West Virginia math 4 life

Content and Timeline for Mathematics

Algebra II

West Virginia DEPARTMENT OF EDUCATION

Algebra II

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 Algebra II 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 Algebra II 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 Algebra I, students added, subtracted, and multiplied polynomials. Students in Algebra II divide polynomials that result in remainders, leading to the factor and remainder theorems. This is the underpinning for much of advanced algebra, including the algebra of rational expressions. Themes from middle-school algebra continue and deepen during high school. As early as grade six, students began thinking about solving equations as a process of reasoning. This perspective continues throughout Algebra I and Algebra II. "Reasoned solving" plays a role in Algebra II because the equations students encounter may have extraneous solutions. In Algebra I, students worked with quadratic equations with no real roots. In Algebra II, they extend their knowledge of the number system to include complex numbers, and one effect is that they now have a complete theory of quadratic equations: Every quadratic equation with complex coefficients has (counting multiplicity) two roots in the complex numbers.

In grade eight, students learned the Pythagorean Theorem and used it to determine distances in a coordinate system. In the Geometry course, students proved theorems using coordinates. In Algebra II, students build on their understanding of distance in coordinate systems and draw on their growing command of algebra to connect equations and graphs of conic sections. In Geometry, students began trigonometry through a study of right triangles. In Algebra II, they extend the three basic functions to the entire unit circle.
As students acquire mathematical tools from their study of algebra and functions, they apply these tools in statistical contexts. In a modeling context, students might informally fit an exponential function to a set of data, graphing the data and the model function on the same coordinate axes.

Building on their work with linear, quadratic, and exponential functions, students in Algebra II extend their repertoire of functions to include polynomial, rational, and radical functions. Students work closely with the expressions that define the functions and continue to expand and hone their abilities to model situations and to solve equations, including solving quadratic equations over the set of complex numbers and solving exponential equations using the properties of logarithms. Based on their previous work with functions, and on their work with trigonometric ratios and circles in Geometry, students now use the coordinate plane to extend trigonometry to model periodic phenomena. They explore the effects of transformations on graphs of diverse functions, including functions arising in applications, in order to abstract the general principle that transformations on a graph always have the same effect regardless of the type of underlying function. 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 making judgments about the domain over which a model is a good fit. Students see how the visual displays and summary statistics learned in earlier grade levels relate to different types of data and to probability distributions. They identify different ways of collecting data—including sample surveys, experiments, and simulations—and the role of randomness and careful design in the conclusions that can be drawn.

Algebra II	West Virginia College- and Career-Readiness Standards
Polynomials, Rational, and Radical Relationships	
Clusters	
• Perform arithmetic operations with complex numbers.	• M.A2HS.1-2
• Use complex numbers in polynomial identities and equations.	• M.A2HS.3-5
• Interpret the structure of expressions.	• M.A2HS.6-7
• Write expressions in equivalent forms to solve problems.	• M.A2HS.8
• Perform arithmetic operations on polynomials.	• M.A2HS.9
• Understand the relationship between zeros and factors of polynomials.	• M.A2HS.10-11
• Use polynomial identities to solve problems.	• M.A2HS.12-13
• Rewrite rational expressions.	• M.A2HS.14-15
• Understand solving equations as a process of reasoning and explain the reasoning.	• M.A2HS.16
• Represent and solve equations and inequalities graphically.	• M.A2HS.17
• Analyze functions using different representations.	• M.A2HS.18
Trigonometric Functions	
Clusters	
• Extend the domain of trigonometric functions using the unit circle.	• M.A2HS.19-20
• Model periodic phenomena with trigonometric functions.	• M.A2HS.21
• Prove and apply trigonometric identities.	• M.A2HS.22
Modeling with Functions	
Clusters	
• Create equations that describe numbers or relationships.	• M.A2HS.23-26
• Interpret functions that arise in applications in terms of a context.	• M.A2HS.27-29

• 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.	• M.A2HS.30-32 • M.A2HS.33 • M.A2HS.34-35 • M.A2HS.36
Inferences and Conclusions from Data	
Clusters	
• Summarize, represent, and interpret data on a single count or measurement variable. • Understand and evaluate random processes underlying statistical experiments. • Make inferences and justify conclusions from sample surveys, experiments, and observational studies. • Use probability to evaluate outcomes of decisions.	• M.A2HS.37 • M.A2HS.38-39 • M.A2HS.40-43 • M.A2HS.44-45

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 Algebra II are Polynomials, Rational, and Radical Relationships; Trigonometric Functions; Modeling with Functions; and Inferences and Conclusions from Data.
- **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.

Algebra II 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** *Functions and Their Inverses*	**Polynomials, Rational, and Radical Relationships** *Logarithmic Functions*	**Polynomials, Rational, and Radical Relationships** *Numbers and Operations*	**Polynomials, Rational, and Radical Relationships** *Polynomial Functions*	**Polynomials, Rational, and Radical Relationships** *Rational Expressions and Functions*	**Trigonometric Functions** *Modeling Periodic Behavior*	**Trigonometric Functions** *Trigonometric Functions, Equations, and Identities*	**Modeling with Functions** *Modeling with Functions*	**Conclusions from Data** *Statistics*
SAMPLE TIMELINE	August/ September	September/ October	October/ November	December	January	February	March	April	May/ June
CONTENT STANDARDS									
RATIONALE									

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