Content and Timeline for Mathematics

Grade 8

West Virginia DEPARTMENT OF EDUCATION

Grade 8

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 grade-level standards. Instruction should be attentive to learning across all early and elementary learning grades and link major topics within grades. Instruction should develop conceptual understanding, procedural skill and fluency, and application.

The table below highlights the content at the cluster level for seventh grade 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 to the Next Grade

In grades six through eight, multiplication and division develop into powerful forms of ratio and proportional reasoning. The properties of operations take on prominence as arithmetic matures into algebra. The theme of quantitative relationships also becomes explicit in grades six through eight, developing into the formal notion of a function by grade eight. Meanwhile, the foundations for later courses in deductive geometry are laid in grades six through eight. The gradual development of data representations in kindergarten through grade five leads to statistics in middle school: the study of shape, center, and spread of data distributions; possible associations between two variables; and the use of sampling in making statistical decisions.

In higher mathematics courses, algebra, functions, geometry, and statistics develop with an emphasis on modeling. Students continue to take a thinking approach to algebra, learning to see and make use of structure in algebraic expressions of growing complexity. To be prepared for courses in higher mathematics, students should be able to demonstrate that they have acquired particular mathematical concepts and procedural skills by the end of grade eight. Prior to grade eight, some standards identify fluency for the grade level, but there are no explicit grade-level fluency expectations for grades seven and beyond. In grade eight, linear algebra is an instructional focus, and although the grade-eight standards do not specifically identify fluency expectations, students in grade eight who can fluently solve linear equations and pairs of simultaneous linear equations will be better prepared to complete courses in higher mathematics. These fluencies and the conceptual understandings that support them are foundational for work in higher mathematics. Many students have worked informally with one-variable linear equations since kindergarten. This important line of development culminates in grade eight with the solution of general one-variable linear

equations, including cases with an infinite number of solutions or no solutions, as well as cases requiring algebraic manipulation using properties of operations.

It is particularly important for students in grade eight to obtain skills and understandings to work with radical and integer exponents; understand connections between proportional relationships, lines, and linear equations; analyze and solve linear equations and pairs of simultaneous linear equations; and define, evaluate, and compare functions. In addition, the skills and understandings to use functions to model relationships between quantities will better prepare students to use mathematics to model real-world problems in higher mathematics.

Grade 8	West Virginia College- and Career-Readiness Standards
The Number System	
Clusters • Know that there are numbers that are not rational, and approximate them by rational numbers	• M.8.1-2
Expressions and Equations	
Clusters • Work with radicals and integer exponents • Understand the connections between proportional relationships, lines, and linear equations • Analyze and solve linear equations and pairs of simultaneous linear equations	• M.8.3-6 • M.8.7-8 • M.8.9-10
Functions	
Clusters • Define, evaluate, and compare functions • Use functions to model relationships between quantities	• M.8.11-13 • M.8.14-15
Geometry	
Clusters • Understand congruence and similarity using physical models, transparencies, or geometry software • Understand and apply the Pythagorean Theorem • Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres	• M.8.16-20 • M.8.21-23 • M.8.24
Statistics and Probability	
Clusters • Investigate patterns of association in bivariate data	• M.8.25-28

Explanations

- **Domains** are broad components that make up a content area. Domains in mathematics vary by grade-level and by course. For example, the five domains for mathematics in Grade 8 are The Number System, Expressions and Equations, Functions, Geometry, and Statistics and Probability.
- **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.

Grade 8 Content Plan

Teachers must provide students the opportunity to master each of the grade-level content standards. **It is important to understand that neglecting grade-level content standards, will leave gaps in students' skills and understandings and will leave students unprepared for the challenges they face in later grades.** Any content plan must demonstrate a means by which students can be provided the opportunity to address all grade-level 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 Grade 8 standards in a school year.

DOMAIN TOPIC	Geometry *Transformations, Dilations, Congruence, and Similarity*	Expressions and Equations *Slope, Linear Relationships, Linear Equations, and Linear Systems*	Functions *Functions*	Geometry *Volume*	Statistics and Probability *Associations in Data*	Expressions and Equations *Exponents and Scientific Notation*	Geometry and The Number System *Pythagorean Theorem and Irrational Numbers*
SAMPLE TIMELINE	August/September	September/October	November/December	January	February	March/April	May/June
CONTENT STANDARDS	M.8.16 M.8.17 M.8.18 M.8.19 M.8.20	M.8.7 M.8.8 M.8.9 M.8.10	M.8.11 M.8.12 M.8.13 M.8.14 M.8.15	M.8.24	M.8.25 M.8.26 M.8.27 M.8.28	M.8.3 M.8.4 M.8.5 M.8.6	M.8.1 M.8.2 M.8.21 M.8.22 M.8.23
RATIONALE	Students in Grade 8 start with the topic of transformational geometry. Transformations, Dilations, Congruence, and Similarity provides context and background knowledge to understand the slope of a line in a coordinate plane. Students build their knowledge of Grade 7 proportional reasoning to build a knowledge base for linear relationships. Students build a solid foundation of linear equations which includes linear systems. Functions are then introduced to show that linear relationships can be functions. The students will apply knowledge of functions in the context of data and variability. They extend their definition of exponents to include all integers, and in the process codify the properties of exponents. They learn about orders of magnitude and scientific notation in order to represent and compute with very large and very small quantities. They encounter irrational numbers for the first time and informally extend the rational number system to the real number system, motivated by their work with the Pythagorean Theorem.						

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