West Virginia math4life

Content and Timeline for Mathematics

Mathematics I

West Virginia DEPARTMENT OF EDUCATION

Mathematics I

The West Virginia College- and Career-Readiness Standards for mathematics emphasize key content, skills, and mathematical habits of mind at each grade level. The focus of instruction is placed on course standards; instruction should integrate content standards and mathematical habits of mind. Instruction should be attentive to learning across course domains and link major topics within domains. Instruction should develop conceptual understanding, procedural skill and fluency, and application.

Students in Mathematics I focus on six critical units that deepen and extend understanding of linear relationships, in part by contrasting them with exponential phenomena, and in part by applying linear models to data that exhibit a linear trend. Students in Mathematics 1 use properties and theorems involving congruent figures to deepen and extend understanding of geometric knowledge from prior grades and develop connections between the algebraic and geometric ideas studied.

The following table highlights the content at the cluster level for Mathematics I standards. The bulk of instructional time should be given to the clusters and the standards within them. Standards should not be neglected; to do so would result in gaps in students' learning, including skills and understandings they may need in later grades. Instruction should reinforce standards within the clusters by including problems and activities that support natural connections between clusters. **Teachers and administrators alike should note that the standards are not topics to be checked off after being covered in isolated units of instruction;** rather, they provide content to be developed throughout the school year through rich instructional experiences presented in a coherent manner.

Connections in the Integrated Pathway

Students now build on previous work with solving linear equations and systems of linear equations from grades seven and eight in two ways: (a) They extend to more formal solution methods, including attending to the structure of linear expressions; and (b) they solve linear inequalities. Students' work with patterns and number sequences in the early grades extends to an understanding of sequences as functions. Students formalize their understanding of the definition of a function, particularly their understanding of linear functions, emphasizing the structure of linear expressions. Students also begin to work with exponential functions by comparing them to linear functions. Work with congruence and similarity transformations that started in grades six through eight progresses. Students consider sufficient conditions for the congruence of triangles. Work with bivariate data and scatter plots in grades six through eight is extended to working with lines of best fit.

Students in Mathematics I continue their work with expressions and modeling and analysis of situations. In previous grade levels, students informally defined, evaluated, and compared functions, using them to model relationships between quantities. In Mathematics I, students learn function notation and develop the concepts of *domain* and *range*. Students move beyond viewing functions as processes that take inputs and yield outputs and begin to view functions as objects that can be combined with operations (e.g., finding $(f + g)(x) = f(x) + g(x)$). They explore many examples of functions, including sequences. They interpret functions that are represented graphically, numerically, symbolically, and verbally, translating between representations and understanding the limitations of various

representations. They work with functions given by graphs and tables, keeping in mind that these representations are likely to be approximate and incomplete, depending upon the context. Students' work includes functions that can be described or approximated by formulas, as well as those that cannot. When functions describe relationships between quantities arising from a context, students reason with the units in which those quantities are measured. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. They also interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

Students who are prepared for Mathematics I have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Mathematics I builds on these earlier experiences by asking students to analyze and explain the process of solving an equation and to justify the process used in solving a system of equations. Students develop fluency in writing, interpreting, and translating between various forms of linear equations and inequalities and using them to solve problems. They master solving linear equations and apply related solution techniques and the laws of exponents to the creation and solving of simple exponential equations. Students explore systems of equations and inequalities, finding and interpreting solutions. All of this work is based on understanding quantities and the relationships between them.

In Mathematics I, students build on their prior experiences with data, developing more formal means of assessing how a model fits data. Students use regression techniques to describe approximately linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

In previous grade levels, students were asked to draw triangles based on given measurements. They also gained experience with rigid motions (translations, reflections, and rotations) and developed notions about what it means for two objects to be congruent. In Mathematics I, students establish triangle congruence criteria based on analyses of rigid motions and formal constructions. They solve problems about triangles, quadrilaterals, and other polygons. They apply reasoning to complete geometric constructions and explain why the constructions work. Finally, building on their work with the Pythagorean Theorem in the grade-eight standards to find distances, students use a rectangular coordinate system to verify geometric relationships, including properties of special triangles and quadrilaterals and slopes of parallel and perpendicular lines.

Mathematics I	West Virginia College- and Career-Readiness Standards
Relationships between Quantities	
Clusters	
• Reason quantitatively and use units to solve problems. • Interpret the structure of expressions. • Create equations that describe numbers or relationships.	• M.1HS.1-3 • M.1HS.4 • M.1HS.5-8
Linear and Exponential Relationships	
Clusters	
• Represent and solve equations and inequalities graphically. • Understand the concept of a function and use function notation. • Interpret functions that arise in applications in terms of a context. • Analyze functions using different representations. • Build a function that models a relationship between two quantities. • Build new functions from existing functions. • Construct and compare linear, quadratic, and exponential models and solve problems. • Interpret expressions for functions in terms of the situation they model.	• M.1HS.9-11 • M.1HS.12-14 • M.1HS.15-17 • M.1HS.18-19 • M.1HS.20-21 • M.1HS.22 • M.1HS.23-25 • M.1HS.26
Reasoning with Equations	
Clusters	
• Understand solving equations as a process of reasoning and explain the reasoning. • Solve equations and inequalities in one variable. • Solve systems of equations.	• M.1HS.27 • M.1HS.28 • M.1HS.29-30

Descriptive Statistics	
Clusters	
• Summarize, represent, and interpret data on a single count or measurement variable.	• M.1HS.31-33
• Summarize, represent, and interpret data on two categorical and quantitative variables.	• M.1HS.34-35
• Interpret linear models.	• M.1HS.36-38
Congruence, Proof, and Constructions	
Clusters	
• Experiment with transformations in the plane.	• M.1HS.39-43
• Understand congruence in terms of rigid motions.	• M.1HS.44-46
• Make geometric constructions.	• M.1HS.47-48
Connecting Algebra and Geometry through Coordinates	
Clusters	
• Use coordinates to prove simple geometric theorems algebraically.	• M.1HS.49-51

Explanations

- **Domains** are broad components that make up a content area. Domains in mathematics vary by grade-level and by course. For example, the six domains for mathematics of Mathematics I are Relationships between Quantities; Linear and Exponential Relationships; Reasoning with Equations; Descriptive Statistics; Congruence, Proof, and Constructions; and Connecting Algebra and Geometry through Coordinates.
- **Clusters** are groups of standards that define the expectations students must demonstrate to be college- and career-ready.
- **Standards** are expectations for what students should know, understand and be able to do; standards represent educational goals.

Note of caution: Neglecting material will leave gaps in students' skills and understandings and will leave students unprepared for the challenges they face in later grades.

Mathematics I Content Plan

Teachers must provide students the opportunity to master each of the course content standards. **It is important to understand that neglecting grade-level or course content standards will leave gaps in students' skills and understandings and will leave students unprepared for the challenges they face in this and later courses**. Any content plan must demonstrate a means by which students can be provided the opportunity to address all course content standards and to revisit and practice skills and strengthen understandings throughout the school year. The information below is an example of how to address all Math I standards in a school year.

DOMAIN TOPIC	**Relationships between Quantities** *Sequences*	**Linear and Exponential Relationships** *Linear and Exponential Functions*	**Linear and Exponential Relationships** *Features of Functions*	**Relationships between Quantities; Reasoning with Equations** *Equations and Inequalities*	**Reasoning with Equations** *Systems of Equations and Inequalities*	**Congruence, Proof, and Constructions** *Transformations and Symmetry*	**Congruence, Proof, and Constructions** *Congruence, Construction, and Proof*	**Connecting Algebra and Geometry through Coordinates** *Connecting Algebra and Geometry*	**Descriptive Statistics** *Modeling Data*
SAMPLE TIMELINE	August/ September	September/ October	October/ November	December	January	February	March	April	May/ June
CONTENT STANDARDS	M.1HS.2 M.1HS.4 M.1HS.20 M.1HS.23 M.1HS.24 M.1HS.26 M.1HS.28	M.1HS.5 M.1HS.6 M.1HS.14 M.1HS.17 M.1HS.18 M.1HS.20 M.1HS.21 M.1HS.23 M.1HS.24 M.1HS.25 M.1HS.26	M.1HS.9 M.1HS.10 M.1HS.11 M.1HS.12 M.1HS.13 M.1HS.14 M.1HS.15 M.1HS.16 M.1HS.18 M.1HS.20 M.1HS.33	M.1HS.1 M.1HS.2 M.1HS.3 M.1HS.5 M.1HS.6 M.1HS.8 M.1HS.27 M.1HS.28	M.1HS.6 M.1HS.7 M.1HS.8 M.1HS.11 M.1HS.21 M.1HS.22 M.1HS.29 M.1HS.30 M.1HS.47	M.1HS.39 M.1HS.40 M.1HS.41 M.1HS.42 M.1HS.43 M.1HS.44 M.1HS.50	M.1HS.43 M.1HS.44 M.1HS.45 M.1HS.46 M.1HS.47 M.1HS.48	M.1HS.19 M.1HS.20 M.1HS.22 M.1HS.29 M.1HS.30 M.1HS.32 M.1HS.49 M.1HS.50 M.1HS.51	M.1HS.31 M.1HS.33 M.1HS.34 M.1HS.35 M.1HS.36 M.1HS.37 M.1HS.38
RATIONALE	In the sample above, Mathematics I begins with students reasoning about sequences and expanding this perception to develop an understanding of functions and their features. Applications of functions create the need to expand problem-solving skills in equations, inequalities, and systems of equations and inequalities. Students strengthen their ability in procedural fluency, conceptual understanding, and applications.								

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