Algebra 1 Unit 1: Generalizing Patterns

Lesson	Learning Targets
1.1 Equations that Describe Patterns	• Use generalizing language to describe the relationship between two or more variables presented verbally, numerically, or algebraically. • Write equations that describe the relationship between two quantities in context. • Evaluate algebraic expressions.
1.2 Describing Arithmetic Patterns	• Recognize scenarios with a common difference between terms as arithmetic sequences. • Describe arithmetic sequences with pictures, tables, words, and graphs.
1.3 Making Use of Structure	• Look for and make use of structure. • Use an identified recursive or explicit pattern to extend the pattern to other values. • Begin to make generalizations using language such as always, every time, the pattern is, the rule is, any number, for all numbers, etc.
1.4 Writing Explicit Rules for Patterns	• Understand that explicit rules can be used to find any term in a sequence, without knowing the one before it. • Make use of structure to generalize a formula for the nth term of a sequence.
1.5 Patterns and Equivalent Expressions	• Understand algebraic equivalence by comparing multiple ways of representing a rule • Create an algebraic expression that represents the general case of a pattern. • Explore how equivalent expressions can reveal distinct properties of the quantity they represent.

1.6 Describing Geometric Patterns	• Recognize and describe geometric sequences by identifying a common ratio between terms. • Distinguish between arithmetic and geometric growth.
1.7 Connecting Patterns Across Multiple Representations	• Connect visual, numerical, verbal, and algebraic representations of arithmetic and geometric patterns. • Choose an appropriate representation to explain or visualize a pattern; consider the advantages and disadvantages of various representations

Algebra 1 Unit 2: Linear Relationships

Lesson	Learning Targets
2.1 Proportional Reasoning	• Recognize when two quantities have a proportional relationship and describe what this means. • Use proportional reasoning to find unknown quantities by scaling in tandem or finding a unit rate. • Write proportional relationships in the form $y = kx$ for some constant multiple, k.
2.2 Proportional Relationships in the Coordinate Plane	• Graph proportional relationships in the coordinate plane. • Interpret points in the coordinate plane in context. • Understand that the set of all points satisfying a proportional relationship form a line passing through the origin.
2.3 Slope of a Line	• Understand that the slope of a line represents a rate of change. • Determine the slope between two points by dividing the change in y by the change in x. • Interpret a slope as the change in the output per unit of input.
2.4 Linear Equations	• Write an equation given a starting value and a constant rate of change. • Interpret the coefficients of a linear equation written in slope-intercept form (rate and starting value).
2.5 Graphing Lines	• Identify the y-intercept and slope from a linear equation. • Graph lines given a point and a slope. • Write the equation of a line shown on a graph.
2.6 Linear Reasoning	• Write equations that model linear relationships. • Solve for missing quantities of a linear relationship.

	• Find x- and y-intercepts of lines using tables, graphs, and linear equations.
2.7 Horizontal and Vertical Lines	• Interpret scenarios that can be represented with horizontal lines. • Explain why horizontal lines have a slope of zero and vertical lines have an undefined slope. • Write equations of horizontal and vertical lines, including the x- and y- axes.
2.8 Standard Form of a Line	• Understand that the standard form of a line represents possible combinations of x and y to reach a fixed sum. • Find and interpret x- and y-intercepts of lines given in standard form. • Identify the slope and y-intercept of lines given in standard form.

Algebra 1 Unit 3: Solving Linear Equations and Inequalities

Lesson	Learning Targets
3.1 Exploring Equivalence	• Understand that an equation can be written in many equivalent ways that have the same solution. • Use properties of equality to write equivalent equations.
3.2 Representing and Solving Linear Problems	• Write linear equations that can be solved to find missing information about a situation. • Write linear equations that can be solved to find missing information about a situation. • Understand each part of a linear equation in context and use this context to isolate the desired value.
3.3 Solving Linear Equations by Balancing	• Use comparative reasoning with constant and variable terms to find solutions to linear equations. • Understand the solution to an equation as the equalizer that makes two variable expressions equal. • Understand the solution to an equation as the equalizer that makes two variable expressions equal.
3.4 Reasoning with Linear Equations	• Extend the balancing method of solving equations to negative coefficients and negative solutions. • Determine the difference between two terms by considering distance on a number line.
3.5 Solving Equations using Inverse Operations	• Understand that inverse operations undo the original operation and must be completed in reverse order to isolate the variable. • Use visuals like double number lines or bar models to reason about the solution of an equation.
3.6 Representing Scenarios with Inequalities	• Use numbers, variables, and inequality symbols to represent relationships. • Interpret inequalities that represent constraints.
3.7 Solutions to 1-Variable Inequalities	• Understand that the solutions to an inequality are the range of values that make the inequality true. • Solve simple inequalities by extending strategies related to solving equations. • Represent solutions to an inequality using a ray on the number line.

3.8 Reasoning with Inequalities	• Solve inequalities by making equivalent inequalities. • Reason about the direction of the inequality symbol.
3.9 Writing and Solving Inequalities	• Write and solve inequalities to represent the constraints and solutions to a problem. • Use context, testing, or structure to determine if the solution to an inequality is greater or less than the solution of the related equation.

Algebra 1 Unit 4: Linear Systems and Inequalities

Lesson	Learning Targets
4.1 Interpreting Linear Systems in Context	• Solve for a break-even or equilibrium point by setting two linear expressions in slope-intercept form equal to one another. • Interpret the graph of a linear system before, at, and after the intersection point in context. • Recognize that the point of intersection between two distinct non-parallel lines represents where the two equations have the same x-value and y-value.
4.2 Interpreting Solutions to a Linear System Graphically	• Understand that a solution to an equation is any ordered pair on its graph and the solution to a system of equations is the ordered pair that lies on the graphs of both equations. • Explain what the graph of a linear system looks like with 0, 1 or infinitely many solutions by describing the slopes and y-intercepts of the equations.
4.3 Substitution	• Understand that equivalent expressions can be substituted for one another. • Use the relationship between variables to rewrite an equation with two variables in terms of one variable and solve the system.
4.4 Solving Linear Systems using Elimination	• Given a system of two equations, write new equations by adding, subtracting, or scaling the given equations. • Choose an appropriate strategy for eliminating one variable by adding the equations or scaling and subtracting the equations.
4.5 Determining Number of Solutions Algebraically	• Interpret scenarios with linear systems that have 0, 1 or infinitely many solutions. • Identify the algebraic structures that make a system of linear equations have 0, 1, or infinitely many solutions.
4.6 Graphing Linear Inequalities in Two Variables	• Graph an inequality in two variables by graphing the related equation and shading in the appropriate direction. • Understand that the shaded region represents all the ordered pairs that satisfy the inequality.
4.7 Writing and Solving Systems of Linear Inequalities	• Understand that the solutions to a system of linear equalities is the set of all ordered pairs that make both inequalities true and are represented by the overlap of the shaded regions. • Use the constraints of a problem to write and graph the inequalities and look for solutions.

Algebra 1 Unit 5: Functions

Lesson	Learning Targets
5.1 Using and Interpreting Function Notation	• Understand that $f(a)$ denotes the output of a function f corresponding to the input a. • Use function notation to describe a function's input and corresponding output. • Interpret statements that use function notation in terms of a context.
5.2 Concept of a Function	• Understand that a function from one set (called the domain) to another set (called the range) is a mapping that assigns to each element of the domain exactly one element of the range. • Determine if a relation is a function or not.
5.3 Functions in Multiple Representations	• Evaluate functions represented as a graph, table, or equation.
5.4 Interpreting Graphs of Functions	• Identify and interpret key features of a function from its graph: domain, range, intervals of increasing/decreasing, intercepts, maxima and minima. • Determine an appropriate domain for a function based on the context it describes.
5.5 From Sequences to Functions	• Understand that sequences are a special type of function that assign to each term number, n, a term value, $f(n)$. The domain of this function is the positive integers. • Use function notation to write a rule for a sequence. • Use notation $f(n+1)$ and $f(n-1)$ to represent next and previous terms, respectively.
5.6 Linear Functions	• Identify if a function is linear or not. • Use and interpret function notation to describe key features of linear relationships. • Write equations for linear functions from a table, graph, or verbal description.
5.7 Piecewise Functions	• Understand that piecewise functions have different rules for different intervals of their domain. • Evaluate piecewise functions.
5.8 Average Rate of Change	• 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.

Algebra 1 Unit 6: Working with Nonlinear Functions

Lesson	Learning Targets
6.1 Nonlinear Growth	• Describe the growth of functions presented in tables, graphs, and verbal descriptions. • Determine if a function exhibits linear or nonlinear growth by identifying whether there is a constant rate of change.
6.2 Step Functions	• Interpret and graph scenarios that can be modeled with step functions. • Interpret and graph scenarios that can be modeled with step functions.
6.3 Absolute Value Functions	• Interpret and graph scenarios that can be modeled with absolute value functions. • Connect the meaning of absolute value functions as describing distances between points to the shape and symmetry of their graphs.
6.4 Solving an Absolute Value Function	• Understand that solving equations of the form $f(x) = k$ means finding the x-values of the intersections of $y = f(x)$ and $y = k$. • Solve equations with absolute value functions graphically. • Solve equations with absolute value functions algebraically.
6.5 Exponent Rules	• Use exponent properties to simplify expressions. • Justify properties related to exponents. • Determine if two expressions are equivalent using exponent properties.
6.6 Power Functions	• Evaluate power functions. • Compare the growth rates of power functions as it relates to the degree of the function.
6.7 Square Root and Root Functions	• Understand square roots, cube roots, and nth roots as operators that undo squares, cubes, and nth powers, respectively. • Graph the parent function $y = \sqrt{x}$ and describe its key features including domain, range, and intercepts.

6.8 Radicals and Rational Exponents	• Understand that the properties of exponents extend to rational exponents and use these properties to identify equivalent expressions. • Know that a radical is in simplest form if the radicand has no perfect square factors; simply radicals. • Explain why expressions involving radicals can be rewritten with rational exponents and vice versa.
6.9 Solving Equations	• Solve equations algebraically using inverse operations. • Construct a viable argument to justify a solution method.

Algebra 1 Unit 7: Quadratic Functions

Lesson	Learning Targets
7.1 Quadratic Growth	• Understand that quadratic functions have a linear rate of change, or a constant second difference over equal intervals of the domain. • Identify patterns or scenarios that can be represented by quadratic functions. • Distinguish quadratic growth from linear and exponential growth.
7.2 The Parent Function	• Understand that quadratic functions are represented by parabolas, which have an axis of symmetry through their vertex. • Graph the parent function $f(x) = x^2$ and identify its domain, range, vertex, and intercepts. Describe its rate of change.
7.3 Transforming Quadratic Functions	• Identify the effect of specific transformations (vertical shifts, horizontal shifts, vertical stretches) on the graph of the parent function $f(x) = x^2$. • Connect numerical changes in outputs of transformed functions with graphs of transformed functions (e.g. all the outputs are 5 greater than the original function corresponds with a graph that has been vertically shifted up 5 units). • Graph quadratic functions in vertex form.
7.4 Features of Quadratic Functions	• Identify a relationship between the vertex and the x-intercepts of a quadratic function using symmetry. • Use graphs, tables, and equations to identify the vertex, intercepts, and other values of a quadratic function. • Use graphs, tables, and equations to identify the vertex, intercepts, and other values of a quadratic function.
7.5 Forms of Quadratic Functions	• Understand that each form of a quadratic equation reveals different features of the graph, such as the x- and y-intercepts, the vertex, and the transformations that occurred from the parent function. • Calculate the vertex of a quadratic function given its equation in standard form using the formula $x = -\frac{b}{2a}$.

	• Demonstrate that two different forms of quadratic equations are equivalent.
7.6 Writing Quadratics in Factored Form	• Factor quadratic functions in standard form when a=1 • Factor quadratic functions with a GCF
7.7 Solving Quadratics using the Zero Product Property	• Understand that the x-intercepts of a parabolic function y=f(x) are the solutions to the equation $f(x) = 0$. • Understand why a quadratic in factored form is equal to zero when one of its factors is zero. • Identify x-intercepts/zeros of a quadratic function from standard form using factoring.
7.8 Solving Quadratics using Symmetry	• Given a quadratic in standard form, find its zeros by identifying the axis of symmetry and calculating the horizontal distance between the vertex and an x-intercept.
7.9 Quadratic Models	• Generate quadratic functions as a product of linear equations. • Interpret zeros and relative extrema of a quadratic in a real-world context.

Algebra 1 Unit 8: Exponential Functions

Lesson	Learning Targets
8.1 Geometric Sequences: From Recursive to Explicit	• Understand that patterns representing repeated multiplication can be described with exponents. • Write explicit rules for geometric sequences using the initial term and the common ratio.
8.2 Exponential Functions	• Extend geometric sequences to exponential functions, whose domains are the real numbers. • Understand that in the function $y = ab^x$, a represents the initial term, and b represents the growth or decay factor. • Evaluate exponential functions for positive, negative, and non-integer values of x.
8.3 Graphs of Parent Exponential Functions	• Graph equations of the form $y = b^x$ and identify the domain, range, y-intercept, and asymptote. • Explain why all functions of the form $y = b^x$ pass through $(0,1)$ and $(1, b)$. • Understand that if $b > 1$, the function is increasing, the slope of the graph is positive, and the function represents exponential growth, and if $0 < b < 1$, the function is decreasing, the slope of the graph is negative, and the function represents exponential decay.
8.4 Transformations of Exponential Functions	• Graph equations of the form $y = ab^x$ and $y = b^x + k$ and identify the domain, range, y-intercept, and asymptote. • Describe how the parameters in $y = ab^x + k$ affect the y-intercept of the graph, the steepness of the graph, and the horizontal asymptote.
8.5 Working with Exponential Functions	• Given values of a geometric sequence or exponential function, solve for the common ratio. • Find missing values of a geometric sequence or exponential function. • Construct exponential functions given a description, table, or graph.
8.6 Interpreting Models for Exponential Growth and Decay	• Interpret the parameters of an exponential function in terms of its context. • Use exponential models to make predictions. • Write exponential models for situations with a growth rate or decay rate given as a percent.

8.7 Constructing Exponential Models	• Understand that choices, assumptions, and approximations are part of the modeling process. • Determine if a linear or exponential model better fits a data set. • Construct a rough exponential model based on data.
8.8 Rational Exponents in Context	• Evaluate exponential functions at values representing fractions of the growth period. • Rewrite annual growth rates as monthly, weekly, or daily growth rates, and vice versa.