Parent Guide
Grade Eight Algebra Curriculum
Diocese of Cleveland

Below is a list of skills your child will be taught in Grade Eight Algebra.
As parents, you are encouraged to support the work of your child's teacher in helping your child acquire each of these skills.

Number System	
Know that there are numbers that are not rational, and approximate them by rational numbers.	
	Understand informally that every number has a decimal expansion; the rational numbers are those with decimal expansions that terminate in 0s or eventually repeat. Know that other numbers are called irrational.
	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π2).
Expressions and Equations	
Expressions and Equations work with radicals and integer exponents.	
	Know and apply the properties of integer exponents to generate equivalent numerical expressions.
	Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.
	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.
	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.
Analyze and solve linear equations and pairs of simultaneous linear equations.	
	Solve linear equations in one variable.
	Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).
	Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
	Analyze and solve pairs of simultaneous linear equations.
	Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
	Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.
	Solve real-world and mathematical problems leading to two linear equations in two variables.
Understand the connections between proportional relationships, lines, and linear equations.	
	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.

Functions	
Define, evaluate, and compare functions.	
	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.
	Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
Use functions to model relationships between quantities.	
	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
Algebra, Seeing Structure in Expressions	
Interpret the structure of expressions.	
	Interpret expressions that represent a quantity in terms of its context.
	Interpret parts of an expression, such as terms, factors, and coefficients.
	Interpret complicated expressions by viewing one or more of their parts as a single entity.
	Use the structure of an expression to identify ways to rewrite it.
Write expressions in equivalent forms to solve problems.	
	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
	Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.
	Factor a quadratic expression to reveal the zeros of the function it defines.
	Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
Algebra, Creating Equations	
Create equations that describe numbers or relationships.	
	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Algebra, Reasoning with Equations & Inequalities	
Represent and solve equations and inequalities graphically.	
	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
	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 solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.
	Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
Solve systems of equations.	
	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
Understand solving equations as a process of reasoning and explain the reasoning.	
	Explain each step in solving a simple 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.
	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
Solve equations and inequalities in one variable.	
	Solve quadratic equations in one variable.
	Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x – p)2 = q that has the same solutions. Derive the quadratic formula from this form.
	Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.
Algebra, Arithmetic with Polynomials & Rational Functions	
Perform arithmetic operations on polynomials.	
	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
Understand the relationship between zeros and factors of polynomials.	
	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).
	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.
Rewrite rational expressions.	
	Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.
	Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Statistics & Probability	
Investigate patterns of association in bivariate data.	
	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
Statistics/Probability, Conditional Probability & the Rules of Probability	
Understand independence and conditional probability and use them to interpret data.	
	Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").
	Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
Use the rules of probability to compute probabilities of compound events in a uniform probability model.	
	Use permutations and combinations to compute probabilities of compound events and solve problems.
DOC : Numbers, Number Sense and Operations	
Number and Number Systems	
	Recognize that natural numbers, whole numbers, integers, rational numbers, and irrational numbers are subsets of the real number system.
	Demonstrate an understanding of the properties of the rational number system; e.g., order, and reciprocals.
Meaning of Operations	
	Apply order of operations to simplify expressions and perform computations involving integer exponents and radicals.
Computation and Estimation	
	Add, subtract, multiply, divide, and compare numbers written in scientific notation.
DOC: Patterns, Functions and Algebra	
Patterns, Relations, and Functions	
	Describe and represent relations and functions with tables, graphs, words, and symbols.
Algebraic Representation	
	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.
	Solve systems of linear equations graphically and by simple substitution.
Analyze Change	
	Differentiate and explain types of changes in mathematical relationships, such as linear vs. nonlinear, direct variation vs. inverse variation.
	Describe and compare how changes in an equation affect the related graphs; e.g., for a linear equation changing the coefficient of x affects the slope and changing the constant affects the intercepts.
	Use calculators or computers to analyze change; e.g., interest compounded over time as a nonlinear growth pattern.

OH: CCSS: Literacy: Reading: Science & Technical Subjects	
Key Ideas and Details	
	Cite specific textual evidence to support analysis of science and technical texts.
Craft and Structure	
	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.
OH: CCSS: Literacy: Writing	
Text Types and Purposes	
	Use precise language and domain-specific vocabulary to inform about or explain the topic.
Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.	
	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

(Source: [1] National Governors Association Center for Best Practices, Council of Chief State School Officers. 2010. *Common Core State Standards for Mathematics*. Washington, D.C.: National Governors Association Center for Best Practices, Council of Chief State School Officers.[2] Office of Catholic Education. 2007. *Mathematics Curriculum*. Cleveland, Ohio: Office of Catholic Education.)

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