

# Mathematics Standard Progressions

## Skill Progressions in West Virginia College- and Career-Readiness Standards for Mathematics

The following pages outline the skill progressions found in the West Virginia College- and Career-Readiness Standards for Mathematics. In Mathematics, the sequence of topics follow a programmatic progression that are reflected in the domains. These domains have been organized into programmatic levels where grade-level clusters provide detail about the skill progressions. The language of the clusters illustrates the advancing rigor and complexity of the expectations for what students should know, understand, and be able to do. Because the diversity of the mathematics in the Fourth Course Options does not support a similar skills progression alignment for these course, the document ends with a listing of the Fourth Course Options in Mathematics.

This document is intended to be a resource that fosters and supports discussion among teachers as they look at the vertical alignment found within the standards that creates a meaningful progression of skills toward college- and career-readiness.

### Mathematics Progressions – High School Integrated Pathway

#### Domain: The Real Number System

Course	Clusters
8th Grade High School Mathematics I	Initial focus begins in High School Mathematics II
High School Mathematics I	Initial focus begins in High School Mathematics II
High School Mathematics II	<ul style="list-style-type: none"><li>Extend the properties of exponents to rational exponents.</li><li>Use properties of rational and irrational numbers.</li></ul>
High School Mathematics III	Not a primary focus of High School Mathematics III

#### Domain: Quantities

Course	Clusters
8th Grade High School Mathematics I	<ul style="list-style-type: none"><li>Reason quantitatively and use units to solve problems. (Foundation for work with expressions, equations, and functions.)</li></ul>
High School Mathematics I	<ul style="list-style-type: none"><li>Reason quantitatively and use units to solve problems. (Foundation for work with expressions, equations, and functions.)</li></ul>
High School Mathematics II	Not a primary focus of High School Mathematics II
High School Mathematics III	Not a primary focus of High School Mathematics III

#### Domain: The Complex Number System

Course	Clusters
8th Grade High School Mathematics I	Initial focus begins in High School Mathematics II

High School Mathematics I	Initial focus begins in High School Mathematics II
High School Mathematics II	<ul style="list-style-type: none"> <li>Perform arithmetic operations with complex numbers. (<math>i^2</math> as the highest power of <math>i</math>)</li> <li>Use complex numbers in polynomial identities and equations (Quadratics with real coefficients)</li> </ul>
High School Mathematics III	<ul style="list-style-type: none"> <li>Use complex numbers in polynomial identities and equations. (Polynomials with real coefficients)</li> </ul>

#### Domain: Seeing Structure in Expressions

Course	Clusters
8th Grade High School Mathematics I	<ul style="list-style-type: none"> <li>Interpret the structure of expressions. (Linear expressions and exponential expressions with integer exponents)</li> </ul>
High School Mathematics I	<ul style="list-style-type: none"> <li>Interpret the structure of expressions. (Linear expressions and exponential expressions with integer exponents)</li> </ul>
High School Mathematics II	<ul style="list-style-type: none"> <li>Interpret the structure of expressions. (Quadratic and exponential)</li> <li>Write expressions in equivalent forms to solve problems. (Quadratic and exponential)</li> </ul>
High School Mathematics III	<ul style="list-style-type: none"> <li>Interpret the structure of expressions. (Polynomial and rational)</li> <li>Write expressions in equivalent forms to solve problems.</li> </ul>

#### Domain: Arithmetic with Polynomials and Rational Expressions

Course	Clusters
8th Grade High School Mathematics I	Initial focus begins in High School Mathematics II
High School Mathematics I	Initial focus begins in High School Mathematics II
High School Mathematics II	<ul style="list-style-type: none"> <li>Perform arithmetic operations on polynomials. (Polynomials that simplify to quadratics.)</li> </ul>
High School Mathematics III	<ul style="list-style-type: none"> <li>Perform arithmetic operations on polynomials. (Beyond quadratics)</li> <li>Understand the relationship between zeros and factors of polynomials.</li> <li>Use polynomial identities to solve problems.</li> <li>Rewrite rational expressions. (Linear and quadratic denominators)</li> </ul>

#### Domain: Creating Equations

Course	Clusters
8th Grade High School Mathematics I	<ul style="list-style-type: none"> <li>Create equations that describe numbers or relationships. (Linear and exponential (integer inputs only))</li> </ul>
High School Mathematics I	<ul style="list-style-type: none"> <li>Create equations that describe numbers or relationships. (Linear and exponential (integer inputs only))</li> </ul>
High School Mathematics II	<ul style="list-style-type: none"> <li>Create equations that describe numbers or relationships. (Include formulas involving quadratic terms)</li> </ul>
High School Mathematics III	<ul style="list-style-type: none"> <li>Create equations that describe numbers or relationships. (Equations using all available types of expressions, including simple root functions.)</li> </ul>

### Domain: Reasoning with Equations and Inequalities

Course	Clusters
8th Grade High School Mathematics I	<ul style="list-style-type: none"> <li>Understand solving equations as a process of reasoning and explain the reasoning. (Master linear, learn as a general principle)</li> <li>Solve equations and inequalities in one variable. (Linear inequalities; literal equations that are linear in the variables being solved for; exponential of a form, such as <math>2^x = 1/16</math>)</li> <li>Analyze and solve linear equations and pairs of simultaneous linear equations. (Systems of linear equations)</li> <li>Solve systems of equations (Linear systems)</li> <li>Represent and solve equations and inequalities graphically. (Linear and exponential; learn as a general principle)</li> </ul>
High School Mathematics I	<ul style="list-style-type: none"> <li>Understand solving equations as a process of reasoning and explain the reasoning. (Master linear, learn as a general principle)</li> <li>Solve equations and inequalities in one variable. (Linear inequalities; literal equations that are linear in the variables being solved for; exponential of a form, such as <math>2^x = 1/16</math>)</li> <li>Analyze and solve linear equations and pairs of simultaneous linear equations. (Systems of linear equations)</li> <li>Solve systems of equations (Linear systems)</li> <li>Represent and solve equations and inequalities graphically. (Linear and exponential; learn as a general principle)</li> </ul>
High School Mathematics II	<ul style="list-style-type: none"> <li>Solve equations and inequalities in one variable. (Quadratics with real coefficients)</li> <li>Solve systems of equations. (Linear-quadratic systems)</li> </ul>
High School Mathematics III	<ul style="list-style-type: none"> <li>Understand solving equations as a process of reasoning and explain the reasoning. (Simple radical and rational)</li> <li>Represent and solve equations and inequalities graphically. (Combine polynomial, rational, radical, absolute value, and exponential functions)</li> </ul>

### Domain: Interpreting Functions

Course	Clusters
8th Grade High School Mathematics I	<ul style="list-style-type: none"> <li>Define, evaluate, and compare functions.</li> <li>Understand the concept of a function and use function notation. (Learn as a general principle. Focus on linear and exponential (integer domains) and on arithmetic and geometric sequences.)</li> <li>Use function to model relationships between quantities.</li> <li>Interpret functions that arise in applications in terms of a context. (Linear and exponential (linear domain))</li> <li>Analyze functions using different representations. (Linear and exponential)</li> </ul>
High School Mathematics I	<ul style="list-style-type: none"> <li>Understand the concept of a function and use function notation. (Learn as a general principle. Focus on linear and exponential (integer domains) and on arithmetic and geometric sequences.)</li> <li>Interpret functions that arise in applications in terms of a context. (Linear and exponential (linear domain))</li> </ul>

	<ul style="list-style-type: none"> <li>Analyze functions using different representations. (Linear and exponential)</li> </ul>
High School Mathematics II	<ul style="list-style-type: none"> <li>Interpret functions that arise in applications in terms of a context. (Include rational, square root and cube root; emphasize selection of appropriate models)</li> <li>Analyze functions using different representations. (Linear, exponential, quadratic, absolute value, step, piecewise-defined)</li> </ul>
High School Mathematics III	<ul style="list-style-type: none"> <li>Interpret functions that arise in applications in terms of a context. (Quadratic)</li> <li>Analyze functions using different representations. (Include rational and radical; focus on using key features to guide selection of appropriate types of model function)</li> </ul>

### Domain: Building Functions

Course	Clusters
8th Grade High School Mathematics I	<ul style="list-style-type: none"> <li>Build a function that models a relationship between two quantities. (Linear and exponential (integer inputs))</li> <li>Build new functions from existing functions. (Linear and exponential; focus on vertical translations for exponential)</li> </ul>
High School Mathematics I	<ul style="list-style-type: none"> <li>Build a function that models a relationship between two quantities. (Linear and exponential (integer inputs))</li> <li>Build new functions from existing functions. (Linear and exponential; focus on vertical translations for exponential)</li> </ul>
High School Mathematics II	<ul style="list-style-type: none"> <li>Build a function that models a relationship between two quantities. (Quadratic and exponential)</li> <li>Build new functions from existing functions. (Quadratic, all exponential, absolute value)</li> </ul>
High School Mathematics III	<ul style="list-style-type: none"> <li>Build a function that models a relationship between two quantities. (Include all types of functions studied)</li> <li>Build new functions from existing functions. (Include simple radical, rational, and exponential functions; emphasize common effect of each transformation across function types)</li> </ul>

### Domain: Linear, Quadratic, and Exponential Models

Course	Clusters
8th Grade High School Mathematics I	<ul style="list-style-type: none"> <li>Construct and compare linear, quadratic, and exponential models and solve problems. (Linear and exponential)</li> <li>Interpret expressions for functions in terms of the situation they model. (Linear and exponential of form <math>f(x) = b^x + k</math>)</li> </ul>
High School Mathematics I	<ul style="list-style-type: none"> <li>Construct and compare linear, quadratic, and exponential models and solve problems. (Linear and exponential)</li> <li>Interpret expressions for functions in terms of the situation they model. (Linear and exponential of form <math>f(x) = b^x + k</math>)</li> </ul>
High School Mathematics II	<ul style="list-style-type: none"> <li>Construct and compare linear, quadratic, and exponential models and solve problems. (Include quadratic)</li> </ul>

High School Mathematics III	<ul style="list-style-type: none"> <li>Construct and compare linear, quadratic, and exponential models and solve problems. (Logarithms as solutions for exponentials)</li> </ul>
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### Domain: Trigonometric Functions

Course	Clusters
8th Grade High School Mathematics I	Initial focus begins in High School Mathematics II
High School Mathematics I	Initial focus begins in High School Mathematics II
High School Mathematics II	<ul style="list-style-type: none"> <li>Prove and apply trigonometric identities.</li> </ul>
High School Mathematics III	<ul style="list-style-type: none"> <li>Extend the domain of trigonometric functions using the unit circle.</li> <li>Model periodic phenomena with trigonometric functions.</li> </ul>

### Domain: Congruence

Course	Clusters
8th Grade High School Mathematics I	<ul style="list-style-type: none"> <li>Experiment with transformations in the plane.</li> <li>Understand congruence in terms of rigid motions. (Build on rigid motions as a familiar starting point for development of concept of geometric proof)</li> <li>Make geometric constructions. (Formalize and explain processes)</li> </ul>
High School Mathematics I	<ul style="list-style-type: none"> <li>Experiment with transformations in the plane.</li> <li>Understand congruence in terms of rigid motions. (Build on rigid motions as a familiar starting point for development of concept of geometric proof)</li> <li>Make geometric constructions. (Formalize and explain processes)</li> </ul>
High School Mathematics II	<ul style="list-style-type: none"> <li>Prove geometric theorems. (Focus on validity of underlying reasoning while using variety of ways of writing proofs)</li> </ul>
High School Mathematics III	Not a primary focus of High School Mathematics III

### Domain: Similarity, Right Triangles, and Trigonometry

Course	Clusters
8th Grade High School Mathematics I	Initial focus begins in High School Mathematics II
High School Mathematics I	Initial focus begins in High School Mathematics II
High School Mathematics II	<ul style="list-style-type: none"> <li>Understand similarity in terms of similarity transformations.</li> <li>Prove theorems involving similarity. (Focus on validity of underlying reasoning while using variety of formats)</li> <li>Define trigonometric ratios and solve problems involving right triangles.</li> </ul>
High School Mathematics III	<ul style="list-style-type: none"> <li>Apply trigonometry to general triangles.</li> </ul>

**Domain: Circles**

Course	Clusters
8th Grade High School Mathematics I	Initial focus begins in High School Mathematics II
High School Mathematics I	Initial focus begins in High School Mathematics II
High School Mathematics II	<ul style="list-style-type: none"> <li>Understand and apply theorems about circles.</li> <li>Find arc lengths and area of sectors of circles. (Radian introduced only as a unit of measure)</li> </ul>
High School Mathematics III	Not a primary focus of High School Mathematics III

**Domain: Expressing Geometric Properties with Equations**

Course	Clusters
8th Grade High School Mathematics I	<ul style="list-style-type: none"> <li>Use coordinates to prove simple geometric theorems algebraically. (Include distance formula; relate to Pythagorean Theorem)</li> </ul>
High School Mathematics I	<ul style="list-style-type: none"> <li>Use coordinates to prove simple geometric theorems algebraically. (Include distance formula; relate to Pythagorean Theorem)</li> </ul>
High School Mathematics II	<ul style="list-style-type: none"> <li>Translate between the geometric description and the equation for a conic section.</li> <li>Use coordinates to prove simple geometric theorems algebraically. (Include simple circle theorems)</li> </ul>
High School Mathematics III	Not a primary focus of High School Mathematics III

**Domain: Geometric Measurement and Dimension**

Course	Clusters
8th Grade High School Mathematics I	<ul style="list-style-type: none"> <li>Understand and apply the Pythagorean Theorem. (Connect to radicals, rational exponents, and irrational numbers)</li> </ul>
High School Mathematics I	Not a primary focus of Mathematics I
High School Mathematics II	<ul style="list-style-type: none"> <li>Explain volume formulas and use them to solve problems.</li> </ul>
High School Mathematics III	<ul style="list-style-type: none"> <li>Visualize the relation between two-dimensional and three-dimensional objects.</li> </ul>

**Domain: Interpreting Categorical and Quantitative Data**

Course	Clusters
8th Grade High School Mathematics I	<ul style="list-style-type: none"> <li>Summarize, represent, and interpret data on a single count or measurement variable.</li> <li>Investigate patterns of association in bivariate data.</li> <li>Summarize, represent, and interpret data on two categorical and quantitative variables. (Linear focus; discuss general principle)</li> <li>Interpret linear models.</li> </ul>
High School Mathematics I	<ul style="list-style-type: none"> <li>Summarize, represent, and interpret data on a single count or measurement variable.</li> </ul>

	<ul style="list-style-type: none"> <li>Investigate patterns of association in bivariate data.</li> <li>Summarize, represent, and interpret data on two categorical and quantitative variables. (Linear focus; discuss general principle)</li> <li>Interpret linear models.</li> </ul>
High School Mathematics II	<ul style="list-style-type: none"> <li>Summarize, represent, and interpret data on two categorical and quantitative variables.</li> </ul>
High School Mathematics III	Not a primary focus of High School Mathematics III

#### Domain: Making Inferences and Justifying Conclusions

Course	Clusters
8th Grade High School Mathematics I	Initial focus begins in Mathematics III
High School Mathematics I	Initial focus begins in Mathematics III
High School Mathematics II	Initial focus begins in Mathematics III
High School Mathematics III	<ul style="list-style-type: none"> <li>Understand and evaluate random processes underlying statistical experiments.</li> <li>Make inferences and justify conclusions from sample surveys, experiments, and observational studies.</li> </ul>

#### Domain: Conditional Probability and the Rules of Probability

Course	Clusters
8th Grade High School Mathematics I	Initial focus begins in Mathematics II
High School Mathematics I	Initial focus begins in Mathematics II
High School Mathematics II	<ul style="list-style-type: none"> <li>Understand independence and conditional probability and use them to interpret data. (Link to data simulations or experiments)</li> <li>Use the rules of probability to compute probabilities of compound events in a uniform probability model.</li> </ul>
High School Mathematics III	Not a primary focus of High School Mathematics III

#### Domain: Using Probability to Make Decisions

Course	Clusters
8th Grade High School Mathematics I	Initial focus begins in Mathematics II
High School Mathematics I	Initial focus begins in Mathematics II
High School Mathematics II	<ul style="list-style-type: none"> <li>Use probability to evaluate outcomes of decisions. (Introductory; apply counting rules)</li> </ul>
High School Mathematics III	<ul style="list-style-type: none"> <li>Use probability to evaluate outcomes of decisions. (Include more complex situations)</li> </ul>

## FOURTH COURSE OPTIONS

Fourth course options available to students in either pathway:

- Advanced Mathematical Modeling
- Calculus
- High School Mathematics IV - Trigonometry/Pre-calculus
- STEM Readiness
- Transition Mathematics for Seniors
- AP<sup>®</sup> Calculus
- AP<sup>®</sup> Computer Science
- AP<sup>®</sup> Statistics
- Dual credit mathematics courses and advanced mathematics courses offered through WV Virtual School.