Common Core State Standards for Mathematics
Curriculum Mapping

Functions	Boardworks Precalculus and Trignometry presentations
Interpreting Functions	
Understand the concept of a function and use function notation.	
1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).	Domain, range and composite functions Inverse functions
2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	Domain, range and composite functions
3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n–1) for n ≥ 1.	Sequences Arithmetic sequences Geometric sequences Quadratic sequences part 1 Quadratic sequences part 2 Other types of sequences
Interpret functions that arise in applications in terms of the context.	
4. 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. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.	Plotting and sketching graphs Even, odd and periodic functions Exponentials with bases other than e Graphing rational functions Exponentials and logarithms
5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.	Domain, range and composite functions

6. 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.	Slopes and intercepts The equation of a straight line Rate of change
Analyze functions using different representations.	
7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.	
a. Graph linear and quadratic functions and show intercepts, maxima, and minima.	Plotting and sketching graphs Linear graphs Graphs of quadratic functions Graphs of important non-linear functions Using graphing calculators in applications
b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	Plotting and sketching graphs Absolute value functions Piecewise-defined functions Graphs of important non-linear functions
c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.	Plotting and sketching graphs Polynomials of degree 3 or more
d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.	Graphing rational functions Solving rational equations
e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	Trigonometric graphs and exact values Transforming trigonometric functions Exponentials and logarithms Exponential growth and decay Exponentials with bases other than e The laws of logarithms Using graphing calculators in applications
8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.	
a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	Solving quadratic equations The Factor Theorem Graphs of quadratic functions

b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.	Exponential growth and decay Exponentials with bases other than e Linear and exponential modeling
9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.	Solving quadratic equations Graphs of quadratic functions Plotting and sketching graphs
Building Functions	
Build a function that models a relationship between two quantities.	
1. Write a function that describes a relationship between two quantities.	
a. Determine an explicit expression, a recursive process, or steps for calculation from a context.	Sequences Arithmetic sequences Geometric sequences Quadratic sequences part 1 Quadratic sequences part 2 Other types of sequences Exponential growth and decay Exponentials with bases other than e Linear and exponential modeling
b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.	Exponential growth and decay Linear and exponential modeling
c. (+) Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.	Domain, range and composite functions
2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.	Sequences Arithmetic sequences Geometric sequences Linear and exponential modeling
Build new functions from existing functions.	

3. 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. Include recognizing even and odd functions from their graphs and algebraic expressions for them.	Even, odd and periodic functions Transforming functions part 1 Transforming functions part 2 Transforming trigonometric functions The reciprocal trigonometric functions
4. Find inverse functions.	
a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, $f(x) = 2x^3$ or f(x) = (x+1)/(x–1) for x ≠ 1.	Inverse functions
b. (+) Verify by composition that one function is the inverse of another.	Inverse functions
c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.	Inverse functions The inverse trigonometric functions
d. (+) Produce an invertible function from a non-invertible function by restricting the domain.	Inverse functions The inverse trigonometric functions
5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.	Exponentials and logarithms The laws of logarithms Solving equations involving logarithms Exponential growth and decay Solving quadratic equations
Linear, Quadratic, and Exponential Models	
Construct and compare linear, quadratic, and exponential models and solve problems.	
1. Distinguish between situations that can be modeled with linear functions and with exponential functions.	
a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.	Linear graphs Exponentials and logarithms Exponential growth and decay Slopes and intercepts Linear and exponential modeling Exponentials with bases other than e Rate of change

b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.	Linear graphs Linear and exponential modeling Arithmetic sequences Slopes and intercepts Rate of change Using graphing calculators in applications
c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	Exponential growth and decay Linear and exponential modeling Exponentials with bases other than e Geometric sequences Using graphing calculators in applications
2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).	Linear graphs The equation of a straight line Exponentials and logarithms Exponential growth and decay Linear and exponential modeling Exponentials with bases other than e Sequences Arithmetic sequences Geometric sequences Quadratic sequences part 1 Quadratic sequences part 2 Other types of sequences Using graphing calculators in applications
3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	Graphs of important non-linear functions Exponentials and logarithms Linear and exponential modeling
4. For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	Exponentials and logarithms The laws of logarithms Solving equations involving logarithms Exponential growth and decay Linear and exponential modeling Exponentials with bases other than e Using graphing calculators in applications
Interpret expressions for functions in terms of the situation they model.	

5. Interpret the parameters in a linear or exponential function in terms of a context.	Exponentials and logarithms The laws of logarithms Solving equations involving logarithms Exponential growth and decay Linear and exponential modeling Exponentials with bases other than e
Trigonometric Functions	
Extend the domain of trigonometric functions using the unit circle.	
1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	Degrees and radians The sine, cosine and tangent of any angle Solving equations using radians
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.	The sine, cosine and tangent of any angle Degrees and radians Trigonometric equations The reciprocal trigonometric functions Solving equations using radians Questions on trigonometry
3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for p/3, p/4 and p/6, and use the unit circle to express the values of sine, cosines, and tangent for x, p + x, and 2p – x in terms of their values for x, where x is any real number.	The sine, cosine and tangent of any angle Trigonometric graphs and exact values
4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.	The sine, cosine and tangent of any angle Trigonometric graphs and exact values
Model periodic phenomena with trigonometric functions.	
5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	Transforming trigonometric functions Using graphing calculators in applications
6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.	The inverse trigonometric functions
7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.	The inverse trigonometric functions
Prove and apply trigonometric identities.	
8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle.	Trigonometric identities

9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.	The addition formulas The double angle formulas Expressions of the form a cos x + b sin x Questions on trigonometry