptors and editorial changes as listed below.

Proposed Revisions:
The current revision makes the following changes to Policy 2520.2:

- It establishes a separate policy for the content standards, objectives and performance descriptors for Mathematics.
- It expands the number of performance levels for each content standard from 3 to 5.
- It adds K-2 Performance Descriptors for Mathematics.
- It includes Performance Descriptors for Algebra I, Geometry, and Algebra II.
- Minor editorial changes were made to correct errors discovered when content standards were used to develop additional performance descriptors.

Slight changes were made to the Foreword, the Explanation of Terms and Abbreviations to reflect the proposed revisions.

126CSR44B

TITLE 126
LEGISLATIVE RULE
BOARD OF EDUCATION

SERIES 44B
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 (or instructional goals) and objectives for mathematics as required by W.Va. 126CSR42 (Policy 2510).

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

1.3. Filing Date.

1.4. Effective Date. July 1, 2003

1.5. Repeal of former rule. This is a new legislative rule.

§126-44B-2. Purpose.

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

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

3.1. A copy of 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.

Foreword

The West Virginia Board of Education and the West Virginia Department of Education are pleased to present Policy 2520.2: Mathematics Content Standards and Objectives for West Virginia Schools.

Committees of educators from across the state gathered to work on curriculum refinement. The committees incorporated content based on the most current research, national standards and best teaching practices in the field. Primary issues that have been addressed in the current revision work are building a rigorous and challenging curriculum, ensuring a curriculum that is accessible to every student, and designing a format that can easily be used and understood.

West Virginia educators have played a key role in shaping the content standards. Their contribution was critical in creating a policy that is meaningful for the classroom.

A primary change in Policy 2520.2 is that the content area begins with a set of content standards. Grade-level objectives are then organized under the standards, so that the focus stays on helping students achieve the comprehensive goals, not just mastering the incremental steps. The objectives (those incremental steps) are still there — curriculum committees worked very hard to consolidate, delete, sequence, and clarify as needed to produce a picture of the curriculum that is clear in its intent and manageable in its implementation.

Another change is the addition of performance descriptors. Performance descriptors answer the question "How well does the student perform on the content standards at any given grade level?" (See "Explanation of Terms" section for further discussion of this topic.)

The content standards, objectives and performance descriptors combine to give teachers a powerful resource for planning instruction. The sequencing of the grade level objectives and the levels of performance descriptors acknowledge that students acquire skills and knowledge in increments and at different rates. The focus throughout the document remains on achieving at a high level and on offering all students in West Virginia rigor and challenge.

David Stewart
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. Five performance levels have been proposed for West Virginia: distinguished, above mastery, mastery, partial mastery and novice. A general description of each of these categories is listed below:

- **Distinguished:** A student at this level has demonstrated exceptional and exemplary performance. The work shows a distinctive and sophisticated application of knowledge and skills that go beyond course or grade level expectations.
- **Above Mastery:** A student at this level has demonstrated competent and proficient performance and exceeds the standard. The work shows a thorough and effective application of knowledge and skills.
- **Mastery:** A student at this level has demonstrated fundamental knowledge and skills that meet the standard. The work is accurate, complete and fulfills all requirements. The work shows solid academic performance at the course or grade level.
- **Partial Mastery:** A student at this level has partially demonstrated fundamental knowledge and skills toward meeting the standard. The work shows basic but inconsistent application of knowledge and skills characterized by errors and/or omissions. Performance needs further development.
- **Novice:** A student at this level has not demonstrated the fundamental knowledge and skills needed to meet the standard. Performance at this level is fragmented and/or incomplete and needs considerable development.

Performance Descriptors serve two functions. Instructionally, they give teachers more information about the level of knowledge and skills they are building in their students. 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 three parts, each part separated by a period:

- The content area code is MA for Mathematics;
- The letter S, for Standard; and
- The standard number.

Illustration: MA refers to Mathematics content standard #1.

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

- The content area code or course code (e.g., PS for Probability and Statistics);

- The grade level (Exceptions are high school mathematics courses, grades 11-12.);
- The number of the content standard addressed; and
- The objective number.

Illustration: MA.6.2.3 refers to a Mathematics sixth grade objective that addresses standard #2 and that it is the third objective listed under that standard.

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

- The content area or course code;
- 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: MA.PD.K.2 refers to Mathematics performance descriptors for kindergarten 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 performance descriptors for fifth grade mathematics, standard #2 will be "200212.MA.PD.5.2".

Abbreviations

Content Area

MA 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

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. 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.

Mathematics Content Standards K-12

Standard 1: Number and Operations (MA.S.1)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Standard 3: Geometry (MA.S.3)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Standard 4: Measurement (MA.S.4)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Standard 5: Data Analysis and Probability (MA.S.5)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

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. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 1: Number and Operations (MA.S.1)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Number and Operations Objectives

Students will:

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

Performance Descriptors (MA.PD.K.1)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in number and operations. The student uses objects to model addition and subtraction facts to ten and writes and explains the corresponding number sentence. The student understands the meaning of addition and subtraction and the relationship between the two operations. The student solves grade level appropriate story problems using multiple strategies and uses clear mathematical language to explain answers in oral and/or picture form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in number and operations. The student identifies place value of numbers up to twenty using expanded form. The student uses objects to model addition and subtraction facts to ten and writes the corresponding number sentence. The student demonstrates the meaning of the commutative property for addition. The student estimates the number of objects up to twenty. The student identifies half of a whole and half of a set of objects. The student solves grade level appropriate story problems.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in number and operations. The student counts forward to twenty and backward from ten with and without objects and knows ordinal numbers to the tenth position. The student models and identifies place value of numbers up to twenty. The student uses objects to model addition and subtraction facts to ten. The student uses models to identify halves and wholes.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in number and operations. Performance needs further development. The student is developing fluency in counting, place value, and grade-level number operations.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in number and operations. Performance needs considerable development in counting, place value and grade-level number operations.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Algebra Objectives
Students will:

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

Performance Descriptors (MA.PD.K.2)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in algebra. The student describes a repeating pattern found in common objects, sound, and movement. The student sorts and classifies objects by three attributes. The student creates and explains a repeating pattern in oral or written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in algebra. The student extends and identifies a repeating pattern found in common objects, sound, and movement. The student sorts and classifies objects by two attributes.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in algebra. The student sorts and classifies objects by one attribute. The student extends a repeating pattern using common objects, sound, and movement. The student models and identifies patterns of counting by 5's and 10's.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in algebra. Performance needs further development. Given the sorting rule, the student sorts objects by one attribute. The students model patterns of counting by 10's.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in algebra. Performance needs considerable development in patterning and sorting.

Standard 3: Geometry (MA.S.3)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Geometry Objectives

Students will:

MA.K.3.1 use physical materials to construct, identify, and classify basic geometric plane shapes: circle, square, rectangle, triangle.

MA.K.3.2 identify basic geometric shapes in the environment.

MA.K.3.3 model and describe spatial relationships: inside/outside, top/bottom, before/after.

MA.K.3.4 identify the separate parts used to make a whole object.

Performance Standards (MA.PD.K.3)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in geometry. The student uses physical materials to construct basic geometric plane shapes: circle, square, rectangle, and triangle. The student uses clear mathematical language to identify basic geometric plane shapes in the environment in oral or written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standards in geometry. The student uses physical materials to identify and classify basic geometric plane shapes: circle, square, rectangle, and triangle. The student describes spatial relationships: inside/outside, top/bottom, and before/after. The student identifies the separate parts used to make a whole object.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in geometry. The student uses physical materials to identify basic geometric plane shapes: circle, square, rectangle, and triangle. The student models spatial relationships: inside/outside, top/bottom, and before/after.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in geometry. Performance needs further development. The student identifies some of the basic geometric plane shapes
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in geometry. Performance needs considerable development in basic geometric shapes and spatial relationships.

Standard 4: Measurement (MA.S.4)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Measurement Objectives

Students will:

MA.K.4.1 estimate the size of an object and compare and order objects with respect to a given attribute.

MA.K.4.2 use standard and nonstandard units of measure to find the length of an object.

MA.K.4.3 compare two objects in nonstandard units of measure, according to one or more of the following attributes: length, height, weight.

MA.K.4.4 name the days of the week and the seasons of the year.

MA.K.4.5 read time to the hour using analog and digital clocks.

MA.K.4.6 identify the name and value of penny, nickel, and dime.

MA.K.4.7 determine the value of a collection of pennies with a total value less than twenty cents.

Performance Descriptors (MA.PD.K.4)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in measurement. The student calculates elapsed time to the hour. The student determines the value of a collection of coins to 25 cents. The student uses varied terminology in telling time. The student solves a wide variety of problems involving measurement and explains solutions orally.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standards in measurement. The student estimates the size of an object and compares and orders objects with respect to a given attribute. The student reads time to the half hour. Starting at any day, the student names the 7 days of the week. The student counts a collection of pennies, nickels, and dimes with a total value of 25 cents or less.. The student trades a collection of pennies and nickels with a value of 10 cents.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in measurement. The student uses standard and nonstandard units to determine length of an object. The student compares two objects according to one or more attributes. The student reads time to the hour and names days of the week and the seasons of the year. The student identifies the name and value of penny, nickel, and dime and determines the value of a collection of pennies with a total value less than twenty cents.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in measurement. Performance needs further development. The student is developing proficiency in measuring length, weight, time, temperature, volume, conversion of units of measurement, and in the calculation of elapsed time and money.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in measurement. Performance needs considerable development in calendar math and skills in calculating time, money, and customary and metric measurement.

Standard 5: Data Analysis and Probability (MA.S.5)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Data Analysis and Probability Objectives

Students will:

MA.K.5.1 collect, sort and organize data as a group project.
MA.K.5.2 construct graphs using objects and pictures.
MA.K.5.3 analyze data represented on a graph using grade level appropriate questions.

Performance Descriptors (MA.PD.K.5)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in data analysis and probability. The student organizes the data in a chart/table and constructs a bar graph. The student analyzes the information and explains it orally.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standards in data analysis and probability. The student organizes the data in a chart/table. The student analyzes data represented on a graph using grade level appropriate questions.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in data analysis and probability. The student collects, sorts, and organizes data as a group project. The student constructs graphs using objects and pictures.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in data analysis and probability. Performance needs further development. The student collects and sorts data as a group project.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in data analysis and probability. Performance needs considerable development in sorting and graphing.

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. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 1: Number and Operations (MA.S.1)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Number and Operations Objectives
Students will:

MA.1.1.1 count forward to 100 and backward from 20 with and without objects.
MA.1.1.2 read, write, order, and compare numbers to 100.
MA.1.1.3 model and identify odd and even numbers to 20 with and without objects.
MA.1.1.4 count and group concrete items by ones, tens, and hundreds.
MA.1.1.5 model and identify place value of each digit utilizing standard and expanded form to 100.
MA.1.1.6 identify and read ordinal numbers 1^{st} - 20^{th}.

MA.1.1.7 estimate the number of objects in a group of 100 or less and count to determine reasonableness of estimate.
MA.1.1.8 identify and name halves, thirds, and fourths as part of a whole and as part of a group using models.
MA.1.1.9 model addition and subtraction of whole numbers using 18 or less items and write the corresponding number sentence.
MA.1.1.10 understand meanings of operations and the relationship between addition and subtraction (e.g., identify element of addition, commutative property, fact families, inverse operations).
MA.1.1.11 memorize basic addition facts with sums to 10 and corresponding subtraction facts.
MA.1.1.12 model 2-digit addition and subtraction without regrouping to solve the algorithm.
MA.1.1.13 add three numbers with a sum of 18 or less.
MA.1.1.14 solve grade level appropriate picture and story problems using multiple strategies.

Performance Descriptors (MA.PD.1.1)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in number and operations. The student adds three numbers with a sum of eighteen or less without a model. The student solves grade level appropriate story problems using multiple strategies and uses clear mathematical language to explain answers in oral and/or written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in number and operations. The student identifies odd and even numbers up to twenty without objects. The student estimates the number of objects in a group of 100 or less and counts to determine reasonableness. The student demonstrates the meaning of the commutative property and the identity elements for addition and subtraction. The student adds and subtracts two-digit numbers without regrouping. The student uses models to identify halves, thirds, and fourths as part of a group. The student solves grade level appropriate picture problems using multiple strategies.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in number and operations. The student counts forward to 100 and backward from twenty with and without objects and knows ordinal numbers to the twentieth position. The student uses models to identify odd and even numbers up to twenty. The student is proficient in place value up to 100. The student has mastered addition and subtraction facts to ten and models and writes facts to eighteen. The student models two-digit addition and subtraction without regrouping. The student understands the relationship between addition and subtraction. The student uses models to identify halves, thirds, and fourths as part of a whole.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in number and operations. Performance needs further development. The student is developing fluency in counting, place value, and grade-level number operations. The student demonstrates mastery of some addition and subtraction facts. The student reads and writes numbers to 100.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in number and operations. Performance needs considerable development in counting, place value, and grade-level number operations. The student reads numbers to 100.

Standard 2: Algebra (MA.S.2)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Algebra Objectives

Students will:

MA.1.2.1 sort and classify objects by more than one attribute.
MA.1.2.2 analyze and create a repeating pattern using common objects and numbers.
MA.1.2.3 use input/output model with grade appropriate functions.
MA.1.2.4 identify and write number patterns by 2's, 5's, and 10's.
MA.1.2.5 identify and represent number patterns using words, AB form, and T-charts.
MA.1.2.6 use models to demonstrate that the quantities on each side of a number sentence are equivalent.

Performance Descriptors (MA.PD.1.2)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in algebra. The students create their own sorting rule for a set of objects. The student creates, analyzes, and explains a repeating pattern in oral or written form. The student uses a number sentence to solve a story problem.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in algebra. Given a table of outputs, the student identifies the rule and gives the input with grade-level appropriate functions. The student identifies number patterns using words, AB form, and T-charts.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in algebra. The student sorts and classifies objects by more than one attribute. The student creates a repeating pattern using common objects and numbers. Given the input and the output, the student identifies the rule with grade-level appropriate functions. The student identifies and writes number patterns by 2's, 5's, and 10's. The student uses models to demonstrate that the quantities on each side of a number sentence are equivalent.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in algebra. Performance needs further development. The student sorts and classifies objects by one attribute. The student completes a pattern by 2's to 20 and 5's and 10's to 100. The student extends a repeating pattern.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in algebra. Performance needs considerable development in using patterns and functions.

Standard 3: Geometry (MA.S.3)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Geometry Objectives

MA.1.3.1 draw and describe triangles, squares, circles, and rectangles according to number of sides and vertices.
MA.1.3.2 use physical materials to construct, identify, and classify three-dimensional figures: cube, cone, sphere, rectangular solid, pyramid, and cylinder.
MA.1.3.3 identify three-dimensional shapes in the environment.
MA.1.3.4 identify and draw open and closed figures.
MA.1.3.5 identify, determine, and draw a line of symmetry.
MA.1.3.6 identify and draw plane shapes that are congruent.
MA.1.3.7 describe spatial relationships: over/under, left/right.
MA.1.3.8 find and name locations with simple relationships on a coordinate system.
MA.1.3.9 describe the shape created by combining two or more two-dimensional shapes.

Performance Descriptors (MA.PD.1.3)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in geometry. The student uses physical materials to classify three-dimensional figures: cube, cone, sphere, rectangular solid, pyramid, and cylinder. The student draws plane shapes that are congruent. The student uses clear mathematical language to identify three-dimensional shapes in the environment in oral or written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standards in geometry. The student uses physical materials to construct three-dimensional figures: cube, cone, sphere, rectangular solid, pyramid, and cylinder. The student describes the shape created by combining two or more two-dimensional shapes.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in geometry. The student draws and describes triangles, squares, circles, and rectangles according to number of sides and vertices. The student uses physical materials to identify three-dimensional figures: cube, cone, sphere, rectangular solid, pyramid, and cylinder. The student identifies and draws open and closed figures. The student identifies, determines, and draws a line of symmetry. The student identifies shapes that are congruent. The student describes spatial relationships over/under, left/right. The student finds and names locations with simple relationships on a coordinate system.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in geometry. Performance needs further development. The student identifies triangles, squares, circles, rectangles and open and closed figures. The student models over/under and left/right. The student creates a new shape by combining two shapes. The student identifies some of the geometric solids.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in geometry. Performance needs considerable development in identifying plane and solid shapes and components, congruency, symmetry, spatial relationships, and coordinate geometry.

Standard 4: Measurement (MA.S.4)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Measurement Objectives

Students will:

MA.1.4.1 estimate, measure, compare and order using customary, metric, and nonstandard units to determine length to nearest whole unit.

MA.1.4.2 understand appropriate grade level conversions within a system of measurement.

MA.1.4.3 compare two objects or events according to one or more of the following attributes: length, height, weight, time, temperature and volume.

MA.1.4.4 name the months of the year and find a date on a monthly calendar.

MA.1.4.5 explain time concept in context of personal experience.

MA.1.4.6 read time to the half hour using an analog and digital clock.

MA.1.4.7 calculate elapsed time to the hour.

MA.1.4.8 identify the name and value of quarter and dollar.

MA.1.4.9 count and trade a collection of pennies, nickels, and dimes with a total value of 100 cents or less.

MA.1.4.10 role-play making change up to a dime.

MA.1.4.11 select the appropriate tools of measurement to determine length, weight, volume and temperature.

Performance Descriptors (MA.PD.1.4)

- **Distinguished**

  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in measurement. The student calculates elapsed time to the half hour. The student mentally calculates money and determines change in real world situations. The student uses varied terminology in telling time. The student solves a wide variety of problems involving measurement and explains solutions in oral and written form.

- **Above Mastery**

  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standards in measurement. The student estimates, measures, and compares using customary, metric, and nonstandard units to determine length, height, weight, time, temperature, and volume. The student reads time to the quarter hour. The student trades money and role-plays making change up to a quarter. The student applies knowledge of measurement tools, units, and conversions in problem-solving situations.

- **Mastery**

  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in measurement. The student uses customary, metric, and nonstandard units to determine length to the nearest whole unit. The student compares two objects or events according to one or more attributes. The student understands appropriate grade level conversions within a system of measurement and selects the appropriate tool needed for measurement. The student explains time in context of personal experience, reads time to the half hour, calculates elapsed time to the hour, and names months of the year and the date on a calendar. The student reads and counts a collection of pennies, nickels, and dimes with a total value of 100 cents or less and role-plays making change up to a dime. The student identifies the name and value of quarter and dollar.

- **Partial Mastery**

  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in measurement. Performance needs further development. The student is developing proficiency in measuring length, weight, time, temperature, volume, conversion of units of measurement, and in the calculation of elapsed time and money.

- **Novice**

  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in measurement. Performance

needs considerable development in calendar math and skills in calculating time, money, and customary and metric measurement.

Standard 5: Data Analysis and Probability (MA.S.5)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Data Analysis and Probability Objectives
Students will:

MA.1.5.1 identify and investigate various forms of data collection.
MA.1.5.2 read and interpret a pictograph with each picture representing a single unit.
MA.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.
MA.1.5.4 discuss events related to students' experiences as likely or unlikely.
MA.1.5.5 tally by one's, organize the data in a chart/table, and construct a bar graph; read and interpret tally charts and tables.
MA.1.5.6 analyze data represented on a graph using grade level appropriate questions.

Performance Descriptors (MA.PD.1.5)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in data analysis and probability. The student formulates questions, collects data, organizes and displays as a chart/graph.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in data analysis and probability. The student tallies by ones, organizes the data in a chart/table, and constructs a bar graph. The student reads and interprets tally charts and tables. The student analyzes data represented on a graph using grade level appropriate questions.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in data analysis and probability. The student identifies and investigates various forms of data collection and reads and interprets a pictograph with each picture representing a single unit. The student organizes the data in a chart/table and constructs a bar graph. The student conducts simple experiments and uses the data to predict which of the events is more likely or less likely to occur if the experiment is repeated. The student discusses events related to his/her experiences as likely or unlikely.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in data analysis and probability. Performance needs further development. The student reads and organizes the data in a chart/table and conducts simple probability experiments.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in data analysis and probability. Performance needs considerable development in tallying, charts, tables, and graphs. The student carries out probability experiments.

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. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 1: Number and Operations (MA.S.1)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Number and Operations Objectives
Students will:

MA.2.1.1 read, write, order, and compare numbers to the thousands place.
MA.2.1.2 identify any number as odd or even.
MA.2.1.3 count and group concrete items by 1's, 10's, 100's, and 1000's.
MA.2.1.4 model and identify place value of each digit utilizing standard and expanded form through 1000.
MA.2.1.5 identify and read any ordinal number.
MA.2.1.6 round to nearer 100 to better understand place value.
MA.2.1.7 identify and name fractions as part of a whole and as part of a group using models.
MA.2.1.8 understand meaning of operations and the relationship between addition and subtraction (e.g., identity element of addition, associative property, commutative property, inverse operations, fact families).
MA.2.1.9 memorize basic addition facts with sums to 18 and corresponding subtraction facts.
MA.2.1.10 model 2- and 3-digit addition and subtraction with regrouping.
MA.2.1.11 use rounding to determine the reasonableness of a sum or a difference.
MA.2.1.12 solve grade level appropriate story problems that require one or two-step solutions using multiple strategies.

Performance Descriptors (MA.PD.2.1)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in number and operations. The student solves two-step grade level appropriate story problems and uses clear mathematical language to explain answers in oral and written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in number and operations. The student demonstrates the meaning of the commutative and associative properties and identity elements for addition and subtraction. The student solves grade level appropriate story problems using multiple strategies.

- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in number and operations. The student is proficient in place value to the thousands place. The student demonstrates mastery of addition and subtraction facts to eighteen. The student models two and three-digit addition and subtraction with regrouping. The student understands the relationship between addition and subtraction. The student identifies fractions as part of a whole and part of a group using models.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in number and operations. Performance needs further development. The student is developing fluency in place value and grade-level number operations. The student demonstrates mastery of some addition and subtraction facts.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in number and operations. Performance needs considerable development in place value and grade-level number operations.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Algebra Objectives
Students will:
MA.2.2.1 analyze, describe, extend and create a growing pattern.
MA.2.2.2 use input/output model with grade appropriate functions.
MA.2.2.3 model and identify patterns of counting by 3's and 4's.
MA.2.2.4 given the rule, complete the pattern.
MA.2.2.5 use models to demonstrate equivalency of two numerical expressions written as a number sentence.

Performance Descriptors (MA.PD.2.2)
- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in algebra. The student creates, analyzes, and explains a growing pattern in oral or written form. The student uses a number sentence to solve a story problem.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in algebra. The student describes and creates a growing pattern. The student creates two equivalent numerical expressions written as a number sentence. Given a table of outputs, the student identifies the rule and gives the input with grade-level appropriate functions.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in algebra. The student extends a growing pattern. Given the input and the output, the student identifies the rule with grade-level appropriate functions. The student models and identifies number patterns by 3's and 4's. The student uses models to demonstrate equivalency of two numerical expressions written as a number sentence.

- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in algebra. Performance needs further development. The student completes the pattern when given the rule. Using a model to demonstrate equivalency, the student completes a number sentence with a given sum.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in algebra. Performance needs considerable development in using patterns, functions, and expressions.

Standard 3: Geometry (MA.S.3)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Geometry Objectives
Students will:

MA.2.3.1 identify and describe a cube, rectangular solid, cylinder, cone, and pyramid according to the number of faces and edges.
MA.2.3.2 compare and contrast plane and solid geometric shapes.
MA.2.3.3 given a design, draw the mirror image.
MA.2.3.4 model line segments and angles.
MA.2.3.5 identify the congruent shape that has been rotated and/or reflected.
MA.2.3.6 plot locations with simple relationships on a coordinate plane.
MA.2.3.7 identify and draw similar shapes.

Performance Descriptors (MA.PD.2.3)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in geometry. The student uses clear mathematical language to compare and contrast plane and solid geometric shapes in oral or written form. The student draws similar and congruent shapes and a symmetrical design.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standards in geometry. Given a design, the student draws the mirror image. The student identifies the congruent shape that has been reflected. The student draws similar shapes.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in geometry. The student identifies and describes a cube, rectangular solid, cylinder, cone, and pyramid according to the number of faces and edges. The student compares and contrasts plane and solid geometric shapes. The student models line segments and angles. The student identifies the congruent shape that has been rotated. The student plots locations with simple relationships on a coordinate plane. The student identifies similar shapes.

- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in geometry. Performance needs further development. The student identifies geometric solids and congruent shapes. The student draws a line of symmetry on a design.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in geometry. Performance needs considerable development in identifying plane and solid shapes and components, congruency and similarity, transformations, and coordinate geometry.

Standard 4: Measurement (MA.S.4)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Measurement Objectives
Students will:

MA.2.4.1	use a ruler to draw and compare lengths given lengths in centimeters and inches.
MA.2.4.2	estimate and determine the perimeter of a polygon.
MA.2.4.3	estimate and count the number of square units needed to cover a given area.
MA.2.4.4	understand appropriate grade level conversions within a system of measurement.
MA.2.4.5	estimate and determine weight/mass of familiar objects in pounds and kilograms.
MA.2.4.6	order events in relation to time.
MA.2.4.7	given a calendar, determine past and future dates of the week and identify specific dates.
MA.2.4.8	read time to the quarter hour using an analog and digital clock.
MA.2.4.9	calculate elapsed time to the half hour.
MA.2.4.10	read and write amounts of money to a dollar.
MA.2.4.11	role-play making change to a dollar.
MA.2.4.12	read Celsius and Fahrenheit thermometers.

Performance Descriptors (MA.PD.2.4)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in measurement. The student models, applies, and explains the formula for the perimeter of a polygon. The student calculates elapsed time to the quarter hour and mentally calculates money and determines change in real world situations. The student uses varied terminology in telling time. The student solves a wide variety of problems involving measurement and explains solutions in oral and written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in measurement. The student estimates and determines the perimeter of a polygon the square units of a given area, and the mass of an object. The student reads time in 5-minute intervals. The student counts amounts of money and role-plays making change up to $5.00. The student applies knowledge of measurement tools, units, and conversions in problem-solving situations.

- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in measurement. The student determines the perimeter of a polygon and the area of a given shape. The student uses appropriate units of measure of mass/weight and length and appropriate conversions within the metric and customary systems. The student orders events, reads time to the nearest quarter hour, calculates elapsed time to the half hour, and identifies specific dates on a calendar. The student reads and writes amounts of money to a dollar and role-plays making change to a dollar. The student reads Celsius and Fahrenheit thermometers.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in measurement. Performance needs further development. The student is developing proficiency in conversion of units of measurement, the use of a formula, and in the calculation of elapsed time and money.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in measurement. Performance needs considerable development in calendar math and skills in calculating time, money, and customary and metric measurement.

Standard 5: Data Analysis and Probability (MA.S.5)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Data Analysis and Probability Objectives
Students will:

MA.2.5.1 create, read, and interpret a pictograph with each picture representing greater than or less than a single unit.
MA.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.
MA.2.5.3 analyze data represented on a graph using grade level appropriate questions.
MA.2.5.4 formulate questions, collect data, organize and display as a chart/graph.

Performance Descriptors (MA.PD.2.5)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in data analysis and probability. The student creates, reads, and interprets a pictograph with each picture representing greater than or less than a simple unit.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in data analysis and probability. The student creates, reads, and interprets a pictograph with each picture representing a single unit. The student formulates questions, collects data, organizes and displays as a chart/graph.

- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in data analysis and probability. The student reads and interprets a pictograph with each picture representing greater than or less than a single unit. The student conducts simple experiments with more than two outcomes and uses the data to predict which event is more, less, or equally likely to occur if the experiment is repeated.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in data analysis and probability. Performance needs further development. The student reads data in a chart, table, and a graph. The student carries out experiments and uses the data to predict which of the events is more likely or less likely to occur if the experiment is repeated.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in data analysis and probability. Performance needs considerable development in in charts, tables, and graphs. The student carries out probability experiments.

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 through five with corresponding division facts. Additional concepts include gathering and organizing data, estimating and performing measurements. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 1: Number and Operations (MA.S.1)
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 estimate

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Number and Operations Objectives
Students will:

MA.3.1.1 read, write, order, and compare numbers to the ten thousands place.
MA.3.1.2 read, write, order, and compare decimals to hundredths with models.
MA.3.1.3 identify place value of each digit utilizing standard and expanded form through 10,000.
MA.3.1.4 estimate to nearer 1000 using rounding, benchmarks, and compatible numbers to determine reasonableness of an answer.
MA.3.1.5 identify fractions as part of a whole/one and as part of a group using models and pictorial representations.
MA.3.1.6 compare and order fractions with like and unlike denominators using concrete models.
MA.3.1.7 add and subtract fractions with like denominators using concrete models and pictorial representations.
MA.3.1.8 recognize and model equivalent fractions using concrete materials.
MA.3.1.9 recognize and model proper and improper fractions and mixed numbers.

MA.3.1.10 add and subtract 2- and 3-digit whole numbers and money without and with regrouping.
MA.3.1.11 understand multiplication as repeated addition and division as repeated subtraction.
MA.3.1.12 understand meanings of operations and the relationship between multiplication and division (e.g., identity element of multiplication, commutative property, property of zero, fact families, associative property).
MA.3.1.13 memorize basic multiplication facts 0-5 and the corresponding division facts.
MA.3.1.14 model multiplication of 2- and 3-digit numbers by a 1-digit number.
MA.3.1.15 model division of 2- and 3-digit numbers by a 1-digit number.
MA.3.1.16 solve grade level appropriate story problems using multiple strategies.

Performance Descriptors (MA.PD.3.1)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in number and operations. The student has mastered all basic facts and can multiply and divide two and three-digit numbers by one digit. The student uses clear mathematical language to explain answers in oral and written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in number and operations. The student demonstrates the meaning of the commutative and associative properties and identity elements for multiplication and division. The student applies estimation strategies to determine reasonableness of answers and solves grade level appropriate story problems using multiple strategies.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in number and operations. The student is proficient in place value to the ten thousands place and models decimals to the hundredths place. The student masters multiplication and division facts through the fives. The student adds and subtracts two and three-digit numbers and money and understands the concepts of multiplication and division. The student identifies fractions as part of a whole and part of a group and uses concrete materials or pictorial representations to compare and order fractions and to model mixed numbers, improper fractions, and equivalent fractions.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in number and operations. Performance needs further development. The student is developing fluency in place value and grade-level number operations and can identify a fraction that is part of a whole.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in number and operations. Performance needs considerable development in place value and grade-level number operations.

Standard 2: Algebra (MA.S.2)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Algebra Objectives

Students will:

MA.3.2.1 analyze and complete a geometric pattern.
MA.3.2.2 use input/output model with grade appropriate functions.
MA.3.2.3 identify and write number patterns of 3's and 4's.
MA.3.2.4 identify and write the rule of a given pattern.
MA.3.2.5 write equivalent numerical expressions.
MA.3.2.6 represent the idea of a variable as an unknown quantity using a symbol.

Performance Descriptors (MA.PD.3.2)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in algebra. The student writes equivalent numerical expressions using different operations on both sides of the equation. The student translates a word problem into an equation using a variable. The student describes any pattern in oral and written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in algebra. Given a table of outputs, the student identifies the rule and gives the input with grade-level appropriate functions. The student identifies and writes the rule of any given pattern. The student writes equivalent numerical expressions using different operations.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in algebra. The student analyzes and completes a geometric pattern. Given the input and the output, the student identifies the rule with grade-level appropriate functions. The student identifies and writes number patterns of 3's and 4's. The student represents the idea of a variable as an unknown quantity using a symbol. The student writes equivalent numerical expressions using the same operation.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in algebra. Performance needs further development. The student continues a pattern when given the rule. Given the input and the rule, the student identifies the output with grade-level appropriate functions. The student completes a geometric pattern.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in algebra. Performance needs considerable development in using patterns, functions, and expressions.

Standard 3: Geometry (MA.S.3)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Geometry Objectives

Students will:

MA.3.3.1 identify basic polygons and their components through decagon.

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

Performance Descriptors (MA.PD.3.3)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in geometry. The student uses clear mathematical language to compare basic polygons and their components through decagon in oral or written form. The student draws plane figures and constructs solids given geometric properties.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in geometry. The student identifies basic polygons and their components through decagon. Given an example of a model, the student draws an example of a reflection (flip). The student plots a point on a one-quadrant grid.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in geometry. The student identifies basic polygons and their components through hexagon. The student identifies and describes a cube, rectangular solid, cylinder, cone, and pyramid according to the number of faces, edges, and vertices. From a plane drawing (a net), the student constructs and identifies the solid figure. The student identifies and draws lines of symmetry and right, obtuse, and acute angles. The student models and describes lines and rays. Given a model, the student draws an example of a translation (slide) and a rotation (turn). The student names the location of a point on a one-quadrant grid.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in geometry. Performance needs further development. The student identifies a cube, rectangular solid, cylinder, cone, and pyramid according to the number of faces and edges. The student identifies lines of symmetry and right, obtuse, and acute angles. Given an object, the student demonstrates reflection (flip), translation (slide), and a rotation (turn).
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in geometry. Performance needs considerable development in identifying plane and solid figures, symmetry, angles, and transformations.

Standard 4: Measurement (MA.S.4)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Measurement Objectives

Students will:

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

Performance Descriptors (MA.PD.3.4)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in measurement. The student models, applies, and explains the formula for the area of a rectangle and the volume of a rectangular consistent and accurate. The student calculates elapsed time and mentally calculates money and determines change in real world situations. The student solves a wide variety of problems involving measurement and explains solutions in oral and written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in measurement. The student models and applies the formula for the area of a rectangle and the volume of a rectangular consistent and accurate. The student role-plays making change up to $10.00. The student applies knowledge of measurement tools, units, and conversions in problem-solving situations.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in measurement. The student discovers through modeling, the formula for finding the area of a rectangle and the volume of a rectangular consistent and accurate. The student uses appropriate units of measure of mass/weight and length and appropriate conversions within the metric and customary systems. The student reads time to 5-minute intervals and calculates elapsed time to quarter-hour. The student reads and writes amounts of money to $100.00. The student reads and recognizes common temperatures of Celsius and Fahrenheit.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in measurement. Performance needs further development. The student is developing proficiency in conversion of units of measurement, the use of a formula, and in the calculation of elapsed time and money.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in measurement. Performance needs considerable development in calculating time, money, and customary and metric measurement.

Standard 5: Data Analysis and Probability (MA.S.5)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Data Analysis and Probability Objectives

Students will:

MA.3.5.1 collect data from observation, surveys, and experiments, and construct and label a graph.

MA.3.5.2 use a timeline to determine a sequence of events.

MA.3.5.3 experiment and describe concepts of probability and chance and list possible outcomes from a sampling.

MA.3.5.4 analyze data represented on a graph by generating questions using grade level appropriate questions.

Performance Descriptors (MA.PD.3.5)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in data analysis and probability. The student analyzes data represented on a graph or an experiment by generating questions and calculating the mean.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standards in data analysis and probability. The student interprets data displayed in a chart, table, and a graph. The student constructs a timeline to determine a sequence of events. The student experiments and describes concepts of probability and chance and lists possible outcomes from a sampling.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in data analysis and probability. The student collects data from observation, surveys, and experiments, and constructs and labels a graph. The student uses a timeline to determine a sequence of events. The student experiments and describes concepts of probability and chance.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in data analysis and probability. Performance needs further development. The student reads data in a chart, table, and a graph. The student carries out experiments to determine probabilities.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in data analysis and probability. Performance needs considerable development in using appropriate statistical methods to analyze data. The student carries out probability experiments.

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, 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. West Virginia teachers are responsible for analyzing the benefits of

technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 1: Number and Operations (MA.S.1)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Number and Operations Objectives
Students will:

MA.4.1.1 read, write, order, and compare numbers to the millions place.
MA.4.1.2 read, write, order, and compare decimals to thousandths with and without models and pictorial representations.
MA.4.1.3 identify place value of each digit utilizing standard and expanded form through 1,000,000.
MA.4.1.4 estimate to nearer 10,000 using rounding, benchmarks, and compatible numbers and identify over and under estimates to determine reasonableness of an answer.
MA.4.1.5 compare and order fractions with like and unlike denominators using pictorial representations.
MA.4.1.6 add and subtract fractions with like and unlike denominators using pictorial representations.
MA.4.1.7 recognize and model equivalent fractions using pictorial representations.
MA.4.1.8 model addition and subtraction of mixed numbers without and with regrouping to solve the algorithm.
MA.4.1.9 understand the relationship of fractions to decimals using concrete objects and pictorial representations.
MA.4.1.10 round decimals to the nearest whole, 10^{th}, or 100^{th}.
MA.4.1.11 add and subtract decimals to the 1000^{th} place.
MA.4.1.12 apply the distributive property of multiplication over addition.
MA.4.1.13 memorize basic multiplication facts and corresponding division facts.
MA.4.1.14 multiply 2-and 3-digit numbers by 1- and 2-digit numbers.
MA.4.1.15 divide 2-and 3-digit numbers by 1-and 2-digit numbers.
MA.4.1.16 apply the order of operations in solving problems.
MA.4.1.17 solve grade level appropriate story problems using multiple strategies.
MA.4.1.18 develop fluency in addition and subtraction of all whole numbers.

Performance Descriptors (MA.PD.4.1)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in number and operations. The student applies the order of operations and the distributive property of multiplication over addition to solve problems. The student uses clear mathematical language to explain answers in oral and written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in number and operations. The student is proficient in comparing and ordering decimals to thousandths without models and in multiplying and dividing by two-digit numbers. The student applies estimation strategies to determine reasonableness of answers and solves grade level appropriate story problems using multiple strategies.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in number and operations. The student is fluent in place value from the millions place to the hundredths place and has mastered all the basic facts. The student is proficient in adding and subtracting whole

numbers and decimals and multiplies and divides by one-digit numbers. The student adds and subtracts fractions and demonstrates equivalence of fractions with models or pictorial representations.

- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in number and operations. Performance needs further development. The student is developing fluency in place value and grade-level number operations. All basic facts have not been mastered.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in number and operations. Performance needs considerable development in place value and grade-level number operations.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Algebra Objectives
Students will:

MA.4.2.1 solve problems involving patterns.
MA.4.2.2 use input/output model with grade appropriate functions.
MA.4.2.3 understand the relationship between number patterns and multiples.
MA.4.2.4 use patterns to predict the nth term.
MA.4.2.5 represent the idea of a variable as an unknown quantity using a letter.

Performance Descriptors (MA.PD.4.2)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in algebra. The student generates a variety of sophisticated growing and real world patterns. The student translates a word problem into an equation using a variable, solves the problem, and justifies the solution in oral or written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in algebra. Given a table of outputs, the student identifies the rule and gives the input with grade-level appropriate functions. The student translates a word problem into an equation using a variable and solves the problem.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in algebra. The student solves problems involving patterns, predicts the nth terms, and understands the relationship between number patterns and multiples. Given the input and the output, the student identifies the rule with grade-level appropriate functions. The student represents the idea of a variable as an unknown quantity using a letter.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in algebra. Performance needs further development. The student continues a pattern when given the rule. Given the input and the rule, the student identifies the output with grade-level appropriate functions.

- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in algebra. Performance needs considerable development in using patterns, functions, and expressions.

Standard 3: Geometry (MA.S.3)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Geometry Objectives
Students will:

MA.4.3.1 identify plane figures and their components.
MA.4.3.2 compare and contrast quadrilateral shapes.
MA.4.3.3 describe three-dimensional objects from different perspectives.
MA.4.3.4 identify and draw intersecting, parallel, and perpendicular lines.
MA.4.3.5 draw, label, compare, and classify acute, right, and obtuse angles.
MA.4.3.6 draw a design with one line of symmetry.
MA.4.3.7 graph/plot ordered pairs on a one-quadrant grid.
MA.4.3.8 draw and identify parts of a circle: center point, diameter, and radius.

Performance Descriptors (MA.PD.4.3)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in geometry. The student uses clear mathematical language to compare quadrilateral shapes in oral or written form. The student draws or creates figures that include given geometric properties.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in geometry. The student describes three-dimensional objects from different perspectives. The student labels, compares, and classifies angles. The student identifies designs with more than one line of symmetry.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in geometry. The student identifies plane figures and their components and compares and contrasts quadrilateral shapes. The student identifies and draws intersecting, parallel, and perpendicular lines, acute, right, and obtuse angles, and parts of a circle: center point, diameter, and radius. The student draws a design with one line of symmetry and graphs/plots ordered pairs on a one-quadrant grid.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in geometry. Performance needs further development. The student identifies quadrilaterals, angles, intersecting, parallel, and perpendicular lines, and the center point and diameter of a circle. The student identifies a design with one line of symmetry.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in geometry. Performance needs considerable development in classifying quadrilaterals and identifying plane and solid figures.

Standard 4: Measurement (MA.S.4)
Students will:

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Measurement Objectives
Students will:

MA.4.4.1 estimate, measure, compare, order and draw lengths using customary and metric units.
MA.4.4.2 determine and compare areas of rectangles and squares by multiplying length and width.
MA.4.4.3 discover through modeling the formula for volume of a rectangular prism.
MA.4.4.4 understand appropriate grade level conversions within a system of measure.
MA.4.4.5 read scales of weight, capacity, and temperature and select appropriate unit.
MA.4.4.6 read time to the minute.
MA.4.4.7 determine elapsed time in hours/ minutes within a 24-hour period.
MA.4.4.8 count coins and bills and determine correct change.

Performance Descriptors (MA.PD.4.4)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in measurement. The student models, applies, and explains the formulas for area of rectangles and squares. The student calculates elapsed time involving more than a 24-hour span and mentally calculates money and determines change. The student solves a wide variety of problems involving measurement and explains solutions in oral and written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in measurement. The student models and applies the formulas for area of rectangles and squares and volume of a rectangular prism. The student applies knowledge of measurement tools, units, and conversions in problem-solving situations.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in measurement. The student demonstrates understanding of the relationship between area and perimeter of plane figures. The student applies the formulas for finding the area of rectangles and squares and discovers through modeling, the formula for the volume of a rectangular prism. The student selects appropriate tools, formulas, and/or units of measure of capacity/volume, length, and temperature and uses appropriate conversions within the metric and customary systems. The student reads time to the minute and calculates elapsed time within a 24-hour span. The student counts coins and bills and determines correct change.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in measurement. Performance needs further development. The student is developing proficiency in conversion of units of measurement, the use of formulas, and in the calculation of elapsed time and money.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in measurement. Performance needs considerable development in calculating time, money, and customary and metric measurement.

Standard 5: Data Analysis and Probability (MA.S.5)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Data Analysis and Probability Objectives
Students will:

MA.4.5.1 understand and reason about the use and misuse of statistics in our society.
MA.4.5.2 read and interpret information represented on a circle graph.
MA.4.5.3 collect, organize, display, read and interpret data from a problem solving situation in line graphs, bar graphs, tally charts and tables with scale increments greater than one.
MA.4.5.4 list all possible outcomes for an experiment using a tree diagram.
MA.4.5.5 determine mean, median, mode and range from collected data.

Performance Descriptors (MA.PD.4.5)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in data analysis and probability. The student chooses the most appropriate statistical method, collects, organizes and displays data, analyzes the data, and formulates questions based on the data. The student explains the relationship between the theoretical and experimental probability of an event in oral and/or written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in data analysis and probability. The student analyzes data displayed in a chart, table, graph, and/or tree diagram. The student understands and reasons about the use and misuse of statistics in our society.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in data analysis and probability. The student reads and interprets information represented on a circle graph. The student collects, organizes, displays, reads, and interprets data from a problem-solving situation in line graphs, bar graphs, tally charts, and tables with scale increments greater than one. The student determines mean, median, mode, and range from collected data. The student lists all possible outcomes for an experiment using a tree diagram.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in data analysis and probability. Performance needs further development. The student reads data in a chart, table, graph, and a tree diagram. The student carries out experiments to determine probabilities.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in data analysis and probability. Performance needs considerable development in using appropriate statistical methods to analyze data. The student carries out probability experiments.

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, plot points on a coordinate plane, 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. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 1: Number and Operations (MA.S.1)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Number and Operations Objectives
Students will:

MA.5.1.1 read, write, order and compare all whole numbers.
MA.5.1.2 read, write, order and compare all decimals.
MA.5.1.3 identify place value of each digit utilizing standard and expanded form in any whole number.
MA.5.1.4 estimate with whole numbers and decimals, including money, to determine reasonableness of an answer.
MA.5.1.5 identify and use the divisibility rules of 2, 3, 5, 9 and 10.
MA.5.1.6 compare and order fractions, improper fractions and mixed numbers with like and unlike denominators (e.g., greatest common factor, lowest common multiple).
MA.5.1.7 model and write equivalencies of fractions, decimals, percents, and ratios.
MA.5.1.8 add and subtract fractions and mixed numbers.
MA.5.1.9 model multiplication and division of fractions to solve the algorithm.
MA.5.1.10 model multiplication of decimals and division of decimals by a whole number divisor to solve the algorithm.
MA.5.1.11 develop fluency in addition, subtraction, multiplication and division of whole numbers.
MA.5.1.12 solve grade level appropriate story problems using multiple strategies.

Performance Descriptors (MA.PD.5.1)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in number and operations. The student multiplies and divides fractions and decimals without models. The student uses clear mathematical language to explain answers in oral and written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in number and operations. The student is proficient in comparing and ordering fractions and decimals. The student applies estimation strategies to determine reasonableness of answers and solves grade level appropriate story problems using multiple strategies.

- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in number and operations. The student is fluent in place value and operations with whole numbers. The student is proficient in adding and subtracting fractions and mixed numbers and models multiplication and division of fractions and decimals. The student demonstrates an understanding of equivalence of fractions, decimals, percents, and ratios with models.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in number and operations. Performance needs further development. The student is developing fluency in whole number operations and place value. The student is not consistently able to accurately add and subtract fractions.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in number and operations. Performance needs considerable development in place value and some operations with whole numbers.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Algebra Objectives
Students will:

MA.5.2.1 explore a variety of patterns with missing elements (e.g., square numbers, powers, triangular numbers, arithmetic sequences).
MA.5.2.2 use input/output model with grade appropriate functions.
MA.5.2.3 write an equation using a variable to solve problems.
MA.5.2.4 evaluate an expression given a value for the variable.

Performance Descriptors (MA.PD.5.2)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in algebra. The student generates a variety of patterns with missing elements. The student translates a word problem into an equation using a variable, solves the problem, and justifies the solution in oral or written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in algebra. The student explores a variety of patterns with missing elements with square numbers, powers, and triangular numbers. Given a table of outputs, the student identifies the rule and gives the input with grade-level appropriate functions. The student translates a word problem into an equation using a variable and solves the problem.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in algebra. The student explores a variety of patterns with missing elements with arithmetic sequences. Given the input and the output, the student identifies the rule with grade-level appropriate functions. The student evaluates an expression given a value for the variable. The student translates a word problem into an equation using a variable.

- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in algebra. Performance needs further development. The student continues a pattern with missing elements when given the rule. Given the input and the rule, the student identifies the output with grade-level appropriate functions. The student solves an equation with a variable.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in algebra. Performance needs considerable development in using patterns, functions, expressions, and equations with variables.

Standard 3: Geometry (MA.S.3)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Geometry Objectives
Students will:

MA.5.3.1 classify and compare polygons.
MA.5.3.2 construct a 3-dimensional figure from different views (orthogonal drawings).
MA.5.3.3 measure angles using a protractor.
MA.5.3.4 draw a design with more than one line of symmetry.
MA.5.3.5 recognize the images of figures after reflections, translations and rotations.
MA.5.3.6 draw a similar figure using a scale.

Performance Descriptors (MA.PD.5.3)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in geometry. The student uses clear mathematical language and more than one characteristic to compare polygons in oral or written form. The student describes a series of motions of a figure that has been transformed.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in geometry. The student constructs a three-dimensional figure from orthogonal drawings. The student draws a similar figure using a scale.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in geometry. The student classifies and compares polygons. The student measures angles using a protractor and draws a design with more than one line of symmetry. The student recognizes the images of figures after reflections, translations, and rotations.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in geometry. Performance needs further development. The student identifies and classifies polygons and identifies lines of symmetry in a design. The student identifies a figure that is drawn to scale.

- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in geometry. Performance needs considerable development in classifying polygons, constructing three-dimensional figures, and recognizing transformations.

Standard 4: Measurement (MA.S.4)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Measurement Objectives
Students will:

MA.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.
MA.5.4.2 determine and compare area of triangles and parallelograms using appropriate formula.
MA.5.4.3 solve problems using the formulas for determining volume of a rectangular prism.
MA.5.4.4 understand the relationship between area and perimeter of a plane figure.
MA.5.4.5 understand appropriate grade level conversions within a system of measure and apply to problem solving situations.
MA.5.4.6 evaluate and/or measure the weight/mass of real objects in ounces, pounds, tons, grams, and kilograms.
MA.5.4.7 calculate elapsed time.
MA.5.4.8 select appropriate customary and metric units and the tools for measuring to desired degree of precision.
MA.5.4.9 determine actual measurement from scale drawings.

Performance Descriptors (MA.PD.5.4)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in measurement. The student models, applies, and explains the formulas for area of triangles and parallelograms. The student solves a wide variety of problems involving measurement and explains solutions in oral and written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in measurement. The student models and applies the formulas for area of triangles and parallelograms and volume of a rectangular prism. The student applies knowledge of measurement tools, units, and conversions in problem-solving situations.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in measurement. The student demonstrates understanding of the relationship between area and perimeter of plane figures. The student applies the formulas for finding the area of triangles and parallelograms and the volume of rectangular prism. The student selects appropriate tools, formulas, and/or units of measure of mass/weight and uses appropriate conversions within the metric and customary systems. The student calculates elapsed time involving more than a 24-hour span.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in measurement. Performance needs further development. The student calculates elapsed time within a 24-hour span. The student is developing proficiency in conversion of units of measurement and the use of formulas.

- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in measurement. Performance needs considerable development in using measurement tools, units, and conversions.

Standard 5: Data Analysis and Probability (MA.S.5)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Data Analysis and Probability Objectives
Students will:

MA.5.5.1 collect, organize, display, read and interpret data from a problem-solving situation in a stem and leaf plot.
MA.5.5.2 identify probabilities and solve problems involving the probability of an event by using tree diagrams or by construction of a sample space representing all possible results.
MA.5.5.3 construct, read, or interpret tables, charts, and graphs to draw reasonable inferences or verify predictions.
MA.5.5.4 carry out experiments to determine probability.
MA.5.5.5 construct a circle graph.

Performance Descriptors (MA.PD.5.5)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in data analysis and probability. The student chooses the most appropriate statistical method, collects, organizes and displays data, analyzes the data, and formulates questions based on the data. The student explains the relationship between the theoretical and experimental probability of an event in oral and/or written form.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in data analysis and probability. The student interprets data displayed in a chart, table, graph, and/or stem and leaf plot. The student constructs a sample space and/or uses a tree diagram to represent the probability of an event.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in data analysis and probability. The student collects, organizes, displays, and reads data in a chart, table, graph, and/or stem and leaf plot. The student constructs, reads, or interprets tables, charts, and graphs to draw reasonable inferences or verify predictions. The student constructs a circle graph. The student carries out experiments to determine probabilities and interprets the results.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in data analysis and probability. Performance needs further development. The student reads data in a chart, table, graph, and stem and leaf plot. The student carries out experiments to determine probabilities.

- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in data analysis and probability. Performance needs considerable development in using appropriate statistical methods to analyze data. The student carries out probability experiments.

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. 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. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 1: Number and Operations (MA.S.1)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Number and Operations Objectives
Students will:

MA.6.1.1 read, write, order, and compare numbers using scientific notation.
MA.6.1.2 identify prime and composite numbers up to 100.
MA.6.1.3 use prime factorization to determine the greatest common factor and least common multiple.
MA.6.1.4 identify and represent integers on a number line.
MA.6.1.5 use estimation to solve problems with whole numbers, fractions and decimals.
MA.6.1.6 solve problems in context involving addition, subtraction, multiplication, and division of whole numbers, fractions, mixed numbers and decimals.
MA.6.1.7 identify, demonstrate, and apply the distributive, commutative, associative and identity properties.
MA.6.1.8 convert between fractions, mixed numbers, decimals and percents.
MA.6.1.9 find the percent of a number.

Performance Descriptors (MA.PD.6.1)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in number and operations. The student identifies prime, composite, and relatively prime numbers and represents numbers with prime factors in exponential form. The student applies prime factorization to determine the greatest common factor and least common multiple. The student converts between fractions, mixed numbers, decimals, and percents, and finds the percent of a number to solve application problems. The student compares and orders integers and applies commutative, associative, distributive, and identity properties as well as a variety of estimation strategies in problem solving. The student evaluates and justifies the reasonableness of

solutions to problems involving integers, whole numbers, decimals, fractions, mixed numbers, and scientific notation.

- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in number and operations. The student identifies prime and composite numbers up to 100 and represents numbers with prime factors in exponential form. The student compares and orders integers and determines the greatest common factor, least common multiple and prime factorization. The student reads, writes, orders, and compares numbers using scientific notation. The student converts between fractions, mixed numbers, decimals, and percents, and calculates the percent of a number. The student solves problems and evaluates the reasonableness of solutions involving integers, whole numbers, decimals, fractions and mixed numbers applying the commutative, associative, distributive, and identity properties appropriately as well as a variety of estimation strategies.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in number and operations. The student determines greatest common factor, least common multiple and prime factorization and identifies prime and composite numbers up to 100. The student reads, writes, orders, and compares numbers using scientific notation. The student converts between fractions, mixed numbers, decimals, and percents, and calculates the percent of a number. The student solves problems involving decimals, fractions and mixed numbers applying the commutative, associative, distributive, and identity properties appropriately as well as a variety of estimation strategies.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in number and operations. Performance needs further development. The student reads, writes, orders, and compares numbers. The student identifies factors, multiples, prime and composite numbers up to 100, and commutative, associative, and identity properties. The student represents integers on a number line and converts between fractions and mixed numbers. The student applies estimation strategies and solves problems involving basic operations with whole numbers and decimals.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in number and operations. Performance needs considerable development. The student reads, writes, orders, and compares numbers. The student recognizes factors and multiples, represents integers on a number line, and identifies the commutative, associative, and identity properties. The student inconsistently converts between fractions and mixed numbers.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Algebra Objectives
Students will:

MA.6.2.1 simplify numerical expressions using order of operations.
MA.6.2.2 identify missing elements in arithmetic and geometric patterns.
MA.6.2.3 explore a variety of patterns, including perfect squares, square roots and exponents.
MA.6.2.4 use input/output models and spreadsheets to evaluate functions.
MA.6.2.5 solve a proportion using cross multiplication.

MA.6.2.6 identify like terms and monomials.
MA.6.2.7 model addition, subtraction, multiplication and division of integers.
MA.6.2.8 locate and plot points within the four quadrants.
MA.6.2.9 use variables to represent and solve real world problems appropriate for the 6th grade using multiple strategies.

Performance Descriptors (MA.PD.6.2)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in algebra. The student creates arithmetic and geometric patterns, uses models and functions to solve problems involving variables, and combines like terms to simplify numerical expressions. The student uses variables, proportions, and the Cartesian Plane to solve real world problems. Students evaluate and justify solutions in a clear and concise manner.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in algebra. The student continues and/ or completes arithmetic and geometric patterns, determines points in four quadrants, and solves problems involving monomials, algebraic expressions, and patterns. The student identifies like terms and monomials, simplifies numerical expressions, solves proportions, and uses input/ output models to evaluate functions. The student uses variables to solve real world problems and to evaluate the reasonableness of solutions.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in algebra. The student identifies missing elements in arithmetic and geometric patterns, explores patterns including perfect squares, square roots and exponents, and uses manipulatives to model and solve problems involving monomials, algebraic expressions, and patterns. The student simplifies numerical expressions using order of operations, solves proportions using cross multiplication, and plots points in four quadrants. The student uses input/ output models to evaluate functions, identifies like terms and monomials, and uses variables to represent and solve real world problems.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in algebra. Work is characterized by errors or omissions and does not yet meet the standard. Performance needs further development. The student inconsistently solves proportions by cross-multiplying, plots points in the Cartesian Plane, simplifies numerical expressions, and uses manipulatives and/ or drawings to model monomials and algebraic expressions.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in algebra. Performance needs considerable development. The student identifies arithmetic and geometric patterns, identify like terms and monomials, and plots points in the first quadrant.

Standard 3: Geometry (MA.S.3)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Geometry Objectives
Students will:
MA.6.3.1 classify lines as parallel, intersecting, perpendicular or skew.
MA.6.3.2 determine the sum of measures of angles in polygons.
MA.6.3.3 bisect a line segment using a compass and straightedge.
MA.6.3.4 draw an angle of a given measure.
MA.6.3.5 identify line symmetry and rotational symmetry in plane figures.
MA.6.3.6 define and sketch similar and congruent plane geometric figures.

Performance Descriptors (MA.PD.6.3)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in geometry. The student constructs congruent segments and angles, and perpendicular and angle bisectors. The student compares and contrasts line and rotational symmetry in local architecture and/ or pictures. The student draws and measures angles, investigates a pattern for the sum of the measures of the interior angles in polygons, and applies properties of symmetry to solve problems in plane geometric figure. The student explains and justifies solutions.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in geometry. The student constructs congruent segments and angles. The student locates and identifies geometric designs in the community. The student draws and measures given angles, determines the sum of the measures of the angles in polygons, and defines and sketches similar and congruent plane geometric figures.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in geometry. The student classifies lines as: parallel, intersecting, perpendicular or skew; bisects a line segment, and identifies line and rotational symmetry in plane figures. The student draws an angle of a given measure, determines the sum of the measures of the angles in polygons, and defines and sketches similar and congruent plane geometric figures.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in geometry. Performance needs further development. The student classifies lines as parallel, intersecting, and/or perpendicular. The student calculates the sum of the measures of a triangle and quadrilateral, but exhibits errors in calculating the sums of measures of other polygons. With assistance, the student bisects line segments, draws an angle of a given measure, and sketches similar and congruent plane geometric figures.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in geometry. Performance needs considerable development. The student classifies lines as parallel or intersecting and recognizes acute, obtuse and right angles with inconsistency.

Standard 4: Measurement (MA.S.4)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Measurement Objectives

Students will:

MA.6.4.1 derive approximation for pi using actual measurements.

MA.6.4.2 apply formulas to determine perimeter, circumference and/or area of plane figures including compound figures.

MA.6.4.3 investigate and model volume and surface area.

MA.6.4.4 select appropriate units and determine length, weight/mass and capacity/volume using metric and customary systems.

MA.6.4.5 construct scale drawings.

Performance Descriptors (MA.PD.6.4)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in measurement. The student applies calculations of pi, circumference, area, perimeter of plane figures, volume and surface area of three-dimensional figures to real world problems, and gives solutions in appropriate units. Students use scale factor of similar plane figures and other strategies to solve application problems related to measurement. The student converts between units of measure within and between the metric and customary systems and evaluates and justifies solutions in a clear and concise manner.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in measurement. The student calculates pi, circumference, area, perimeter of plane figures, volume and surface area of three-dimensional figures, and gives solutions in appropriate units. Students determine scale factor of similar plane figures and solve application problems related to measurement. The student converts between units of measure within the metric and customary systems to solve application problems and evaluates his/her solutions.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in measurement. The student derives an approximation of pi and calculates circumference, area, and perimeter of plane figures, volume and surface area of three-dimensional figures, and gives solutions in appropriate units. The student determine scale factor of similar plane figures and solve problems related to measurement. Students convert between units of measure within the metric and customary systems.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in measurement. Performance needs further development. The student calculates circumference, area, and perimeter of plane figures and volume of rectangular prisms using appropriate units. Students determine scale factor of similar plane figures. Students convert between units of measure within the customary system.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in measurement. Performance needs considerable development. The student demonstrates need when calculating area and perimeter of plane figures. The student has great difficulty converting between units of measure.

Standard 5: Data Analysis and Probability (MA.S.5)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Data Analysis and Probability Objectives

Students will:

MA.6.5.1 collect, organize, display, and read data using appropriate graphs and tables.
MA.6.5.2 interpret data using mean, median, mode, and range.
MA.6.5.3 determine the probability of a given event and express that probability as a ratio, decimal or percent.
MA.6.5.4 determine combinations, permutations and probability using sample spaces (by listing and tree diagrams).

Performance Descriptors (MA.PD.6.5)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in data analysis and probability. The student constructs graphs and interprets measures of central tendency and dispersion. The student makes conjectures about the outcomes of events based on simulations and solves problems involving probability, combinations, and/or permutations. The student evaluates and justifies solutions in a clear and concise manner.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in data analysis and probability. The student predicts, collects, organizes, displays, and uses measures of central tendency to interpret data from graphs and tables. The student solves problems involving probability, combinations, and/or permutations. The student evaluates solutions.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in data analysis and probability. The student collects, organizes, displays, and uses the mean, median, mode, and range to interpret data from graphs and tables. The student expresses probability as a ratio, decimal or percent and determines combinations, permutations, and probability of a given event.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in data analysis and probability. Performance needs further development. The student calculates the mean, median, mode, and range given a set of data and reads data from graphs and tables. The student expresses probability as a ratio, decimal or percent but demonstrates difficulty determining combinations and permutation.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in data analysis and probability. Performance needs considerable development. The student identifies the mean, median, mode, and range of a set of data and, with assistance, reads data from simple tables and/or graphs. The student has difficulty expressing probability as a ratio.

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. Students are routinely permitted to use available technology. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 1: Number and Operations (MA.S.1)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Number and Operations Objectives
Students will:

MA.7.1.1 compare and order integers, decimals, and fractions using symbols (<,>,=) manipulatives and graphing on a number line.
MA.7.1.2 find powers, squares, and square roots using manipulatives, models, calculators, tables and mental math.
MA.7.1.3 define absolute value and determine its effect on a number or expression.
MA.7.1.4 recognize and write rational numbers in the form a/b.
MA.7.1.5 perform operations with integers (e.g., addition, subtraction, multiplication, division).
MA.7.1.6 apply the commutative, associative, distributive, identity and inverse properties.
MA.7.1.7 solve application problems with whole numbers, decimals, fractions and percents.
MA.7.1.8 use appropriate estimation strategies in problem situations including evaluating the reasonableness of a solution.

Performance Descriptors (MA.PD.7.1)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in number and number operation. The student compares and orders integers, decimals, and fractions, and performs basic operations with integers. The student solves multiple-step application problems with integers, whole numbers, decimals, fractions and percents applying the commutative, associative, distributive, identity, and inverse properties appropriately. The student applies rational numbers, powers, squares, square roots, absolute value, and estimation strategies in problem solving. The student evaluates and justifies the reasonableness of solutions using rational numbers, powers, squares, square roots, absolute values, and estimation strategies.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in number and number operation. The student compares and orders integers, decimals, and fractions, and performs basic operations with integers. The student solves application problems with whole numbers, decimals, fractions and percents applying the commutative, associative, distributive, identity, and inverse properties appropriately. The student applies rational numbers, powers, squares, square roots, and absolute value, and estimation strategies in problem solving. The student evaluates the reasonableness of solutions.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in number and number operation. The student compares and orders integers, decimals, and fractions, and performs basic operations with integers. The student uses an algorithm and/ or estimation strategies to solve one-step application problems with whole numbers, decimals, fractions and percents

applying the commutative, associative, distributive, identity, and inverse properties appropriately. The student finds rational numbers, powers, squares, square roots, and absolute values.

- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in number and number operation. Performance needs further development. The student lacks consistency in comparing and ordering integers, decimals and fractions. When solving application problems with whole numbers, decimals, fractions, and percents, students often apply commutative, associative, distributive, identity, and/or inverse properties incorrectly. Work with rational numbers, powers, squares, square roots, absolute value, and/or estimation strategies in problem situations may contain errors.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in number and number operation. Performance needs considerable development. The student works with comparing and ordering whole numbers, decimals, fractions and/ or percents demonstrates the need for skill development. The student has difficulty solving simple application problems. Correct application of the commutative, associative, distributive, identity, and/or inverse properties shows need for improvement, and the use of rational numbers, powers, squares, square roots, absolute value, and/or estimation strategies in problem situations is lacking.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Algebra Objectives
Students will:

MA.7.2.1 find missing elements in a variety of arithmetic and geometric patterns including algebraic sequences and series.
MA.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.
MA.7.2.3 add, subtract, multiply and divide monomials with no more than two variables and no exponent greater than two.
MA.7.2.4 find and use the Greatest Common Factor (GCF) and Least Common Multiple (LCM) of a set of monomials or algebraic fractions using prime factorization and exponent rules.
MA.7.2.5 input data into a spreadsheet to create input/output function tables.
MA.7.2.6 use ratios and proportions to represent and solve application problems.
MA.7.2.7 write and evaluate complex algebraic expressions for word phrases.
MA.7.2.8 use and apply scientific notation containing positive and negative exponents.
MA.7.2.9 solve one-step linear equations containing whole numbers, fractions, decimals and integers with integer solutions.
MA.7.2.10 solve basic inequalities using inverse operations and graph solutions.
MA.7.2.11 plot lines within the Cartesian coordinate plane from a table of values.
MA.7.2.12 determine the slope of a line from its graphical representation.
MA.7.2.13 represent and solve real world problems appropriate for 7th grade using multiple strategies.

Performance Descriptors (MA.PD.7.2)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in algebra. The student applies GCF and LCM of monomials and algebraic fractions, ratio and proportion,

function tables, and the Cartesian plane to solve application problems. The student graphs, determines, and interprets the slope of a line. The student uses scientific notation containing positive and negative exponents and graphs one-step linear equations and inequalities with no more than two variables and no exponent greater than two to solve real world application problems. The student evaluates and justifies solutions in a clear and concise manner.

- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in algebra. The student uses GCF and LCM of monomials and algebraic fractions, ratio and proportion, function tables, and the Cartesian plane to solve application problems. The student graphs and determines the slope of a line. The student uses scientific notation containing positive and negative exponents, and solves and graphs one-step linear equations and inequalities with no more than two variables and no exponent greater than two. The student evaluates solutions.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in algebra. The student finds and uses GCF and LCM of monomials, ratio and proportion and function tables, plots lines within the Cartesian plane, and determines the slope of a line from its graphical representation. The student writes, simplifies and evaluates algebraic sequences and expressions, uses scientific notation, computes monomials with no more than two variables and no exponent greater than two, and solves one-step linear equations with integer solutions.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in algebra. Performance needs further development. The student is inconsistent and/ or makes errors in finding and using GCF and LCM of monomials, using ratio and proportion, reading function tables, and plotting points in the Cartesian plane. The student writes expressions for word phrases and identifies missing elements in patterns. The student identifies monomials and adds and subtracts like terms.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in algebra. Performance needs considerable development. The student identifies factors and multiples of monomials, writes ratios, and plots points in the Cartesian Plane.

Standard 3: Geometry (MA.S.3)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Geometry Objectives
Students will:

MA.7.3.1 identify and construct angle-pairs (e.g., adjacent, complementary, supplementary, vertical).
MA.7.3.2 use a formula to determine the sum of the measures of the interior angles of a polygon.
MA.7.3.3 use 2-dimensional representations of 3-dimensional objects to visualize and solve problems.
MA.7.3.4 identify and construct congruent segments and angles, perpendicular bisectors of segments and angle-bisectors.
MA.7.3.5 apply and demonstrate line symmetry.
MA.7.3.6 apply transformations (rotations, reflections, translations) to plane figures using graph paper.
MA.7.3.7 solve ratio and proportion problems including scale drawings and similar polygons.

Performance Descriptors (MA.PD.7.3)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in geometry. The student uses angle-pairs, properties of congruency, sketches, scale drawings and transformations to solve real world application problems. The student explains and justifies the solutions.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in geometry. The student finds the missing angle in angle pairs and in regular polygon angle sums. The student applies properties of symmetry, transformations and scaling to creating designs. The student evaluates solutions.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in geometry. The student identifies and constructs angle-pairs (adjacent, complementary, supplementary, vertical), congruent segments and angles, perpendicular and angle bisectors of segments, and uses a formula to determine the sum of the measures of the interior angles of a polygon. The student solves problems using sketches of three-dimensional objects, line symmetry, and transformations (rotations, reflections, translations). The student uses scale drawings and similar polygon relationships to solve ratio and proportion problems.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in geometry. Performance needs further development. The student identifies angle pairs (adjacent, complementary, supplementary, and vertical) and congruent segments and angles. The student sketches and identifies line symmetry and reflections. With assistance, the student solves simple ratio and proportion problems.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in geometry. Performance needs considerable development. The student identifies adjacent angles but lacks consistency in identifying other angle pairs. The student can recognize sketches of three-dimensional figures and determine line symmetry of simple plane figures.

Standard 4: Measurement (MA.S.4)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Measurement Objectives

Students will:

MA.7.4.1 use and apply formulas in problem solving situations involving perimeter, circumference, area, surface area, distance and temperature (Celsius, Fahrenheit).

MA.7.4.2 use the concept of volume for prisms, pyramids, and cylinders as the relationship between the area of the base and height.

MA.7.4.3 use the Pythagorean Theorem to find the length of any side of a right triangle.

MA.7.4.4 convert units of measurement within and between customary and metric systems.

Performance Descriptors (MA.PD. 7.4)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in measurement. The student formulates and solves problems involving perimeter, circumference, area, and surface area of complex figures, and finds volume of prisms, pyramids, and cylinders. The student calculates distance and temperature (Celsius and Fahrenheit), uses the Pythagorean Theorem to find the length of any side of a right triangle, and converts units of measurement between customary and metric systems to formulate and solve real world problems, explaining and justifying his/her solutions.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in measurement. The student solves problems involving perimeter, circumference, area of circles, and surface area, and finds the volume of three-dimensional figures. The student calculates distance and temperature (Celsius and Fahrenheit), uses the Pythagorean Theorem to find the length of any side of a right triangle, and converts units of measurement between customary and metric systems. The student solves real world problems and explains his/her reasoning.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in measurement. The student solves problems involving perimeter, circumference, area, and surface area, and finds the volume of prisms, pyramids, and cylinders as the relationship between the area of the base and height. The student calculates distance and temperature (Celsius and Fahrenheit), uses the Pythagorean Theorem to find the length of any side of a right triangle, and converts units of measurement between customary and metric systems.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in measurement. Performance needs further development. The student calculates perimeter, circumference, area, and surface area of regular polygons and finds the volume and surface area of rectangular prisms with few errors. Inconsistencies exist in using distance, temperature, Pythagorean Theorem, and converting unit measures.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in measurement. Performance needs considerable development. The student needs considerable development in identifying and using appropriate formulas.

Standard 5: Data Analysis and Probability

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Data Analysis and Probability Objectives (MA.S.5)

Students will:

MA.7.5.1 determine experimental and theoretical probability of an event using appropriate technology.

MA.7.5.2 construct sample spaces by listing, tree diagrams, and frequency distribution tables to determine combinations and permutations.

MA.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.

MA.7.5.4 solve application problems involving measures of central tendency (mean, median, mode) and dispersion (range) from data, graphs, tables, and experiments using appropriate technology.

Performance Descriptors (MA.PD.7.5)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in data analysis and probability. The student finds, uses, and interprets interquartile range of a data set, and solves application problems involving measures of central tendency and dispersion. The student collects, organizes, selects, and graphically represents and interprets data. The student determines if an event is dependent or independent, calculates the probability of an event, and describes the anticipated outcome.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in data analysis and probability. The student collects, organizes, and selects an appropriate means to graphically represents and interpret the data. The student uses measures of central tendency and dispersion, experimental and theoretical probability, and combinations and permutations to solve real world problems and explains solutions.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in data analysis and probability. The student identifies experimental and theoretical probability of an event and constructs sample space by making lists, tree diagrams, and/or frequency distribution tables to determine combinations and permutations. The student collects, organizes, graphically represents, and interprets data displays including: frequency distributions, line-plots, scatter plots, box and whiskers, and multiple-line graphs. The student solves application problems involving measures of central tendency (mean, median, mode) and dispersion (range) from data, graphs, tables, and experiments.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in data analysis and probability. Performance needs further development. The student collects, organizes and graphically represents data. The student constructs sample space but has difficulty in determining combinations and permutations. The student can perform experimental and theoretical probability but has difficulty in differentiating between the two and applying these skills to problem situations.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in data analysis and probability. Performance needs considerable development. The student calculates measures of central tendency and dispersion and constructs simple graphs with assistance. The student can perform simple probability events but needs skill development in applying these skills.

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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. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 1: Number and Operations (MA.S.1)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Number and Operations Objectives
Students will:

MA.8.1.1 compare and order rational and irrational numbers.
MA.8.1.2 utilize the properties of terminating, repeating, and non-repeating decimals, and conversions between fractions, mixed numbers, and decimals.
MA.8.1.3 extend scientific notation to numbers with a wide range of values using a calculator when appropriate.
MA.8.1.4 use powers, squares, and square roots to solve problems.
MA.8.1.5 use estimation techniques with whole numbers, decimals, percent, fractions and mixed numbers to solve and verify solutions in application problems.
MA.8.1.6 solve application problems with whole numbers, decimals, fractions, percents and integers including, but not limited to, rates, tips, discounts, sales tax and interest.
MA.8.1.7 develop computational strategies based on the commutative, associative, and identity properties with emphasis on the inverse and distributive properties.

Performance Descriptors (MA.PD.8.1)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in number and operations. Scaling, based on ratio and proportion, along with other computational strategies and properties are used to solve application problems. The student applies properties of rational and irrational numbers, scientific notation, powers, squares, and square roots appropriately to solve problems. The student evaluates and justifies the reasonableness of solutions in a clear and concise manner.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in number and operations. The student compares and orders rational and irrational numbers using the properties of decimals and converting among fractions, decimals, and mixed numbers. The student applies properties of rational and irrational numbers, ratio and proportion, and other computational strategies to solve application problems with pi, whole numbers, decimals, fractions, percents, and integers including, but not limited to rates, tips, discounts, sales tax and interest. The student calculates

scientific notation in large and small values and uses powers, squares, and square roots appropriately to solve problems. The student evaluates the reasonableness of solutions.

- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in number and operations. The student compares and orders rational and irrational numbers using the properties of terminating, repeating, and non-repeating decimals and converting among fractions, decimals, and mixed numbers. The student applies computational strategies based on commutative, associative, distributive, identity, and inverse properties, and extends scientific notation to large and small values. The student solves application problems with whole numbers, decimals, fractions, percents, and integers including, but not limited to rates, tips, discounts, sales tax and interest, and uses powers, squares, and square roots appropriately to solve problems.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in number and operations. Performance needs further development. The student compares and orders rational numbers. The student uses an algorithm and/ or estimation strategies to solve one-step application problems with rational numbers using the commutative, associative, distributive, identity, and inverse properties. Application of powers, squares, and square roots to solve problems is inconsistent.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in number and operations. Performance needs considerable development. The student lacks consistency in comparing and ordering integers, decimals and fractions. When solving problems with rational numbers, students often apply properties incorrectly.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Algebra Objectives
Students will:

MA.8.2.1 use order-of-operations and exponents rules to solve problems with numerical and algebraic expressions containing whole numbers, integers, absolute value, fractions and exponents.
MA.8.2.2 solve one and two step linear equations and inequalities with integers, fractions, and decimal solutions.
MA.8.2.3 use ratio and proportion to create and solve equations.
MA.8.2.4 add and subtract polynomials limited to two variables and positive exponents.
MA.8.2.5 apply algebraic equations and expressions to solve application problems.
MA.8.2.6 apply inductive and deductive reasoning to write a rule from data in a function table.
MA.8.2.7 graph linear equations and inequalities within the Cartesian coordinate plane using ordered pairs table of values and appropriate technology.
MA.8.2.8 formulate and apply a rule to generate an arithmetic, geometric and algebraic pattern.
MA.8.2.9 determine the slope of a line given two-points or slope/y-intercept equation (y=mx+b).
MA.8.2.10 represent and solve real world problems appropriate for 8^{th} grade using multiple strategies.

Performance Descriptors (MA.PD.8.2)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in algebra. The student uses order of operations and exponent rules, adds, subtracts, multiplies, and divides polynomials, solves application problems with algebraic expressions, solves and graphs one and two-step linear equations and inequalities. The student selects and applies algebraic equations, ratio and proportion, slope, and function rules to solve application problems. He/she explains and justifies solutions in a clear and concise manner.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in algebra. The student uses order of operations and exponent rules, adds and subtracts polynomials, solves application problems with algebraic expressions, and solves and graphs one and two-step linear equations and inequalities. The student selects and applies algebraic equations and ratio and proportion to solve application problems and determines the slope of a line. The student formulates a rule from data in a function table and/ or generates an arithmetic, geometric, and algebraic pattern. The student explains his/her solutions.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in algebra. The student uses order of operations and exponent rules, adds and subtracts polynomials limited to two variables and positive exponents, solves application problems with numerical and algebraic expressions, solves and graph one and two-step linear equations and inequalities. The student selects and applies algebraic equations and ratio and proportion to solve application problems and determines the slope of a line given two points or slope/y-intercept equation. The student formulates a rule from data in a function table and/ or generates an arithmetic, geometric, and algebraic pattern.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in algebra. Performance needs further development. The student is inconsistent in using order of operations and exponent rules to solve problems and exhibits difficulty in solving linear equations. The student adds and subtracts polynomials limited to two variables and positive exponents and completes a function table. The student plots lines on a Cartesian plane and is inconsistent in solving ratio and proportion problems.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in algebra. Performance needs considerable development. The student identifies monomials, adds and subtracts like terms, writes expressions using a variable, and plots points in the Cartesian plane. Further development is needed with ratio and proportion, recognizing and performing operations with polynomials, and problem solving skills.

Standard 3: Geometry (MA.S.3)

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 through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Geometry Objectives

Students will:

MA.8.3.1 investigate the relationship between corresponding, alternate interior, and alternate exterior angles when parallel lines are cut by a transversal using models, pencil/paper and graphing calculator.

MA.8.3.2 classify polyhedrons according to the number and shape of faces; determine the relationship between vertices, faces and edges.

MA.8.3.3 identify, apply, and construct perpendicular and angle bisectors.

MA.8.3.4 create geometric patterns including tiling, art design, tessellations and scaling using transformations (rotations, reflections, translations).

MA.8.3.5 use coordinate geometry to represent and examine properties of similar and congruent figures and graph transformations.

MA.8.3.6 create scale models including ratio, proportion and similar figures using pencil/paper and dynamic geometry software.

Performance Descriptors (MA.PD.8.3)

- **Distinguished**

  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in algebra. The student applies the relationships of angles when parallel lines are cut by a transversal, properties of polyhedra, and properties of similar and congruent figures to solve application problems. The student uses transformations and /or ratio and proportion of geometric patterns and scale models to sketch corresponding nets and solve application problems. The student evaluates solutions.

- **Above Mastery**

  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in algebra. The student constructs parallel lines cut by a transversal, explains the resulting angle relationships, determines missing angle measurements, and determines the relationship between vertices, faces, and edges. The student creates geometric patterns and scale models using ratio and proportion of geometric patterns and scale models to solve application problems. The student evaluates solutions.

- **Mastery**

  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in algebra. The student investigates the relationship between corresponding, alternate interior, and alternate exterior angles when parallel lines are cut by a transversal; classifies polyhedra according to the number and shape of faces. The student identifies, applies, and constructs perpendicular and angle bisectors, represents, graphs, and examines properties of similar and congruent figures using coordinate geometry. The student identifies and models geometric patterns and scale models including tiling, art design, tessellations, and similar figures using transformations (rotations, reflections, translations) and ratio and proportion.

- **Partial Mastery**

  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in algebra. Performance needs further development. The student identifies parallel lines, transversals, perpendicular and angle bisectors; recognizes similar and congruent figures with some inconsistency.

- **Novice**

  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in algebra. Performance needs considerable development. The student recognizes similar and congruent figures and, with assistance, identifies geometric patterns.

Standard 4: Measurement (MA.S.4)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Measurement Objectives

Students will:

MA.8.4.1 estimate and solve application problems involving perimeter, area, surface area and volume of plane and solid geometric figures.

MA.8.4.2 use the concept of volume for cone and pyramids as one-third the product of the area of the base and the height.

MA.8.4.3 solve problems involving missing measurements in plane and solid geometric figures using formulas and drawings including irregular figures, models or definitions.

MA.8.4.4 solve right triangle problems using the Pythagorean Theorem, indirect measurement and definitions.

Performance Descriptors (MA.PD.8.4)

- **Distinguished**

  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in measurement. The student estimates and solves application problems involving perimeter, area, surface area and volume of complex plane and solid geometric figures, uses volume for cone and pyramids, and determines missing measurements in plane and solid geometric figures and irregular forms to solve real world problems. The student defines and solves right triangle problems using the Pythagorean Theorem, Pythagorean triples, and indirect measurement. The student explains and justifies solutions in a clear and concise manner.

- **Above Mastery**

  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in measurement. The student estimates and solves problems involving perimeter, area, surface area and volume of plane and solid geometric figures, uses volume for cone and pyramids, and determines missing measurements in plane and solid geometric figures and irregular forms to solve real world problems. The student solves right triangle problems using the Pythagorean Theorem and indirect measurement. The student explains solutions.

- **Mastery**

  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in measurement. The student estimates and solves problems involving perimeter, area, surface area and volume of plane and solid geometric figures, uses the concept of volume for cone and pyramids as one-third the product of the area of the base and the height, and solves problems involving missing measurements in plane and solid geometric figures including irregular forms. The student solves right triangle problems using the Pythagorean Theorem and indirect measurement.

- **Partial Mastery**

  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in measurement. Performance needs further development. The student calculates perimeter, area, and volume of plane and solid geometric figures and calculates missing measurements in plane geometric figures. The student is inconsistent in using the concept of volume for cones and pyramids and in applying the Pythagorean Theorem to right triangle problems.

- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in measurement. Performance needs considerable development. The student needs assistance in identifying and calculating perimeter and area of plane geometric figures.

Standard 5: Data Analysis and Probability (MA.S.5)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Data Analysis and Probability Objectives
Students will:

MA.8.5.1 use appropriate technology to solve application problems involving combinations and permutations.

MA.8.5.2 investigate the experimental and theoretical probability, including compound probability of an event.

MA.8.5.3 create and extrapolate information from multiple-bar graphs, box and whisker plots, and other data displays using appropriate technology.

MA.8.5.4 analyze problem situations, games of chance, and consumer applications using statistical samplings to determine probability and make predictions.

MA.8.5.5 draw inferences and construct convincing arguments, including misuses of statistical or numeric information, based on data analysis.

Performance Descriptors (MA.PD.8.5)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in data analysis and probability. The student applies data analysis and statistical samplings to solve, analyze, and interpret real world application problems. The student calculates and explains the benefits of data-based solutions. The student justifies problem-solving methods with valid and convincing evidence.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in data analysis and probability. The student constructs convincing arguments based on data analysis to explain outcomes and uses statistical analysis to make connections to real world situations to predict probability of simple and compound events. The student communicates problem-solving methods with sound reasoning.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in data analysis and probability. The student creates and extrapolates information from multiple-bar graphs, box and whisker plots, and other data to draw inferences and construct convincing arguments based on data analysis. The student displays, analyzes and solves application problems involving combinations, permutations, games of chance, and consumer applications using statistical samplings to determine probability and make predictions. The student, given the results of experiments, calculates the experimental and theoretical probabilities of simple and compound events.

- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in data analysis and probability. Performance needs further development. The student predicts and reports probable outcomes of simple probability experiments and reads information from multiple-bar graphs and box and whisker plots. The student analyzes problem situations involving games of chance but is inconsistent in solving consumer applications problems involving statistics.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in data analysis and probability. Performance needs considerable development. The student records and displays data involving games of chance and may predict and/ or calculate probable outcomes of a simple experiment as compared to the actual outcomes. Skill development is needed for the student to calculate combinations and permutations in application problems. The student constructs simple graphs based on data.

Algebra/Geometry Preparation Objectives

Algebra/Geometry preparation is an elective course designed to be a bridge between the concrete elementary curriculum and the more formal mathematics curriculum ahead. In this course students will explore algebraic concepts in an informal way to build a foundation for subsequent formal study of algebra. Such 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 to represent and make sense of the world. Geometric models will provide a perspective from which students are to analyze and solve problems, and geometric interpretations are to help make abstract representations more easily understood. The study of geometry at this level should simply provide increased opportunities for students to engage in more systematic explorations. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 1: Number and Operations (MA.S.1)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Algebra/Geometry Preparation Objectives
Students will:

AGP.1.1 identify and use properties of numbers (commutative, associative, distributive, etc).
AGP.1.2 add, subtract, multiply, and divide decimals, integers, fractions and mixed numbers.
AGP.1.3 use order relations to compare, order, or locate whole numbers, integers, fractions, and decimals on a number line.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

AGP.2.1 substitute values, evaluate expressions involving variables, and calculate formulas to solve application problems.
AGP.2.2 solve equations with at least two operations.

Standard 3: Geometry (MA.S.3)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

AGP.3.1 use a compass to construct congruent angles, bisect angles, and bisect line segments.
AGP.3.2 estimate and find circumference and area of a circle.
AGP.3.3 estimate and find the area and perimeter of polygons
AGP.3.4 estimate and find the surface area and the volume of three-dimensional figures.
AGP.3.5 identify angle relationships: complementary, supplementary, vertical, and adjacent.
AGP.3.6 identify angle relationships; involving parallel lines and apply in solving problems (corresponding angles, alternate interior angles, and alternate exterior angles).
AGP.3.7 investigate similar triangles and apply proportions in problem solving situations.
AGP.3.8 develop and explore circle relationships, emphasizing the vocabulary of circles.

Standard 4: Measurement (MA.S.4)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

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

Standard 5: Data Analysis and Probability (MA.S.5)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

AGP.5.1 read, interpret, and construct graphs to solve problems.
AGP.5.2 use data to determine mean, median, mode, and range.
AGP.5.3 find the probability of complementary events and exclusive events.

Algebra I Objectives

Algebra I is a course that provides the gateway to all higher mathematics courses. This course uses a conceptual approach to mathematics and does not focus on algorithmic methods. Algebraic representations will be used to generalize, and the algebraic method will be viewed as a problem-solving tool. 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 graphing utilities are to be used as tools to enhance learning. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Algebra I Objectives
Students will:

AI.2.1	simplify and evaluate algebraic expressions using grouping symbols, order of operations and properties of real numbers with justification of steps.
AI.2.2	solve multi-step linear equations in one variable and apply skills toward solving practical problems.
AI.2.3	solve multi-step linear inequalities in one variable, interpret the results on a number line and apply the skills toward solving practical problems.
AI.2.4	solve literal equations for a given variable and apply the skills toward solving practical problems.
AI.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.
AI.2.6	solve absolute value equations in one variable and interpret the results on a number line.
AI.2.7	use the laws of exponents to perform operations on expressions with integral exponents.
AI.2.8	determine the slope of a line given an equation of a line, the graph of a line and two points to be identified.
AI.2.9	graph linear equations using slope-intercept, point slope, and x- and y-intercepts.
AI.2.10	write an 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.
AI.2.11	solve systems of linear equations numerically and graphically, by the elimination method and by the substitution method.
AI.2.12	add and subtract polynomials.
AI.2.13	multiply and divide binomials by binomials or monomials.
AI.2.14	factor polynomials by using appropriate methods.
AI.2.15	estimate and simplify square roots into both exact and approximate forms.
AI.2.16	solve quadratic equations by graphing, factoring and quadratic formula.
AI.2.17	add, subtract, multiply and divide simple rational expressions.
AI.2.18	collect, organize, interpret data and predict outcomes using the mean, mode, median, and range.
AI.2.19	perform a linear regression and use the results to predict specific values of a variable, and identify the equation for the line of regression.
AI.2.20	predict the outcomes of simple events using the rules of probability.
AI.2.21	use process (flow) charts and histograms, scatter diagrams and normal distribution curves.

Performance Descriptors (MA.PD.AI.2)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in **Algebra I**. The student solves literal, linear, and quadratic equations and linear inequalities to interpret solutions of complex, practical application problems. The student justifies and judges the reasonableness of real number solutions given in both exact and approximate forms in a clear concise manner. The student factors and performs operations on polynomials and simplifies algebraic expressions using laws of exponents. The student solves absolute value equations in one variable and solves linear systems numerically and graphically justifying solutions analytically. Given graphical and numerical data, the student determines the slope and various forms of the equation of a line and performs linear regressions using the regression equation to predict values. The student predicts and interprets outcomes of collected data based on measures of central tendency and dispersion, constructed graphs, and simple events using rules of probability summarizing results in a clear concise manner.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in **Algebra I**. The student solves simple, multi-step practical application problems using literal and linear equations and linear inequalities. The student solves quadratic equations by graphing, factoring, and quadratic formula. The student simplifies algebraic expressions with integer exponents and factors and performs basic operations on simple polynomials, solves absolute value equations in one variable, and solves linear systems numerically or graphically. The student determines the slope and equation of a line given graphical and numerical data and performs linear regressions giving the regression equation. The student predicts outcomes of collected data based on measures of central tendency and dispersion, constructed graphs, and simple events using rules of probability.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in **Algebra I**. The student solves simple, multi-step problems using literal and linear equations and linear inequalities. The student solves quadratic equations by using the quadratic formula. The student simplifies algebraic expressions with whole number exponents and factors, adds, subtracts, and multiplies simple polynomials. The student determines the slope of a line from two points or from the equation of a line, and given a graph solves linear systems. The student calculates measures of central tendency and dispersion of collected data, predicts outcomes of simple events using rules of probability, and reads frequency distributions and line plots to solve simple problems.
- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in **Algebra I**. Performance needs further development. The student inconsistently solves one-step linear equations, simplifies algebraic expressions without exponents and adds, subtracts, and multiplies simple polynomials. The student determines the slope of a line given two points. The student calculates the mean and range of given data and reads line plots.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in **Algebra I.** Performance needs considerable development. The student solves one-step linear equations in one variable with procedural errors and attempts to simplify algebraic expressions.

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Applied Mathematics I Objectives

Applied Mathematics I and Applied Mathematics II reflect the content of a complete course in Applied Mathematics. Applied Mathematics I is the first half of the Applied Mathematics course. One Applied Mathematics credit will be given for successful completion of this course. Upon successful completion of both courses, Algebra I credit will be given. Applied Mathematics I is a lab-based course taught with teacher-led, concrete activities. This course is designed to develop algebraic concepts applicable in the work place as well as in traditional areas. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Applied Mathematics I Objectives
Students will:

AM1.2.1 solve practical problems involving computation using estimation.
AM1.2.2 write numbers in scientific notation and combine numbers written in scientific notation to solve practical problems.
AM1.2.3 distinguish between counting and measuring using micrometers, calipers and other precision tools to make measurements.
AM1.2.4 solve practical problems and interpret results using rational numbers and vectors.
AM1.2.5 evaluate algebraic expressions using grouping symbols, order of operations and properties of real numbers with justification of steps.
AM1.2.6 translate word phrases into algebraic expressions or word sentences into equations and inequalities.
AM1.2.7 justify steps in the solving of equations based on the properties of real numbers.
AM1.2.8 solve literal equations for a given variable and apply the skills toward solving practical problems.
AM1.2.9 solve practical problems using a four-step problem solving approach.
AM1.2.10 solve multi-step linear equations in one variable and apply skills toward solving practical problems.
AM1.2.11 solve multi-step linear inequalities in one variable, interpret the results on a number line and apply the skills toward solving practical problems.
AM1.2.12 solve absolute value equations in one variable and interpret the results on a number line.
AM1.2.13 collect, organize, interpret data, and predict outcomes using the mean, mode, median, range and standard deviation.
AM1.2.14 estimate and simplify square roots into both exact and approximate forms.
AM1.2.15 use the laws of exponents to perform operations on expressions with integral exponents.
AM1.2.16 predict the outcomes of simple events using the rules of probability.

Applied Mathematics II Objectives

Applied Mathematics II is the second half of the Applied Mathematics course. Upon successful completion of both courses, Algebra I credit will be given. Algebraic concepts will be taught using laboratory activities based on several strategies that include the use of the graphing

calculator. Working in groups will be used to develop problem solving skills and social skills needed in the work place as well as in traditional areas. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Applied Mathematics II Objectives
Students will:

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.
AM2.2.2 determine the slope of a line given an equation of a line, the graph of a line and two points to be identified.
AM2.2.3 graph linear equations using slope-intercept, point slope, and x- and y-intercepts.
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.
AM2.2.5 solve systems of linear equations numerically and graphically, by the elimination method and by the substitution method.
AM2.2.6 add and subtract polynomials.
AM2.2.7 multiply and divide binomials by binomials or monomials.
AM2.2.8 factor polynomials by using appropriate methods.
AM2.2.9 solve quadratic equations by graphing, factoring and quadratic formula.
AM2.2.10 add, subtract, multiply and divide simple rational expressions.
AM2.2.11 use process (flow) charts and histograms, scatter diagrams, and normal distribution curves in order to perform statistical process (quality) control.
AM2.2.12 perform a linear regression and use the results to predict specific values of a variable. Identify the equation for the line of regression.

Geometry and Applied Geometry Objectives

Geometry is a course designed for students who have successfully completed the objectives for Algebra I. 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 proofs. Emphasis should be placed on applications to the work place and everyday life and on connections to other branches of mathematics and other disciplines. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Applied Geometry is a course for students who have successfully completed the objectives of Algebra I. Upon completion of this course a geometry credit will be given. Applied Geometry will use manipulatives to enhance the understanding of geometric concepts and terminology. Working in groups will allow students to analyze applications of geometry in their lives and in the work place. Concepts will be taught using laboratory activities including the use of technology as

a learning tool. The objectives for Applied Geometry will be the same as those for Geometry. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 3: Geometry (MA.S.3)

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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Geometry Objectives

Students will:

G.3.1 represent points, lines, and planes pictorially with proper identification, as well as basic concepts derived from these undefined terms, such as segments, rays and angles.

G.3.2 differentiate between inductive and deductive reasoning.

G.3.3 use the basic concepts of symbolic logic including identifying the converse, inverse, and contrapositive of a conditional statement and testing the validity of conclusions with Venn Diagrams.

G.3.4 construct logical arguments in formal and informal methods with direct and indirect reasoning.

G.3.5 apply definitions, theorems, and postulates related to such topics as complementary, supplementary, and vertical angles and angles formed by perpendicular lines.

G.3.6 explore the relationship 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.

G.3.7 investigate and verify congruence relationships in triangles.

G.3.8 explore and identify properties of quadrilaterals and verify the properties for parallelograms, rectangles, rhombuses, squares, and trapezoids.

G.3.9 investigate measures of angles and lengths of segments to determine the existence of triangles (triangle inequality) and the order of sides and unknown side lengths or angles and inaccessible heights and distances, construct scaled drawings, and derive the basis for the trigonometric ratios.

G.3.10 using trigonometric ratios, determine lengths of sides and measures of angles in right triangles.

G.3.11 apply the Pythagorean Theorem and its converse in solving practical problems and in deriving the special right triangle relationships.

G.3.12 investigate measures of angles formed by chords, tangents, and secants of a circle and the relationship to its arcs.

G.3.13 given a polygon, find angle measures of interior and exterior angles; find length of sides from given data; and use properties of regular polygons to find missing data.

G.3.14 develop properties of tessellating figures and use those properties to tessellate the plane.

G.3.15 develop and apply formulas for area, perimeter, surface area, and volume and apply them in the modeling of practical problems.

G.3.16 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.

G.3.17 using various methods, construct a triangle's medians, altitudes, angle and perpendicular bisectors; identify conjectures and develop mathematical arguments about their relationships.

G.3.18 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.

G.3.19 compare and contrast other geometry to Euclidean geometry.

G.3.20 find or approximate the area of irregularly shaped regions.

G.3.21 using the Cartesian coordinate system, find the dimensions of a polygon, given the coordinates of the polygon.

Performance Descriptors (MA.PD.G.3)

- **Distinguished**

  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in **geometry**. The student produces geometric figures and verifies properties of each. The student uses the converse, inverse, and contrapositive of a conditional statement and Venn diagrams to develop and test arguments. The student applies definitions, theorems and postulates to explore angles formed by lines, including parallel and perpendicular, and determines measures of angles found in figures containing polygons and circles and justifies solutions in a clear, concise manner. Students apply appropriate formulas to solve complex practical application problems involving area, perimeter, surface area, and volume expressing solutions in both exact and approximate forms in a clear, concise manner. The student develops proofs and differentiates among inductive, deductive, direct and indirect methods included in both formal and informal logical arguments. The student solves complex application problems involving triangles by applying properties of congruence, similarity, the Pythagorean Theorem, special right triangles, and right triangle trigonometric ratios justifying conclusions in a clear concise manner. The student compares and contrasts other geometries to Euclidean geometry.

- **Above Mastery**

  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in **geometry**. The student verifies properties of geometric figures and polygons. The student explains the converse, inverse, and contrapositive of a conditional statement and uses Venn diagrams to test the validity of arguments. The student applies definitions, theorems, and postulates to determine measures of angles formed by lines, including parallel and perpendicular, as well as angles found in figures containing polygons and circles. Students apply appropriate formulas to solve practical application problems involving area, perimeter, surface area, and volume. The student recognizes examples of inductive, deductive, direct and indirect proofs that include both formal and informal logical arguments. The student solves practical triangle application problems by applying properties of congruence, similarity, the Pythagorean Theorem, special right triangles, and right triangle trigonometric ratios. The student applies transformations and uses analytical geometry to explain practical mathematical situations and recognize the existence of non-Euclidean geometries.

- **Mastery**

  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in **geometry**. The student identifies and represents basic geometric figures such as points, lines, planes and polygons and uses basic properties of each to solve problems. The student recognizes the converse, inverse, and contrapositive of a conditional statement and constructs Venn diagrams depicting intersections and unions. The student finds measures of angles found in figures containing polygons and circles as well as those formed by lines, including parallel and perpendicular, using definitions, theorems and postulates. The student solves problems involving area, perimeter, surface area, and volume by using appropriate formulas. The student solves triangle problems involving congruence, similarity, and the Pythagorean Theorem and creates basic transformations. The student uses coordinate geometry to determine distance, slope and midpoint.

- **Partial Mastery**

  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in **geometry**. Performance needs further development. The student identifies basic geometric figures such as points, lines, planes, triangles and quadrilaterals and inconsistently uses basic properties of each to solve problems. Given definitions, theorems, and postulates, the student inconsistently finds measures of angles found in figures containing triangles, quadrilaterals and regular polygons as well as those formed

by lines. Given appropriate formulas and detailed drawings, the student inconsistently solves problems involving area, perimeter, surface area, and volume. Given the properties, a student inconsistently solves simple triangle problems involving congruence, similarity, and the Pythagorean Theorem.

- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in **geometry.** Performance needs considerable development. The student recognizes some of the basic geometric figures such as points, lines, planes; triangles, quadrilaterals and basic angle pairs. Given appropriate formulas and tools, a student attempts to determine the area and perimeter of triangles and quadrilaterals.

Algebra II Objectives

Listed below are the objectives for Algebra II. It is an underlying assumption that a mastery of Algebra I has been achieved since Algebra II continues the study of concepts introduced in Algebra. Graphing calculators are an integral part of instruction in the Algebra II objectives. Students will have the opportunity to make conjectures and test them by using any graphing utility. Manipulatives and other available technology will be used as appropriate. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Algebra II Objectives
Students will:

A2.2.1 write equations of lines given various information including parallel and perpendicular lines and vertical and horizontal lines.

A2.2.2 factor higher order polynomials by applying various methods including factoring by grouping and the sum and difference of two cubes.

A2.2.3 define and use to develop the complex number system; simplify powers and products of it.

A2.2.4 perform basic operations with complex numbers and give answers in simplest form.

A2.2.5 simplify radicals and expressions involving fractional exponents and convert between the two forms.

A2.2.6 solve quadratic equations over the set of complex numbers: apply the techniques of factoring and completing the square and the quadratic formula; use the discriminate to determine the nature of the roots; confirm the solutions numerically and graphically; and apply to practical problems.

A2.2.7 define the components of a matrix: develop and use the appropriate field properties by adding, subtracting, and multiplying; solve a system of linear equations using matrices; and apply skills toward solving practical problems.

A2.2.8 solve equations containing radicals and exponents.

A2.2.9 define a function: find the domain, range, zeros; 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.

A2.2.10 explore basic families of functions: recognize linear, quadratic, absolute value, step, and exponential functions; and convert among graphs, tables and equations.

A2.2.11 solve quadratic inequalities and graph their solution sets.

A2.2.12 solve and graph the solution set of systems of linear inequalities in two variables by finding the maximum and minimum values of a function over a region using linear program techniques

A2.2.13 solve practical problems involving direct, inverse, and joint variation.

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.

A2.2.15 solve absolute value equations and inequalities graphically, numerically, and algebraically.

A2.2.16 define a logarithmic function: transform equations from exponential form into logarithmic form; and apply the basic properties of logarithms to simplify or expand an expression.

A2.2.17 perform a quadratic regression and use the results to predict specific values of a variable. Identify the regression equation.

Performance Descriptors (MA.PD.A2.2)

- **Distinguished**
  The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in **Algebra II.** The student develops equations of lines to solve practical application problems and solves practical application problems involving direct, inverse, and joint variation giving solutions in a clear, concise manner, factors polynomials using a variety of techniques including grouping and the sum and difference of two cubes, and performs operations with complex numbers giving answers in simplest form. The student solves equations containing radicals and rational exponents and converts between forms and justifies solutions. The student finds domain, range, inverse and zeros of functions and their families converting forms among graphs, tables and equations and performs operations on functions including compositions. The student solves quadratic and absolute value equations and inequalities over the set of complex numbers using various techniques, confirming solutions both numerically and graphically in a clear concise manner and performs quadratic regressions using the regression equation to predict values. The student applies properties of logarithms to simplify expressions and converts equations between logarithmic and exponential form. The student solves practical application problems involving linear inequalities using linear programming techniques giving solutions in a clear concise manner and converts between graphs and equations of conic sections.
- **Above Mastery**
  The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in **Algebra II**. The student writes equations of lines in various forms, solves practical application problems involving direct and inverse variation, factors polynomials using a variety of techniques including grouping, and performs basic operations with complex numbers and give answers in simplest form. The student solves equations containing radicals and rational exponents and converts between forms. The student finds domain, range, inverse and zeros of basic functions (such as linear, quadratic, absolute value, step and exponential) and their families using graphs, tables and equations and performs basic operations on functions including composition. The student solves quadratic and absolute value equations and inequalities over the set of complex numbers using various techniques, confirming solutions either numerically or graphically and performs quadratic regressions giving the regression equation. The student simplifies basic logarithmic expressions. The student solves a system of linear equations using various techniques including matrices and determines solutions to systems of linear inequalities using linear programming techniques and identifies and sketches graphs of simple conic sections.
- **Mastery**
  The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in **Algebra II**. The student determines the slope and equation of a line given graphical and numerical data, solves simple problems involving direct variation, factors basic polynomials, and performs simple

operations with complex numbers. The student solves equations containing radicals or rational exponents and finds domain, range, and zeros of basic linear, quadratic and absolute value functions using graphs, tables and equations. The student solves quadratic and absolute value equations over the set of complex numbers confirming solutions either numerically or graphically. The student solves a system of linear equations using various techniques; adds, subtracts, and multiplies matrices; and determines solutions to simple systems of three or four linear inequalities using linear programming techniques. The student identifies graphs of simple conic sections.

- **Partial Mastery**
  The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in **Algebra II**. Performance needs further development. The student determines the slope of a line from two points or from the equation of a line, solves direct variation problems with errors and inconsistently finds the domain, range and zeros of simple linear and quadratic functions. The student attempts to solve simple quadratic and absolute value equations and given a graph, inconsistently solves systems of linear equations.
- **Novice**
  The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in **Algebra II.** Performance needs considerable development. The student determines the slope of a line given two points, graphs lines and parabolas given a table, and attempts to solve simple linear and quadratic equations.

Conceptual Mathematics Objectives

Conceptual Mathematics is a one-year course 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 also be included. These, along with other ideas, will be presented in the context of their historical development. Students will be encouraged to be active learners either in cooperative groups or 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 graphing calculators and computer applications such as spreadsheets, database, and Internet use, is essential to effectively master the objectives of this course. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Conceptual Mathematics Objectives
Students will:

CM.2.1 develop a variety of problem solving strategies (e.g., draw a diagram, look for a pattern, and work backwards).
CM.2.2 interpret graphs of functions (i.e., linear, quadratic, exponential).
CM.2.3 solve application problems using linear, quadratic and exponential functions with emphasis on data collection and analysis.
CM.2.4 use appropriate formulas to solve workplace problems.

CM.2.5 calculate costs, simple and compound interest, finance charges, loan payments and taxes.
CM.2.6 compare various methods of investing money.

Standard 3: Geometry (MA.S.3)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

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

Standard 5: Data Analysis and Probability (MA.S.5)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

CM.5.1 relate mathematical content to its historical development.
CM.5.2 integrate other disciplines into the study of mathematics through simulations, research, and projects
CM.5.3 determine possible outcomes using tree diagrams and the counting principles of permutations and combinations.
CM.5.4 apply the basic probability rules in expressing the chances of events occurring using technology when appropriate.
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.
CM.5.6 relate the measures of central tendency and the measures of dispersion to a normal distribution.
CM.5.7 apply the measures of central tendency and the measures of dispersion to workplace situations.
CM.5.8 use statistical tools for workplace applications such as quality control, marketing and predicting trends.

Trigonometry Objectives

Trigonometry is designed for students who have successfully completed Algebra II. Connections between right triangle trigonometry and circular functions should be emphasized. Graphing utilities such as calculators and computers will be used to enhance student learning and to aid in finding the values of trigonometric functions and their inverses. West Virginia teachers are

responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 3: Geometry (MA.S.3)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Trigonometry Objectives
Students will:

T.3.1 define the six trigonometric functions in terms of a right triangle and find the values of the functions of an angle in standard position, given a point on the terminal side of the angle. Circular function definitions will be connected with trigonometric function definitions.

T.3.2 find the values of the other trigonometric functions, given the value of one trigonometric function.

T.3.3 develop recall of the values of the six trigonometric functions of special angles as related to the unit circle.

T.3.4 use a calculator to find the values of the trigonometric functions for any angle and to find the measure of an angle given the value of one of its trigonometric functions.

T.3.5 convert angle measures from radians to degrees and vice versa.

T.3.6 verify trigonometric identities by making substitutions and recalling basic identities.

T.3.7 solve trigonometric equations that include both infinite solutions and solutions with a restricted domain.

T.3.8 find the value of inverse trigonometric functions.

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).

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.

T.3.11 solve practical problems involving triangles using the trigonometric functions, the Pythagorean Theorem, the Law of Sines, and the Law of Cosines.

T.3.12 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.

T.3.13 model periodic data sets using graphs, tables, and equations.

T.3.14 recognize and graph the inverse of trigonometric functions. Restrictions on the domain will be included.

T.3.15 develop and use formulas such as sum or difference of two angles, double-angle, and half-angle.

T.3.16 perform mathematical operations with vectors and use vectors to solve practical problems.

Probability and Statistics 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. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 5: Data Analysis and Probability (MA.S.5)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Probability and Statistics Objectives
Students will:

PS.5.1 distinguish between experimental and theoretical probability.
PS.5.2 create and interpret data using various methods of displaying circle graphs, histograms, and frequency curves, and make predictions about outliers.
PS.5.3 determine possible outcomes using tree diagrams and the counting principles of permutations and combinations.
PS.5.4 express the chances of events occurring either in terms of a probability or odds.
PS.5.5 use the normal distribution and the binomial distribution including pascal's triangle, to determine probability of events.
PS.5.6 interpret and calculate measures of central tendency (mean, median, and mode) from data presented in a variety of forms such as charts, tables, and graphs or from data created through experimentation.
PS.5.7 interpret and calculate measures of dispersions (range and standard deviation) from data presented in a variety of forms such as charts, tables and graphs or from data created through experimentation.
PS.5.8 describe individual performances in terms of percentiles, z-scores, and t- scores.
PS.5.9 describe the role of sampling, randomness, bias, and sample size in data collection and interpretation.
PS.5.10 explain and illustrate the use and misuse of statistics.
PS.5.11 test the validity of a hypothesis using appropriate statistical concepts.
PS.5.12 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.
PS.5.13 calculate the Chi-Square values for a given population.
PS.5.14 perform a t-test for a designated set of data, and use the results to test the validity of a hypothesis.
PS.5.15 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.
PS.5.16 perform an analysis of variance (ANOVA) and interpret the results.

Pre-calculus Objectives

Pre-calculus is intended for students who have mastered the concepts of Algebra II. It will extend students' knowledge of functions as well as provide appropriate preparation for a calculus

course. Available technology will be used by students and teachers to enhance learning. Graphing utilities are powerful tools for solving and verifying equations and inequalities. They also aid in investigating functions and their inverses. West Virginia teachers are responsible for analyzing the benefits of technology for learning and for integrating technology appropriately in the students' learning environment. See the related grade-level Technology Standards and Objectives.

Standard 2: Algebra (MA.S.2)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

Pre-calculus Objectives
Students will:

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.

PC.2.2 solve higher order polynomial equations utilizing techniques such as Descartes' Rule of Signs, upper and lower bounds, and Rational Root Theorem.

PC.2.3 expand binomials with positive integral exponents by the use of Pascal's triangle and the Binomial Theorem.

PC.2.4 establish the relationship between exponential and logarithmic functions; graph related functions and include their domain and range.

PC.2.5 solve equations and practical problems involving exponential and logarithmic expressions: include natural and common logarithms; use laws of exponents; and confirm solutions graphically and numerically.

PC.2.6 solve problems involving the sum of finite and infinite sequences and series. Sigma (summation) notation will be included.

PC.2.7 find the limit of a function, a sequence, or a series by graphing, intuitive reasoning, algebraic methods, and numerical substitution.

PC.2.8 perform mathematical operations with vectors and use vectors to solve practical problems.

PC.2.9 apply the method of mathematical induction to prove formulas and statements.

Standard 3: Geometry (MA.S.3)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

PC.3.1 graph functions and conic sections using translation.

PC.3.2 investigate properties and solve practical problems of the conic sections.

Standard 5: Data Analysis and Probability (MA.S.5)
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

through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

PC.5.1 perform a regression analysis on a set of data and use the results to predict specific values of a variable. Identify the regression equation.

FORM HD 201
(10-66)

FISCAL NOTE WORKSHEET
(Submit 4 Copies)

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

SUBJECT Policy 2520.2 Mathematics Content Standards 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):

There will be no increase in costs due to this policy.

DATE: November 14, 2002

AGENCY: West Virginia Department of Education

AUTHORIZED REPRESENTATIVE: _____

Policy 2520.2: Mathematics
Content Standards and Objectives for
West Virginia Schools

Please use this form when commenting on proposed Policy 2520.2. You may attach additional sheets if necessary.

Individual/Organization: _____

Title: _____

Street Address: _____ **City** _____ **State** _____ **Zip** _____

Comments/Suggestions

Explanation of Terms, Abbreviations

Mathematics Kindergarten Objectives and Performance Descriptors

Mathematics 1st Grade Objectives and Performance Descriptors

Mathematics 2nd Grade Objectives and Performance Descriptors

Mathematics 3rd Objectives and Performance Descriptors

Mathematics 4th Grade Objectives and Performance Descriptors

Mathematics 5th Grade Objectives and Performance Descriptors

Mathematics 6th Grade Objectives and Performance Descriptors

Mathematics 7th Grade Objectives and Performance Descriptors

Mathematics 8th Grade Objectives and Performance Descriptors

Algebra I Objectives and Performance Descriptors

Geometry and Applied Geometry Objectives and Performance Descriptors

Algebra II Objectives and Performance Descriptors

Applied Mathematics I Objectives

Applied Mathematics II Objectives

Conceptual Mathematics Objectives

Trigonometry Objectives

Probability and Statistics Objectives

Please return comments by January 10, 2003, to:

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