Tutorials are designed specifically for the Virginia Standards of Learning to prepare students for the Standards of Learning tests.

Math Tutorials offer targeted instruction, practice and review designed to develop computational fluency, deepen conceptual understanding, and apply mathematical practices. They automatically identify and address learning gaps down to elementary-level content, using adaptive remediation to bring students to grade-level no matter where they start. Students engage with the content in an interactive, feedback-rich environment as they progress through standards-aligned modules. By constantly honing the ability to apply their knowledge in abstract and real world scenarios, students build the depth of knowledge and higher order skills required to demonstrate their mastery when put to the test.

In each module, the Learn It and Try It make complex ideas accessible to students through focused content, modeled logic and process, multi-modal representations, and personalized feedback as students reason through increasingly challenging problems. The Review It offers a high impact summary of key concepts and relates those concepts to students' lives. The Test It assesses students' mastery of the module's concepts, providing granular performance data to students and teachers after each attempt. To help students focus on the content most relevant to them, unit-level pretests and posttests can quickly identify where students are strong and where they're still learning.

Unit 1: Quadratic Functions and Inequalities

- **REPRESENTATIONS OF QUADRATIC FUNCTIONS**
  - A2.EI.2.a: Create a quadratic equation or inequality in one variable to model a contextual situation.
- **SOLVING QUADRATIC INEQUALITIES**
  - A2.EI.2.c: Determine the solution to a quadratic inequality in one variable over the set of real numbers algebraically.
  - A2.EI.2.d: Verify possible solution(s) to quadratic equations or inequalities in one variable algebraically, graphically, and with technology to justify the reasonableness of answer(s). Explain the solution method and interpret solutions for problems given in context.

Unit 2: Quadratic Equations and Complex Numbers

- **QUADRATIC FORMULA**
  - A2.EI.2.b: Solve a quadratic equation in one variable over the set of complex numbers algebraically.
- **COMPLEX NUMBERS**
  - A2.EO.4.a: Explain the meaning of i.
  - A2.EO.4.b: Identify equivalent radical expressions containing negative rational numbers and expressions in a + bi form.

- A2.EO.4.c: Apply properties to add, subtract, and multiply complex numbers.

- **COMPLEX NUMBERS AND QUADRATIC FUNCTIONS**
  - A2.EI.2.b: Solve a quadratic equation in one variable over the set of complex numbers algebraically.
  - A2.EI.6.c: Solve a polynomial equation over the set of complex numbers.

Unit 3: Exponential and Logarithmic Functions

- **EXPONENTIAL FUNCTIONS**
  - A2.F.1.b: Write the equation of a square root, cube root, rational, exponential, and logarithmic function, given a graph, using transformations of the parent function, including f(x) + k; f(kx); f(x + k); and kf(x), where k is limited to rational values. Transformations of exponential and logarithmic functions, given a graph, should be limited to a single transformation.
  - A2.F.2.a: Determine and identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically, including graphs with discontinuities.
- **LOGARITHMIC FUNCTIONS**
  - A2.F.1.c: Graph a square root, cube root, rational, exponential, and logarithmic function, given the equation, using transformations of the parent function including f(x) + k; f(kx); f(x + k); and kf(x), where k is limited to rational values. Use technology to verify transformations of the functions.
  - A2.F.2.a: Determine and identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically, including graphs with discontinuities.

Unit 4: Operations with Polynomials

- **ADDITION AND SUBTRACTION OF POLYNOMIALS**
  - A2.EO.3.a: Determine sums, differences, and products of polynomials in one and two variables.
- **MULTIPLICATION OF POLYNOMIALS**
  - A2.EO.3.a: Determine sums, differences, and products of polynomials in one and two variables.
- **DIVISION OF POLYNOMIALS**
  - A2.EO.3.c: Determine the quotient of polynomials in one and two variables, using monomial, binomial, and factorable trinomial divisors.
- **FACTORING SPECIAL CASES**
  - A2.EO.3.b: Factor polynomials completely in one and two variables with no more than four terms over the set of integers.
  - A2.EO.3.d: Represent and demonstrate equality of polynomial expressions written in different forms and verify polynomial identities including the difference of squares, sum and difference of cubes, and perfect square trinomials.

Unit 5: Polynomial Functions and Factoring

- **GRAPHS OF POLYNOMIAL FUNCTIONS**

- A2.F.2.d: Determine the location and value of absolute (global) maxima and absolute (global) minima of a function.
- A2.F.2.e: Determine the location and value of relative (local) maxima or relative (local) minima of a function.
- A2.F.2.g: Describe the end behavior of a function.

- **FACTORING CUBIC POLYNOMIALS**
  - A2.EO.3.b: Factor polynomials completely in one and two variables with no more than four terms over the set of integers.
  - A2.EO.3.d: Represent and demonstrate equality of polynomial expressions written in different forms and verify polynomial identities including the difference of squares, sum and difference of cubes, and perfect square trinomials.
  - A2.EI.6.a: Determine a factored form of a polynomial equation, of degree three or higher, given its zeros or the x-intercepts of the graph of its related function.
- **FACTORING HIGHER ORDER POLYNOMIALS**
  - A2.EO.3.b: Factor polynomials completely in one and two variables with no more than four terms over the set of integers.
  - A2.EO.3.d: Represent and demonstrate equality of polynomial expressions written in different forms and verify polynomial identities including the difference of squares, sum and difference of cubes, and perfect square trinomials.
  - A2.EI.6.a: Determine a factored form of a polynomial equation, of degree three or higher, given its zeros or the x-intercepts of the graph of its related function.
  - A2.EI.6.b: Determine the number and type of solutions (real or imaginary) of a polynomial equation of degree three or higher.
- **RATIONAL ROOT THEOREM**
  - A2.EI.6.c: Solve a polynomial equation over the set of complex numbers.

Unit 6: Exponents and Square Roots

- **SIMPLIFYING SQUARE ROOTS**
  - A2.EO.2.a: Simplify and determine equivalent radical expressions that include numeric and algebraic radicands.
  - A2.EO.2.b: Add, subtract, multiply, and divide radical expressions that include numeric and algebraic radicands, simplifying the result. Simplification may include rationalizing the denominator.
- **LAWS OF EXPONENTS**
  - A2.EO.2.c: Convert between radical expressions and expressions containing rational exponents.

Unit 7: Radical Functions

- **ANALYZING GRAPHS OF SQUARE ROOT FUNCTIONS**

- A2.F.1.b: Write the equation of a square root, cube root, rational, exponential, and logarithmic function, given a graph, using transformations of the parent function, including f(x) + k; f(kx); f(x + k); and kf(x), where k is limited to rational values. Transformations of exponential and logarithmic functions, given a graph, should be limited to a single transformation.
- A2.F.1.c: Graph a square root, cube root, rational, exponential, and logarithmic function, given the equation, using transformations of the parent function including f(x) + k; f(kx); f(x + k); and kf(x), where k is limited to rational values. Use technology to verify transformations of the functions.
- A2.F.2.a: Determine and identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically, including graphs with discontinuities.
- A2.F.2.i: Determine the inverse of a function algebraically and graphically, given the equation of a linear or quadratic function (linear, quadratic, and square root). Justify and explain why two functions are inverses of each other.

- **SOLVING SQUARE ROOT EQUATIONS**
  - A2.EO.2.b: Add, subtract, multiply, and divide radical expressions that include numeric and algebraic radicands, simplifying the result. Simplification may include rationalizing the denominator.
  - A2.EI.5.a: Solve an equation containing no more than one radical expression algebraically and graphically.
  - A2.EI.5.b: Verify possible solution(s) to radical equations algebraically, graphically, and with technology, to justify the reasonableness of answer(s). Explain the solution method and interpret solutions for problems given in context.
  - A2.EI.5.c: Justify why a possible solution to an equation with a square root might be extraneous.

Unit 8: Rational Expressions and Functions

- **OPERATIONS WITH RATIONAL EXPRESSIONS**
  - A2.EO.1.a: Add, subtract, multiply, or divide rational algebraic expressions, simplifying the result.
  - A2.EO.1.b: Justify and determine equivalent rational algebraic expressions with monomial and binomial factors. Algebraic expressions should be limited to linear and quadratic expressions.
  - A2.EO.1.d: Represent and demonstrate equivalence of rational expressions written in different forms.
- **SOLVING RATIONAL EQUATIONS**
  - A2.EI.4.b: Solve rational equations with real solutions containing factorable algebraic expressions algebraically and graphically. Algebraic expressions should be limited to linear and quadratic expressions.
  - A2.EI.4.c: Verify possible solution(s) to rational equations algebraically, graphically, and with technology to justify the reasonableness of answer(s). Explain the solution method and interpret solutions for problems given in context.
  - A2.EI.4.d: Justify why a possible solution to an equation containing a rational expression might be extraneous.

- **MODELING SITUATIONS WITH RATIONAL FUNCTIONS**
  - A2.EI.4.a: Create an equation containing a rational expression to model a contextual situation.

Unit 9: Nonlinear Functions

- **ABSOLUTE VALUE FUNCTIONS**
  - A2.EI.1.a: Create an absolute value equation in one variable to model a contextual situation.
  - A2.EI.1.b: Solve an absolute value equation in one variable algebraically and verify the solution graphically.
  - A2.EI.1.e: Verify possible solution(s) to absolute value equations and inequalities in one variable algebraically, graphically, and with technology to justify the reasonableness of answer(s). Explain the solution method and interpret solutions for problems given in context.
- **SYSTEMS OF NONLINEAR EQUATIONS**
  - A2.EI.3.b: Determine the number of solutions to a linear-quadratic and quadratic-quadratic system of equations in two variables.
  - A2.EI.3.c: Solve a linear-quadratic and quadratic-quadratic system of equations algebraically and graphically, including situations in context.
  - A2.EI.3.d: Verify possible solution(s) to linear-quadratic or quadratic-quadratic system of equations algebraically, graphically, and with technology to justify the reasonableness of answer(s). Explain the solution method and interpret solutions for problems given in context.

Unit 10: Direct and Inverse Variations

- **INVERSE VARIATION**
  - A2.F.1.d: Determine when two variables are directly proportional, inversely proportional, or neither, given a table of values. Write an equation and create a graph to represent a direct or inverse variation, including situations in context.
- **MODELING SITUATIONS WITH DIRECT AND INVERSE VARIATION**
  - A2.F.1.d: Determine when two variables are directly proportional, inversely proportional, or neither, given a table of values. Write an equation and create a graph to represent a direct or inverse variation, including situations in context.

Unit 11: Parent and Inverse Functions

- **PARENT FUNCTIONS**
  - A2.F.1.a: Distinguish between the graphs of parent functions for square root, cube root, rational, exponential, and logarithmic function families.
  - A2.F.1.e: Compare and contrast the graphs, tables, and equations of square root, cube root, rational, exponential, and logarithmic functions.
  - A2.F.2.b: Compare and contrast the characteristics of square root, cube root, rational, polynomial, exponential, logarithmic, and piecewise-defined functions.

- A2.F.2.h: Determine the equations of any vertical and horizontal asymptotes of a function using a graph or equation (rational, exponential, and logarithmic).

- **INVERSE FUNCTIONS**
  - A2.F.2.i: Determine the inverse of a function algebraically and graphically, given the equation of a linear or quadratic function (linear, quadratic, and square root). Justify and explain why two functions are inverses of each other.
  - A2.F.2.j: Graph the inverse of a function as a reflection over the line y = x.

Unit 12: Working with Functions

- **TRANSFORMATIONS OF PARENT FUNCTIONS**
  - A2.F.1.c: Graph a square root, cube root, rational, exponential, and logarithmic function, given the equation, using transformations of the parent function including f(x) + k; f(kx); f(x + k); and kf(x), where k is limited to rational values. Use technology to verify transformations of the functions.
  - A2.F.2.a: Determine and identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically, including graphs with discontinuities.
- **MULTIPLE TRANSFORMATIONS OF FUNCTIONS**
  - A2.F.1.c: Graph a square root, cube root, rational, exponential, and logarithmic function, given the equation, using transformations of the parent function including f(x) + k; f(kx); f(x + k); and kf(x), where k is limited to rational values. Use technology to verify transformations of the functions.
  - A2.F.2.a: Determine and identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically, including graphs with discontinuities.
- **EVALUATING FUNCTIONS**
  - A2.F.2.f: For any value, x, in the domain of f, determine f(x) using a graph or equation. Explain the meaning of x and f(x) in context, where applicable.

Unit 13: Statistics with Univariate Data

- **EXPERIMENTAL AND OBSERVATIONAL DESIGN**
  - A2.ST.1.b: Collect or acquire univariate data through research, or using surveys, observations, scientific experiments, polls, or questionnaires.
- **DATA ANALYSIS**
  - A2.ST.1.c: Examine the shape of a data set (skewed versus symmetric) that can be represented by a histogram, and sketch a smooth curve to model the distribution.
  - A2.ST.1.j: Compare multiple data distributions using measures of center, measures of spread, and shape of the distributions.
- **NORMAL DISTRIBUTION**
  - A2.ST.1.d: Identify the properties of a normal distribution.
  - A2.ST.1.e: Describe and interpret a data distribution represented by a smooth curve by analyzing measures of center, measures of spread, and shape of the curve.

- A2.ST.1.f: Calculate and interpret the z-score for a value in a data set.
- A2.ST.1.h: Determine the solution to problems involving the relationship of the mean, standard deviation, and z-score of a data set represented by a smooth or normal curve.
- A2.ST.1.i: Apply the Empirical Rule to answer investigative questions.

Unit 14: Statistics with Bivariate Data

- **SCATTERPLOTS**
  - A2.ST.2.a: Formulate investigative questions that require the collection or acquisition of bivariate data and investigate questions using a data cycle.
- **COMBINATIONS AND PERMUTATIONS**
  - A2.ST.3.e: Calculate and verify permutations and combinations using technology.
- **SCATTERPLOTS AND MODELING**
  - A2.ST.2.g: Make predictions, decisions, and critical judgments using data, scatterplots, or the equation(s) of the mathematical model.