Mathematics
Unit 1: Algebra Concepts

Essential Understandings	▪ Simplifying algebraic expressions and solving equations and inequalities are foundational tools for further algebraic study and for practical applications. ▪ Graphs, tables, and linear functions can be used to make predictions and solve problems.
Essential Questions	▪ How does one model linear and quadratic algebraic expressions geometrically? ▪ How does the Distributive Property work with numerical and algebraic expressions? ▪ How does one simplify algebraic expressions without the geometric model? ▪ How does one evaluate expressions with square roots, exponents, and rational numbers? ▪ How does one solve one- and two-step equations with integers? ▪ How does one solve equations with variables on both sides of the equation? ▪ How does one solve equations which need simplification? ▪ Are there equations which do not have solutions or which have more than one solution? ▪ How does one translate verbal sentences into equations? ▪ How does one apply equation solving to practical situations? ▪ How does one solve equations using geometric formulas? ▪ How does one check the solution of an equation? ▪ How does one write an inequality from a sentence? ▪ How does one graph an inequality in one-variable and write an inequality from a graph? ▪ How does one solve simple one-variable inequalities? ▪ How does one interpret story graphs that have positive and negative relationships? ▪ What are the connections between ordered pairs expressed in tables of values, the linearity of a graph, and ratios made between ordered pairs? ▪ What are the connections between the steepness of a line and the ratios made by the change in the y-values and the change in the x-values? ▪ What is the definition of the slope of a line and what are the types of slopes? ▪ How is slope applied in practical situations? ▪ How are lines expressed as equations in slope-intercept form? ▪ What are the characteristics of an equation that would produce a non-linear graph? ▪ How can lines and linear equations be used to make predictions from data? ▪ How is a line graphed using either a table of values or slope-intercept form?

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Essential Knowledge	▪ Algebraic expressions can be modeled geometrically. ▪ The Distributive Property can be modeled arithmetically and geometrically. ▪ Solving equations follows a logical sequential process. ▪ A solution of an equation is a number which when substituted for the variable makes the equation a true statement. ▪ There are some equations which have no solutions or many solutions. ▪ An inequality is a statement expressing a less-than or greater-than relationship. ▪ Inequalities are solved like equations except that if an inequality is multiplied or divided on both sides by a negative the relationship must be reversed. ▪ A solution of an inequality is a number which when substituted for the variable makes the inequality a true statement. ▪ The direction of lines on coordinate planes indicates specific relationships between the units shown on the axes. ▪ There are important ratio connections found in tables of values which indicate whether or not a graph will be linear, and if so the steepness and direction of the graph. ▪ The slope ratio, which is 'change in y/change in x', can be found from any two ordered pairs and has practical meaning as a rate of change. ▪ An equation in slope-intercept form ($y = mx + b$) will be a linear graph and the parts of the equation indicate the slope and the y-intercept of the graph. ▪ Directly proportional relationships found in tables and graphs can be expressed in the form $y = kx$. ▪ The $y = kx$ form graphs as a line which intersects the origin. ▪ The equations of horizontal and vertical lines have special forms. ▪ Lines and linear equations can be used to make predictions from data.
Vocabulary	▪ <u>Terms</u>: ○ algebraic expressions, algebraic equation, combine like terms, coefficient, constant, constant rate of change, Distributive Property, evaluate, inequality, intercepts, inverse operations, isolate the variable, line of best fit, linear pattern, nonlinear pattern, rate of change, sequence, simplify, solution, solve, systems of linear equations, variable
Essential Skills	▪ Model algebraic expressions geometrically. (I, R, A) ▪ Use variables to represent unknown quantities to write linear algebraic expressions. (I, R, A) ▪ Create, evaluate, and simplify numerical and algebraic expressions (with square roots, exponents, rational numbers) using properties of the real number system and algebraic properties. (I, R)

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Essential Skills	▪ Demonstrate that two expressions are or are not equivalent by using geometric models, algebraic properties, or substitution. (I, R) ▪ Solve any linear equation of the form ax + b = cx + d including those using the distributive property and combining like terms. (I, R, A) ▪ Solve formulas for a variable using one transformation. (I) ▪ Solve problems involving systems of linear equations in a context using informal methods. (I) ▪ Check solutions of equations. (R, A) ▪ Translate verbal sentences and applications into equations and solve. (I, R) ▪ Solve equations using geometric formulas. (I, R) ▪ Recognize that some equations have no solutions and others have solutions where the variable can be all Real numbers. (I) ▪ Use graphs to estimate solutions of equations and linear systems. (I) ▪ Solve linear inequalities in one variable. (I) ▪ Interpret the solutions to linear inequalities. (I) ▪ Write algebraic expressions for a variety of linear and nonlinear patterns found in tables, graphs, sequences, and applications. (I, R) ▪ Generalize a nonlinear relationship using words or symbols or generalize a common nonlinear relationship to find a specific case. (I) ▪ Distinguish between linear and nonlinear relationships in tables, graphs and equations. (I, R) ▪ Recognize directly proportional relationships from data in a table, graph, or formula. (I, R) ▪ Translate common directly proportional relationships into symbolic statements $y = kx$ and graphs. (I) ▪ Interpret the slope and y-intercept of the graph of $y = kx$ in terms of a given context. (I) ▪ Express the connections found between ordered pairs in tables of values in terms of linearity of the graphs of the ordered pairs and in terms of the ratios made in the ordered pairs. (I, R) ▪ Determine the slope and identify types of slopes. (I, R) ▪ Determine the connections between the steepness of a line and the '$\Delta y/\Delta x$' ratios. (I, R) ▪ Use the slope as a rate of change in practical situations. (I, R) ▪ Identify the slope and y-intercept in linear equations. (I, R) ▪ Graph linear equations in slope-intercept $y = mx + b$ form. (I, R) ▪ Use linear graphs to make predictions from data sets. (I, R)

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Related Maine Learning Results	D. Algebra Symbols and Expressions D1.Students create, evaluate, and manipulate expressions. a. Create and evaluate expressions using real numbers. b. Add and subtract linear expressions. c. Apply the properties of the real number system, including distributive and associative laws, to create equivalent expressions. Equations and Inequalities D2.Students understand and solve problems involving linear equations. a. Solve any linear equation of the form ax + b = cx + d. (Gr. 7 NECAP) b. Recognize that, in general linear equations have just one solution – but know also that some linear equations can have no solution and those linear equations that are identities have every value of x as a solution. c. Use graphs to estimate solutions to equations and systems of equations, check algebraic approaches, provide alternative solution paths, and communicate the solution to a problem. D3.Students understand and solve linear inequalities in one unknown. a. Represent problem situations as inequalities. b. Solve linear inequalities c. Interpret the solutions to linear inequalities. Functions and Relations D4.Students understand and use basic properties of linear relationships, y = mx + b. a. Understand that linear relationships are characterized by a constant rate of change, m. b. Understand that the graph of a linear relationship y = mx + b is a line where the slope is *m* and *b* is the y-coordinate of the point where the graph crosses the y-axis (i.e., value of y when x = 0). c. Translate common linear phenomena into symbolic statements and graphs, and interpret the slope and y-intercept of the graph of y = mx + b in terms of the original situation.

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NECAP	NECAP Functions and Algebra M (F & A) 8-1 Identifies and extends to specific cases a variety of patterns (linear and nonlinear)… …generalizes a nonlinear relationship using words or symbols; or generalizes a common nonlinear relationship to find a specific case. M (F & A) 8-2 …..distinguishes between linear and nonlinear relationships…in tables, graphs, equations, or problem situations. …describes how change in the value of one variable relates to change in the value of a second variable in problem situations with constant and varying rates of change. M (F & A) 8-3 …simplify algebraic expressions (including those with square roots, whole number exponents, or rational numbers)… M (F & A) 8-4 …informally solve problems using systems of linear equations…