

Ohio State Core Curriculum
Standards adopted 2001
Patterns, Functions and Algebra Standard

Strand	Reference	Description	Boardworks High School Algebra presentations
Grade 8: Use Patterns, Relations and Functions	1	Relate the various representations of a relationship; i.e., relate a table to graph, description and symbolic form.	Non-linear functions Function notation
	2	Generalize patterns and sequences by describing how to find the nth term.	Sequences and rules Arithmetic sequences Geometric sequences Other types of sequences
	3	Identify functions as linear or nonlinear based on information given in a table, graph or equation.	Non-linear functions
	4	Extend the uses of variables to include covariants where y depends on x.	Linear graphs Slopes and intercepts
	5	Use physical models to add and subtract monomials and polynomials, and to multiply a polynomial by a monomial.	Operations with polynomials
	6	Describe the relationship between the graph of a line and its equation, including being able to explain the meaning of slope as a constant rate of change and y-intercept in real-world problems.	Linear graphs Slopes and intercepts Coordinate geometry The equation of a straight line
	7	Use symbolic algebra (equations and inequalities), graphs and tables to represent situations and solve problems.	Solving linear equations Equations with parentheses and fractions Using equations to solve problems Inequalities Solving linear inequalities Inequalities and regions Inequalities in two variables Linear graphs Slopes and intercepts

Grade 8: Use Algebraic Representations

8	Write, simplify and evaluate algebraic expressions (including formulas) to generalize situations and solve problems.	<p>Solving linear equations Equations with parentheses and fractions Using equations to solve problems Equations, formulas and identities Substituting into formulas Formula problems Rearranging a formula Manipulating formulas Generating formulas</p>
9	Solve linear equations and inequalities graphically, symbolically and using technology.	<p>Solving linear equations Equations with parentheses and fractions Using equations to solve problems Inequalities Solving linear inequalities Inequalities and regions Inequalities in two variables Linear graphs Slopes and intercepts</p>
10	Solve 2 by 2 systems of linear equations graphically and by simple substitution.	<p>Systems of equations and graphs The elimination method for systems of equations The substitution method for systems of equations Problems leading to systems of equations</p>
11	Interpret the meaning of the solution of a 2 by 2 system of equations; i.e., point, line, no solution.	Systems of equations and graphs
12	Solve simple quadratic equations graphically; e.g., $y = x^2 - 16$.	Graphs of quadratic functions
13	Compute and interpret slope, midpoint and distance given a set of ordered pairs.	<p>Slopes and intercepts Coordinate geometry The equation of a straight line</p>

Grade 8: Analyze Change	14	Differentiate and explain types of changes in mathematical relationships, such as linear vs. nonlinear, continuous vs. noncontinuous, direct variation vs. inverse variation.	Direct proportion Inverse proportion Non-linear functions Plotting and sketching graphs
	15	Describe and compare how changes in an equation affects the related graphs; e.g., for a linear equation changing the coefficient of x affects the slope and changing the constant affects the intercepts.	Linear graphs Slopes and intercepts Graphs of important non-linear functions Graphs of quadratic functions Plotting and sketching graphs
	16	Use graphing calculators or computers to analyze change; e.g., interest compounded over time as a nonlinear growth pattern.	Slopes and intercepts Real life graphs
	1	Define function with ordered pairs in which each domain element is assigned exactly one range element.	Functions and relations Domain, range and composite functions
	2	Generalize patterns using functions or relationships (linear, quadratic and exponential), and freely translate among tabular, graphical and symbolic representations.	Solving linear equations Using equations to solve problems Linear graphs Problems leading to quadratic equations Solving quadratic equations Graphs of quadratic functions The laws of logarithms Solving equations involving logarithms Exponentials and logarithms Exponential growth and decay

Grade 9: Use Patterns, Relations and Functions	3	Describe problem situations (linear, quadratic and exponential) by using tabular, graphical and symbolic representations.	Solving linear equations Using equations to solve problems Linear graphs Problems leading to quadratic equations Solving quadratic equations Graphs of quadratic functions The laws of logarithms Solving equations involving logarithms Exponentials and logarithms Exponential growth and decay
	4	Demonstrate the relationship among zeros of a function, roots of equations, and solutions of equations graphically and in words.	Graphs of important non-linear functions Graphs of quadratic functions Plotting and sketching graphs
	5	Describe and compare characteristics of the following families of functions: linear, quadratic and exponential functions; e.g., general shape, number of roots, domain, range, rate of change, maximum or minimum.	Graphs of important non-linear functions Graphs of quadratic functions Plotting and sketching graphs
Grade 9: Use Algebraic Representations	6	Write and use equivalent forms of equations and inequalities in problem situations; e.g., changing a linear equation to the slope-intercept form.	Slopes and intercepts Coordinate geometry The equation of a straight line
	7	Use formulas to solve problems involving exponential growth and decay.	Exponential growth and decay
	8	Find linear equations that represent lines that pass through a given set of ordered pairs, and find linear equations that represent lines parallel or perpendicular to a given line through a specific point.	Linear graphs Slopes and intercepts Parallel and perpendicular lines Coordinate geometry The equation of a straight line
	9	Solve and interpret the meaning of 2 by 2 systems of linear equations graphically, by substitution and by elimination, with and without technology.	Systems of equations and graphs The elimination method for systems of equations The substitution method for systems of equations Problems leading to systems of equations

	10	Solve quadratic equations with real roots by factoring, graphing, using the quadratic formula and with technology.	Factoring Factoring quadratic expressions Quadratic equations and factoring Solving quadratic equations Graphs of quadratic functions
	11	Add, subtract, multiply and divide monomials and polynomials (division of polynomials by monomials only).	Operations with polynomials Dividing polynomials The factor theorem
	12	Simplify rational expressions by eliminating common factors and applying properties of integer exponents.	Equations involving algebraic fractions Simplifying rational functions Improper fractions Partial fractions
Grade 9: Analyze Change	13	Model and solve problems involving direct and inverse variation using proportional reasoning.	Direct proportion Inverse proportion
	14	Describe the relationship between slope and the graph of a direct variation and inverse variation.	Linear graphs Slopes and intercepts
	15	Describe how a change in the value of a constant in a linear or quadratic equation affects the related graphs.	Linear graphs Slopes and intercepts Graphs of quadratic functions
Grade 10: Use Patterns, Relations and Functions	1	Define function formally and with $f(x)$ notation.	Non-linear functions Function notation Functions and relations
	2	Describe and compare characteristics of the following families of functions: square root, cubic, absolute value and basic trigonometric functions; e.g., general shape, possible number of roots, domain and range.	Graphs of important non-linear functions Plotting and sketching graphs Absolute value functions
	3	Solve equations and formulas for a specified variable; e.g., express the base of a triangle in terms of the area and height.	Equations, formulas and identities Substituting into formulas Formula problems Rearranging a formula Manipulating formulas Generating formulas
	4	Use algebraic representations and functions to describe and generalize geometric properties and relationships.	Coordinate geometry The equation of a straight line The equation of a circle

Grade 10: Use Algebraic Representations	5	Solve simple linear and nonlinear equations and inequalities having square roots as coefficients and solutions.	Manipulating formulas Manipulating radicals
	6	Solve equations and inequalities having rational expressions as coefficients and solutions.	Simplifying rational functions Operations with algebraic fractions Improper fractions
	7	Solve systems of linear inequalities.	Inequalities in two variables
	8	Graph the quadratic relationship that defines circles.	Graphs of important non-linear functions
	9	Recognize and explain that the slopes of parallel lines are equal and the slopes of perpendicular lines are negative reciprocals.	Parallel and perpendicular lines
	10	Solve real-world problems that can be modeled using linear, quadratic, exponential or square root functions.	Manipulating formulas Using equations to solve problems Problems leading to quadratic equations Exponential growth and decay
	11	Solve real-world problems that can be modeled, using systems of linear equations and inequalities.	Problems leading to systems of equations
Grade 10: Analyze Change	12	Describe the relationship between slope of a line through the origin and the tangent function of the angle created by the line and the positive x-axis.	–
Grade 11: Use Patterns, Relations and Functions	1	Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest.	Compound percentages
	2	Translate a recursive function into a closed form expression or formula for the nth term to solve a problem situation involving an iterative process; e.g., find the value of an annuity after 7 years.	Geometric sequences Other types of sequences
	3	Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior.	Graphs of important non-linear functions Graphs of quadratic functions Plotting and sketching graphs Exponentials and logarithms Simplifying rational functions

	4	Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology.	Graphs of important non-linear functions Graphs of quadratic functions Plotting and sketching graphs Even, odd and periodic functions
	5	Identify families of functions with graphs that have rotation symmetry or reflection symmetry about the y-axis, x-axis or $y = x$.	Even, odd and periodic functions
Grade 11: Use Algebraic Representations	6	Represent the inverse of a function symbolically and graphically as a reflection about $y = x$.	Inverse functions
	7	Model and solve problems with matrices and vectors.	–
	8	Solve equations involving radical expressions and complex roots.	Manipulating formulas Manipulating radicals
	9	Solve 3 by 3 systems of linear equations by elimination and using technology, and interpret graphically what the solution means (a point, line, plane, or no solution).	Systems of equations and graphs The elimination method for systems of equations The substitution method for systems of equations Problems leading to systems of equations
	10	Describe the characteristics of the graphs of conic sections.	–
Grade 11: Analyze Change	11	Describe how a change in the value of a constant in an exponential, logarithmic or radical equation affects the graph of the equation.	Graphs of important non-linear functions Plotting and sketching graphs
	1	Analyze the behavior of arithmetic and geometric sequences and series as the number of terms increases.	Sequences and rules Arithmetic sequences Geometric sequences Sequences and series The sum of an arithmetic series The sum of a geometric series

Grade 12: Use Patterns, Relations and Functions	2	Translate between the numeric and symbolic form of a sequence or series.	Sequences and rules Arithmetic sequences Geometric sequences Other types of sequences Sequences and series The sum of an arithmetic series The sum of a geometric series
	3	Describe and compare the characteristics of transcendental and periodic functions; e.g., general shape, number of roots, domain and range, asymptotic behavior, extrema, local and global behavior.	Exponentials and logarithms Exponential growth and decay Even, odd and periodic functions
	4	Represent the inverse of a transcendental function symbolically.	–
Grade 12: Use Algebraic Representations	5	Set up and solve systems of equations using matrices and graphs, with and without technology.	Systems of equations and graphs
	6	Make arguments about mathematical properties using mathematical induction.	–
	7	Make mathematical arguments using the concepts of limit.	–
	8	Compare estimates of the area under a curve over a bounded interval by partitioning the region with rectangles; e.g., make successive estimates using progressively smaller rectangles.	–
	9	Translate freely between polar and Cartesian coordinate systems.	–
Grade 12: Analyze Change	10	Use the concept of limit to find instantaneous rate of change for a point on a graph as the slope of a tangent at a point.	–