West Virginia math 4 life

Content and Timeline for Mathematics

Mathematics III

West Virginia DEPARTMENT OF EDUCATION

Mathematics III

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 III make connections and applications using the accumulation of learning that they have from their previous courses, with content grouped into four critical units. Students apply methods from probability and statistics to draw inferences and conclusions from data. They expand their repertoire of functions to include polynomial, rational and radical functions and their study of right triangle trigonometry to include general triangles. Students bring together their experiences with functions and geometry to create models and solve contextual problems.

The table below highlights the content at the cluster level for Mathematics III 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

In Mathematics II, students began to see polynomials as a system analogous to the integers that they can add, subtract, and multiply. Students understand that polynomials can be extended to rational expressions, which are analogous to rational numbers. Students also extend their knowledge of linear, exponential, and quadratic functions to include a much broader range of classes of functions. Students begin to examine the role of randomization in statistical design.

In Mathematics III, students understand the structural similarities between the system of polynomials and the system of integers. Students draw on analogies between polynomial, arithmetic and base-ten computation, focusing on properties of operations, particularly the distributive property. They connect multiplication of polynomials with multiplication of multi-digit integers and division of polynomials with long division of integers. Students identify zeros of polynomials and make connections between zeros of polynomials and solutions of polynomial equations. Their work on polynomial expressions culminates with the Fundamental Theorem of Algebra.

Rational numbers extend the arithmetic of integers by allowing division by all numbers except 0. Similarly, rational expressions extend the arithmetic of polynomials by allowing division by all polynomials except the zero polynomial. A central theme of working with rational expressions is that the arithmetic of rational expressions is governed by the same rules as the arithmetic of rational numbers.

Students synthesize and generalize what they have learned about a variety of function families. They extend their work with exponential functions to include solving exponential equations with logarithms. They explore the effects of transformations on graphs of diverse functions, including functions arising in an application, in order to abstract the general principle that transformations on a graph always have the same effect, regardless of the type of the underlying functions.

Students develop the Laws of Sines and Cosines in order to find missing measures of general (not necessarily right) triangles. They are able to distinguish whether three given measures (angles or sides) define 0, 1, 2, or infinitely many triangles. This discussion of general triangles opens up the idea of trigonometry applied beyond the right triangle—that is, at least to obtuse angles. Students build on this idea to develop the notion of radian measure for angles and extend the domain of the trigonometric functions to all real numbers. They apply this knowledge to model simple periodic phenomena.

Students see how the visual displays and summary statistics they learned in previous grade levels or courses relate to different types of data and to probability distributions. They identify different ways of collecting data—including sample surveys, experiments, and simulations—and recognize the role that randomness and careful design play in the conclusions that may be drawn.

Finally, students in Mathematics III extend their understanding of modeling: they identify appropriate types of functions to model a situation, adjust parameters to improve the model, and compare models by analyzing appropriateness of fit and by making judgments about the domain over which a model is a good fit. The description of modeling as “the process of choosing and using mathematics and statistics to analyze empirical situations, to understand them better, and to make decisions” is one of the main themes of this course. Students apply knowledge of functions, statistics, and geometry in a modeling context.

Mathematics III	*West Virginia College- and Career-Readiness Standards*
Inferences and Conclusions from Data	
Clusters	
» Summarize, represent, and interpret data on single count or measurement variable.	» M.3HS.1
» Understand and evaluate random processes underlying statistical experiments.	» M.3HS.2-3
» Make inferences and justify conclusions from sample surveys, experiments, and observational studies.	» M.3HS.4-7
» Use probability to evaluate outcomes of decisions.	» M.3HS.8-9
Polynomials, Rational, and Radical Relationships	
Clusters	
» Use complex numbers in polynomial identities and equations.	» M.3HS.10-11
» Interpret the structure of expressions.	» M.3HS.12-13
» Write expressions in equivalent forms to solve problems.	» M.3HS.14
» Perform arithmetic operations on polynomials.	» M.3HS.15
» Understand the relationship between zeros and factors of polynomials.	» M.3HS.16-17
» Use polynomial identities to solve problems.	» M.3HS.18-19
» Rewrite rational expressions.	» M.3HS.20-21
» Understand solving equations as a process of reasoning and explain the reasoning.	» M.3HS.22
» Represent and solve equations and inequalities graphically.	» M.3HS.23
» Analyze functions using different representations.	» M.3HS.24
Trigonometry of General Triangles and Trigonometric Functions	
Clusters	
» Apply trigonometry to general triangles.	» M.3HS.25-27
» Extend the domain of trigonometric functions using the unit circle.	» M.3HS.28-29
» Model periodic phenomena with trigonometric functions.	» M.3HS.30

Mathematics III	*West Virginia College- and Career-Readiness Standards*
Mathematical Modeling	
Clusters	
» Create equations that describes numbers of relationships	» M.3HS.31-34
» Interpret functions that arise in applications in terms of a context.	» M.3HS.35-37
» Analyze functions using different representations.	» M.3HS.38-40
» Build a function that models a relationship between two quantities.	» M.3HS.41
» Build new functions from existing functions.	» M.3HS.42-43
» Construct and compare linear, quadratic, and exponential models and solve problems.	» M.3HS.44
» Visualize relationships between two dimensional and three-dimensional objects.	» M.3HS.45
» Apply geometric concepts in modeling situations.	» M.3HS.46-48

Explanations

- **Domains** are broad components that make up a content area. Domains in mathematics vary by grade-level and by course. For example, the four domains for mathematics of Mathematics III are Inferences and Conclusions from Data; Polynomials, Rational, and Radical Relationships; Trigonometry of General Triangles and Trigonometric Functions; and Mathematical Modeling.
- **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 III 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.

DOMAIN TOPIC	**Polynomials, Rational, and Radical Relationships** *Polynomial Functions*	**Polynomials, Rational, and Radical Relationships** *Functions and Their Inverses*	**Polynomials, Rational, and Radical Relationships** *Logarithmic Functions*	**Polynomials, Rational, and Radical Relationships** *Rational Expressions and Functions*	**Mathematical Modeling** *Modeling with Functions*	**Inferences and Conclusions from Data** *Statistics*	**Mathematical Modeling** *Modeling with Geometry*	**Trigonometry of General Triangles and Trigonometric Functions** *Modeling Periodic Behavior*	**Trigonometry of General Triangles and Trigonometric Functions** *Trigonometric Functions, Equations, and Identities*
SAMPLE TIMELINE	August/ September	September/ October	October/ November	December	January	February	March	April	May/ June
CONTENT STANDARDS	M.3HS.10 M.3HS.11 M.3HS.12 M.3HS.13 M.3HS.15 M.3HS.16 M.3HS.17 M.3HS.18 M.3HS.19 M.3HS.23 M.3HS.24 M.3HS.38 M.3HS.39 M.3HS.40	M.3HS.38 M.3HS.39 M.3HS.40 M.3HS.41 M.3HS.42 M.3HS.43	M.3HS.14 M.3HS.23 M.3HS.24 M.3HS.38 M.3HS.39 M.3HS.40 M.3HS.41 M.3HS.42 M.3HS.43 M.3HS.44	M.3HS.12 M.3HS.13 M.3HS.20 M.3HS.21 M.3HS.22 M.3HS.23 M.3HS.24 M.3HS.38 M.3HS.39 M.3HS.40	M.3HS.31 M.3HS.32 M.3HS.33 M.3HS.34 M.3HS.35 M.3HS.36 M.3HS.37 M.3HS.38 M.3HS.39 M.3HS.40 M.3HS.41 M.3HS.42 M.3HS.43 M.3HS.44	M.3HS.1 M.3HS.2 M.3HS.3 M.3HS.4 M.3HS.5 M.3HS.6 M.3HS.7 M.3HS.8 M.3HS.9	M.3HS.45 M.3HS.46 M.3HS.47 M.3HS.48	M.3HS.24 M.3HS.28 M.3HS.29 M.3HS.30	M.3HS.24 M.3HS.25 M.3HS.26 M.3HS.27 M.3HS.29 M.3HS.30 M.3HS.35 M.3HS.36 M.3HS.37 M.3HS.38 M.3HS.39 M.3HS.40 M.3HS.41
RATIONALE	In the sample above, Mathematics III begins with students reasoning about polynomial functions and extending this understanding to exponential, logarithmic, rational, and trigonometric functions and their inverses. This format starts with a mathematical concept that is recognized by students and incorporates opportunities to practice concepts and skills developed in prior years. In the plan, students can be provided opportunities to strengthen their ability in procedural fluency, conceptual understanding, and applications.								

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