

Tennessee Tutorials are designed specifically for the Tennessee Academic Standards to prepare students for the Tennessee Comprehensive Assessment Program (TCAP) and the TNReady assessments.

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.

1. LITERAL EQUATIONS AND GEOMETRIC SEQUENCES

• LITERAL EQUATIONS

- **M3.A.CED.A.1** Create equations and inequalities in one variable and use them to solve problems.
- **M3.A.CED.A.3** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

• SUMS OF GEOMETRIC SEQUENCES

- **M3.A.SSE.B.3** Recognize a finite geometric series (when the common ratio is not 1), and know and use the sum formula to solve problems in context.

2. EXPONENTIAL EQUATIONS AND FUNCTIONS

• EXPONENTIAL FUNCTIONS

- **M3.A.SSE.B.2.a** Use the properties of exponents to rewrite expressions for exponential functions.
- **M3.F.IF.A.2** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
- **M3.F.LE.A.1** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- **M3.F.IF.A.1** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
- **M3.A.CED.A.1** Create equations and inequalities in one variable and use them to solve problems.

• SOLVING EXPONENTIAL EQUATIONS

- **M3.A.SSE.B.2.a** Use the properties of exponents to rewrite expressions for exponential functions.
- **M3.F.LE.A.2** For exponential models, express as a logarithm the solution to $ab = c$ to the ct power $= d$ where a , c , and d are numbers and the base b is 2, 10, or e ; evaluate the logarithm using technology.
- **M3.F.IF.A.1** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
- **M3.F.IF.B.3.d** Graph exponential and logarithmic functions, showing intercepts and end behavior.

- **EXPONENTIAL GROWTH AND DECAY**

- **M3.F.LE.A.1** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- **M3.N.Q.A.1** Identify, interpret, and justify appropriate quantities for the purpose of descriptive modeling.

3. LOGARITHMIC FUNCTIONS AND EXPRESSIONS

- **LOGARITHMIC FUNCTIONS**

- **M3.F.IF.A.1** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
- **M3.F.BF.A.2.a** Find the inverse of a function when the given function is one-to-one.
- **M3.F.LE.A.2** For exponential models, express as a logarithm the solution to ab to the ct power $= d$ where a , c , and d are numbers and the base b is 2, 10, or e ; evaluate the logarithm using technology.
- **M3.N.Q.A.1** Identify, interpret, and justify appropriate quantities for the purpose of descriptive modeling.
- **M3.F.IF.B.3.d** Graph exponential and logarithmic functions, showing intercepts and end behavior.

- **EVALUATING LOGARITHMIC EXPRESSIONS**

- **M3.F.LE.A.2** For exponential models, express as a logarithm the solution to ab to the ct power $= d$ where a , c , and d are numbers and the base b is 2, 10, or e ; evaluate the logarithm using technology.

- **SOLVING LOGARITHMIC EQUATIONS**

- **M3.F.BF.A.2.a** Find the inverse of a function when the given function is one-to-one.
- **M3.F.IF.A.1** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
- **M3.F.LE.A.2** For exponential models, express as a logarithm the solution to ab to the ct power $= d$ where a , c , and d are numbers and the base b is 2, 10, or e ; evaluate the logarithm using technology.
- **M3.A.REI.A.1** Explain each step in solving an equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

4. FACTORING POLYNOMIALS AND THE FACTOR THEOREM

- **FACTORING CUBIC POLYNOMIALS**

- **M3.A.SSE.A.1** Use the structure of an expression to identify ways to rewrite it.
- **M3.A.APR.B.3** Know and use polynomial identities to describe numerical relationships.
- **M3.A.APR.A.2** Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

- **FACTORING HIGHER-ORDER POLYNOMIALS**

- **M3.A.SSE.A.1** Use the structure of an expression to identify ways to rewrite it.
- **M3.A.APR.A.2** Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
- **M3.A.APR.B.3** Know and use polynomial identities to describe numerical relationships.

- **FACTOR THEOREM AND REMAINDER THEOREM**

- **M3.A.APR.A.1** Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a , the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.
- **M3.A.APR.C.4** Rewrite rational expressions in different forms.

5. POLYNOMIAL FUNCTIONS

• GRAPHS OF POLYNOMIAL FUNCTIONS

- **M3.A.APR.A.2** Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
- **M3.F.IF.A.1** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
- **M3.F.BF.A.1** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
- **M3.F.IF.B.3.c** Graph polynomial functions, identifying zeros when suitable factorizations are available and showing end behavior.

• MULTIPLE REPRESENTATIONS OF FUNCTIONS

- **M3.F.IF.A.1** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
- **M3.F.IF.B.4** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
- **M3.A.CED.A.2** Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.

6. POLYNOMIAL IDENTITIES

• POLYNOMIAL IDENTITIES

- **M3.A.APR.B.3** Know and use polynomial identities to describe numerical relationships.
- **M3.A.SSE.A.1** Use the structure of an expression to identify ways to rewrite it.

• POLYNOMIAL IDENTITIES AND COMPLEX NUMBERS

- **M3.A.SSE.A.1** Use the structure of an expression to identify ways to rewrite it.
- **M3.A.APR.B.3** Know and use polynomial identities to describe numerical relationships.

7. SQUARE ROOT FUNCTIONS AND EQUATIONS

• ANALYZING GRAPHS OF SQUARE ROOT FUNCTIONS

- **M3.F.BF.A.1** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
- **M3.F.IF.B.3.b** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- **M3.F.BF.A.2.a** Find the inverse of a function when the given function is one-to-one.

• SOLVING SQUARE ROOT EQUATIONS

- **M3.A.REI.A.2** Solve rational and radical equations in one variable, and identify extraneous solutions when they exist.
- **M3.A.REI.A.1** Explain each step in solving an equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

8. RATIONAL EXPRESSIONS AND EQUATIONS

• OPERATIONS WITH RATIONAL EXPRESSIONS

- **M3.A.SSE.A.1** Use the structure of an expression to identify ways to rewrite it.
- **M3.A.APR.C.4** Rewrite rational expressions in different forms.

- **SOLVING RATIONAL EQUATIONS**

- **M3.A.REI.A.1** Explain each step in solving an equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
- **M3.N.Q.A.1** Identify, interpret, and justify appropriate quantities for the purpose of descriptive modeling.
- **M3.A.REI.A.2** Solve rational and radical equations in one variable, and identify extraneous solutions when they exist.

9. RATIONAL FUNCTIONS

- **ANALYZING GRAPHS OF RATIONAL FUNCTIONS**

- **M3.F.IF.A.1** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
- **M3.A.CED.A.2** Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.

- **MODELING SITUATIONS WITH RATIONAL FUNCTIONS**

- **M3.A.REI.A.2** Solve rational and radical equations in one variable, and identify extraneous solutions when they exist.
- **M3.A.CED.A.2** Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.

10. TRIGONOMETRY

- **RADIANS AND THE UNIT CIRCLE**

- **M3.F.TF.A.1.a** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
- **M3.F.TF.A.2** Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
- **M3.F.TF.A.1.b** Use the unit circle to find $\sin \theta$, $\cos \theta$, and $\tan \theta$ when θ is a commonly recognized angle between 0 and 2π .
- **M3.F.TF.B.3.a** Given a point on a circle centered at the origin, recognize and use the right triangle ratio definitions of $\sin \theta$, $\cos \theta$, and $\tan \theta$ to evaluate the trigonometric functions.

- **TRIGONOMETRIC FUNCTIONS**

- **M3.F.TF.A.2** Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
- **M3.F.TF.B.3.a** Given a point on a circle centered at the origin, recognize and use the right triangle ratio definitions of $\sin \theta$, $\cos \theta$, and $\tan \theta$ to evaluate the trigonometric functions.
- **M3.F.TF.B.3.b** Given the quadrant of the angle, use the identity $\sin^2 \theta + \cos^2 \theta = 1$ to find $\sin \theta$ given $\cos \theta$, or vice versa.

11. FUNCTIONS

- **INVERSE FUNCTIONS**

- **M3.F.BF.A.2.a** Find the inverse of a function when the given function is one-to-one.

- **SYSTEMS OF NONLINEAR EQUATIONS**

- **M3.A.REI.B.3** Explain why the x -coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the approximate solutions using technology.

12. PARENT FUNCTIONS AND TRANSFORMATIONS

• PARENT FUNCTIONS

- **M3.F.IF.A.1** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
- **M3.F.IF.B.3.b** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- **M3.F.BF.A.1** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
- **M3.F.IF.B.3.c** Graph polynomial functions, identifying zeros when suitable factorizations are available and showing end behavior.
- **M3.F.IF.B.3.a** Graph linear and quadratic functions and show intercepts, maxima, and minima.
- **M3.F.IF.B.3.d** Graph exponential and logarithmic functions, showing intercepts and end behavior.

• TRANSFORMATIONS OF PARENT FUNCTIONS

- **M3.F.IF.A.1** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
- **M3.F.IF.B.3.b** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- **M3.F.BF.A.1** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
- **M3.F.IF.B.3.a** Graph linear and quadratic functions and show intercepts, maxima, and minima.
- **M3.F.IF.B.3.c** Graph polynomial functions, identifying zeros when suitable factorizations are available and showing end behavior.
- **M3.F.IF.B.3.d** Graph exponential and logarithmic functions, showing intercepts and end behavior.

• MULTIPLE TRANSFORMATIONS OF PARENT FUNCTIONS

- **M3.F.IF.A.1** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
- **M3.F.IF.B.3.b** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- **M3.F.BF.A.1** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
- **M3.F.IF.B.3.a** Graph linear and quadratic functions and show intercepts, maxima, and minima.
- **M3.F.IF.B.3.c** Graph polynomial functions, identifying zeros when suitable factorizations are available and showing end behavior.
- **M3.F.IF.B.3.d** Graph exponential and logarithmic functions, showing intercepts and end behavior.

13. CIRCLE BASICS

• CIRCLE BASICS

- **M3.G.C.A.2** Identify and describe relationships among inscribed angles, radii, and chords.
- **M3.G.MG.A.1** Use geometric shapes, their measures, and their properties to describe objects.

• CONGRUENT AND SIMILAR CIRCLES

- **M3.G.C.A.1** Recognize that all circles are similar.

- **CENTRAL ANGLES, INSCRIBED ANGLES, AND CHORDS**

- **M3.G.C.A.2** Identify and describe relationships among inscribed angles, radii, and chords.
- **M3.G.MG.A.1** Use geometric shapes, their measures, and their properties to describe objects.

14. CIRCLE PROPERTIES

- **SECANTS, ANGLES, AND INTERCEPTED ARCS**

- **M3.G.MG.A.1** Use geometric shapes, their measures, and their properties to describe objects.
- **M3.G.C.A.2** Identify and describe relationships among inscribed angles, radii, and chords.

- **TANGENTS, ANGLES, AND INTERCEPTED ARCS**

- **M3.G.C.A.2** Identify and describe relationships among inscribed angles, radii, and chords.
- **M3.G.MG.A.1** Use geometric shapes, their measures, and their properties to describe objects.

- **AREA OF CIRCLES AND SECTORS**

- **M3.G.MG.A.1** Use geometric shapes, their measures, and their properties to describe objects.
- **M3.G.MG.A.2** Apply geometric methods to solve real-world problems.
- **M3.G.C.B.4** Find the area of a sector of a circle in a real-world context.

15. GEOMETRY

- **CONSTRUCTIONS**

- **M3.G.CO.A.1** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

- **TRIANGLE BISECTORS**

- **M3.G.C.A.3** Construct the incenter and circumcenter of a triangle and use their properties to solve problems in context.
- **M3.G.CO.A.1** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

16. THE COORDINATE PLANE 1

- **PARALLEL AND PERPENDICULAR LINES**

- **M3.G.GPE.B.3** Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.

- **LENGTH AND THE DISTANCE FORMULA**

- **M3.G.GPE.B.4** Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
- **M3.G.GPE.B.5** Know and use coordinates to compute perimeters of polygons and areas of triangles and rectangles.
- **M3.G.MG.A.1** Use geometric shapes, their measures, and their properties to describe objects.

- **MIDPOINT FORMULA ON THE COORDINATE PLANE**

- **M3.G.GPE.B.4** Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
- **M3.G.MG.A.1** Use geometric shapes, their measures, and their properties to describe objects.
- **M3.G.GPE.B.5** Know and use coordinates to compute perimeters of polygons and areas of triangles and rectangles.

17. THE COORDINATE PLANE 2

- **CONJECTURES IN COORDINATE GEOMETRY**

- **M3.G.GPE.B.2** Use coordinates to prove simple geometric theorems algebraically.

- **AREA ON THE COORDINATE PLANE**

- **M3.G.GPE.B.5** Know and use coordinates to compute perimeters of polygons and areas of triangles and rectangles.

- **CIRCLES**

- **M3.G.GPE.A.1** Know and write the equation of a circle of given center and radius using the Pythagorean Theorem.

18. STATISTICS

- **ANALYZING STATISTICAL SAMPLES**

- **M3.S.IC.A.1** Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
- **M3.S.IC.A.2** Decide if a specified model is consistent with results from a given data-generating process (e.g., using simulation).
- **M3.S.IC.B.4** Use data from a sample survey to estimate a population mean or proportion; use a given margin of error to solve a problem in context.

- **EXPERIMENTAL AND OBSERVATIONAL DESIGN**

- **M3.S.IC.B.3** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

- **NORMAL DISTRIBUTION**

- **M3.S.ID.A.1** Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages using the Empirical Rule.
- **M3.S.IC.B.4** Use data from a sample survey to estimate a population mean or proportion; use a given margin of error to solve a problem in context.

19. SCATTERPLOTS AND REGRESSION

- **SCATTERPLOTS**

- **M3.S.ID.B.2.a** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context.
- **M3.S.ID.B.2.b** Fit a linear function for a scatter plot that suggests a linear association.
- **M3.F.IF.A.2** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

- **SCATTERPLOTS AND MODELING**

- **M3.S.ID.B.2.a** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context.
- **M3.S.ID.B.2.b** Fit a linear function for a scatter plot that suggests a linear association.