New Jersey Student Learning Standards for Mathematics and Student Learning Objectives

Issued by the New Jersey Department of Education – Updated August 2019

Algebra 1 – Modeling with Linear Equations and Inequalities – Unit 1

Rationale

Unit 1 focuses on modeling linear relationships with equations and inequalities and emphasizes graphing, interpreting, and justifying solutions. In grade 8, learners solved linear equations in one variable, including equations that required collecting like terms and expanding expressions using the distributive property. They, interpreting $y = mx + b$ as defining a linear function, constructed linear functions by finding the rate of change and initial value. Algebra 1 students build on these previously learned skills to create and solve equations and inequalities in one and two variables. They use equivalence to construct viable arguments to justify solutions. They also create and graph linear equations and inequalities in two variables, understanding that the graph of represents all solutions.

Algebra 1 learners also build on grade 8 experiences solving systems of two linear equations algebraically and graphically. They model systems by representing any constraints with equations or inequalities, solve systems of linear equations exactly and approximately, and interpret solutions as viable or nonviable in the context of the situation.

Note: Double asterisks (**) indicate that the example(s) included within the New Jersey Student Learning Standard may be especially informative when considering the Student Learning Objective.

Algebra 1 – Unit 1, Module A

Standard	Student Learning Objectives We are learning to … / We are learning that …
▢ **N.Q.A.2** Define appropriate quantities for the purpose of descriptive modeling.	▪ define appropriate quantities to be used in descriptive modeling
■ **A.CED.A.1** 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. ▢ **N.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; Choose and interpret units consistently in formulas; Choose and interpret the scale and the origin in graphs and data displays.	▪ create linear equations and inequalities in one variable to model a problem or situation ▪ use linear equations and inequalities to solve problems ▪ use units as a way to understand problems and to guide the solution of multi-step problems

Key: ■ Major Cluster ▢ Supporting Cluster ○ Additional Cluster

Standard	Student Learning Objectives We are learning to … / We are learning that …
A.REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. **A.REI.A.1** 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 linear equations and inequalities in one variable ▪ explain each step in solving a simple equation, assuming it has a solution ▪ construct viable arguments to justify a solution method ▪ solve one-variable linear equations that have coefficients represented by letters
A.CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* **N.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; Choose and interpret units consistently in formulas; Choose and interpret the scale and the origin in graphs and data displays. **N.RN.B.3** Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. **N.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	▪ rearrange formulas to isolate a variable of interest, using the same reasoning as in solving equations ▪ interpret units consistently in formulas ▪ explain why the sum and product of two rational numbers is rational ▪ explain that the sum of a rational number and irrational number is irrational ▪ explain that the product of a nonzero rational number and irrational number is irrational ▪ choose an appropriate level of accuracy based on the limitations on measurement

Algebra 1 – Unit 1, Module B

Standard	Student Learning Objectives We are learning to … / We are learning that …
A.CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **N.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; Choose and interpret units consistently in formulas; Choose and interpret the scale and the origin in graphs and data displays. **A.REI.D.10** 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).	▪ create linear equations to represent relationships between two or more quantities ▪ graph linear equations on the coordinate plane to represent relationships ▪ choose and interpret the scale and the origin in graphs ▪ understand that the graph of an equation, in two variables, is the set of all solutions, often forming a curve
A.CED.A.3 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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*	▪ constraints reflect conditions in the modeling process ▪ represent a constraint as an equation or inequality ▪ interpret possible solutions as viable or nonviable in the modeling context
A.REI.D.12 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.	▪ graph the solution of a linear inequality in two variables as a half plane

Algebra 1 – Unit 1, Module C

Standard	Student Learning Objectives We are learning to … / We are learning that …
A.CED.A.3 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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* **A.REI.C.6** Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	▪ represent constraints by a system of equations in the modeling context ▪ solve a system of linear equations in two variables exactly and approximately ▪ interpret possible solutions as viable or nonviable in the modeling context
A.REI.C.5 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.	▪ transform a system of two equations in two variables into simpler forms that produce a system with the same solutions ▪ prove that through elimination. the transformed system will produce the same solution as the original system
A.CED.A.3 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. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* **A.REI.D.12** 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.	▪ represent constraints by a system of inequalities in the modeling context ▪ graph a system of inequalities in two variables ▪ graph the solution set to a system of linear inequalities as the intersection of the two shaded regions ▪ interpret possible solutions as viable or nonviable in the modeling context

Algebra 1 – Linear and Exponential Modeling: Functions and Bivariate Statistics – Unit 2

Rationale

The focus of Unit 2 is introducing exponential modeling while extending learners understanding of function to include domain, range, and function notation. Grade 8 learners constructed functions to model linear relationships, graphed proportional relationships and interpreted the unit rate as the slope of the graph. Algebra 1 students extend those skills to relate the domain of linear and exponential functions to their graphs, to sketch linear and exponential graphs showing key features, and to interpret key features of graphs and tables. They use function notation, evaluate functions using function notation, and interpret statements that use function notation in context.

Algebra 1 learners continue to compare properties of two functions each represented in a different way, but extend the comparison beyond linear functions to include exponential functions. In this unit, learners first experiment with transformations on graphs, replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k, and illustrating their explanations using technology.

In Module C, learners represent data on a scatter plot and fit linear and exponential functions to data. They assess the fit of these functions by plotting and analyzing residuals. This builds upon their prior grade 8 experiences constructing scatter plots for linear bivariate measurement data, informally fitting straight lines to data, and informally assessing the fit of the model. Algebra 1 learners go on to interpret the slope, intercept, and correlation coefficient of these linear models, distinguishing between correlation and causation in various contexts.

To conclude this unit, learners use the properties of exponents learned in grade 8 to rewrite exponential expressions and create exponential equations and inequalities. They construct both linear and exponential functions, including arithmetic and geometric sequences and recognize that sequences are functions.

Algebra 1 – Unit 2, Module A

Standard	Student Learning Objectives We are learning to … / We are learning that …
F.IF.B.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.	▪ the key features of a graph include intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior ▪ sketch linear and exponential graphs showing key features of a relationship between two quantities given a verbal description of the relationship ▪ interpret key features of graphs and tables that model a linear or exponential relationship between two quantities in the context of those quantities
F.IF.A.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 $y = f(x)$. **F.IF.A.2** Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	▪ the domain is the set of all possible input values and the range is the set of all possible output values ▪ in a function, each element of the domain is assigned to exactly one element in the range ▪ $f(x)$ denotes the output for a given input value of x, for a function f ▪ the graph of a f is equivalent to the graph of $y = f(x)$ ▪ use function notation to find range values for inputs from a function's domain ▪ interpret statements that use function notation in terms of a context

Algebra 1 – Unit 2, Module B

Standard	Student Learning Objectives We are learning to … / We are learning that …
F.IF.B.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.*★	▪ relate the domain of a function to its graph ▪ relate the domain of a function to the quantitative relationship it describes in the context of the problem or situation
F.IF.B 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.	▪ calculate the average rate of change of linear and exponential functions, presented as a table, over a specified interval and interpret it in the context of the problem ▪ estimate the average rate of change of linear and exponential functions from a graph and interpret it in the context of the problem ▪ calculate the average rate of change of linear and exponential function, presented symbolically, over a specified interval and interpret it in the context of the problem
F.IF.C.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.* **F.BF.B.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.	▪ compare properties of two exponential functions each represented in different ways (numerically, graphically, algebraically, or verbally) ▪ identify the effect on the graph of linear and exponential functions by replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k, and illustrate an explanation of the effects on the graph using technology ▪ identify the effect on the graph of linear and exponential functions by replacing $f(x)$ by $kf(x)$ and $f(kx)$ for specific values of k, and illustrate an explanation of the effects on the graph using technology ▪ find the value of k given graphs of linear and exponential functions ▪ experiment with all cases, $f(x) + k$, $f(x + k)$, $kf(x)$ and $f(\mathrm{k}x)$, and illustrate an explanation of the effects on the graph using technology ▪ recognize even and odd functions from their graphs and algebraic expressions for them

Standard	Student Learning Objectives We are learning to … / We are learning that …
☐ **F.LE.A.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. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	▪ recognize situations in which one quantity changes at a constant rate per unit interval relative to another (linear relationships) ▪ recognize situations in which a quantity grows or decays by a constant percent (exponential relationships) ▪ distinguish between situations that can be modeled with linear functions and with exponential functions ▪ prove that a function is linear by showing that the first differences are equal ▪ prove that a function is exponential by showing that the function grows by equal factors over equal intervals
☐ **F.LE.A.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.	▪ use a graph and a table to observe that a quantity that increases exponentially eventually exceeds a quantity that increases linearly
☐ **F.IF.C.7.** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	▪ graph exponential functions, showing intercepts and end behavior of the graph

Algebra 1 – Unit 2, Module C

Standard	Student Learning Objectives We are learning to … / We are learning that …
S.ID.B.6 Represent data on two quantitative variables on a scatter plot and describe how the variables are related. a. Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology. c. Fit a linear function for a scatter plot that suggests a linear association.	▪ represent data on two quantitative variables on a scatterplot ▪ describe the relationship between the two sets of quantitative data ▪ fit linear and exponential functions to data by hand and with the use of technology ▪ use a function fitted to data to solve problems in the context of the data ▪ use given functions or choose a function suggested by the context. ▪ assess the fit of a function by plotting and analyzing residuals, including with the use of technology
S.ID.C.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	▪ interpret the slope of a linear model as a constant rate of change in context of the data ▪ interpret the constant term of a linear model in context of the data
S.ID.C.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.	▪ compute (using technology) and interpret the correlation coefficient for a linear fit
S.ID.C.9 Distinguish between correlation and causation.	▪ distinguish between correlation and causation

Algebra 1 – Unit 2, Module D

Standard	Student Learning Objectives We are learning to … / We are learning that …
A.CED.A.1 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 exponential equations and inequalities in one variable to model a problem or situation
F.BF.A.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. **A.SSE.A.1** Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.*	▪ write a function that describes a linear relationship between two quantities ▪ write a function that describes an exponential relationship between two quantities ▪ determine an explicit expression for a function that models a linear or exponential relationship between two quantities ▪ determine a recursive process for a function that model a linear or exponential relationship between two quantities ▪ determine a set of steps for calculation for a function that models a linear of exponential relationship between two quantities ▪ interpret parts of an expression, such as terms, factors, and coefficients, in context ▪ interpret the meaning of a complicated expression by viewing one or more parts as a single quantity
A.SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. c. Use the properties of exponents to transform expressions for exponential functions. *For example: the expression 1.15^t can be rewritten as $(1.15)^{1/12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*	▪ use the properties of exponents to rewrite exponential expressions the define an exponential function in order to reveal information in the context of the problem or situation

Standard	Student Learning Objectives We are learning to … / We are learning that …
F.LE.A.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). **F.IF.A.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.* **F.LE.B.5** Interpret the parameters in a linear or exponential function in terms of a context.	▪ construct linear functions given a graph, a description of a relationship, or two input-output pairs (include reading these from a table) ▪ interpret the parameters (slope and constant term) of a linear function in terms of a context ▪ construct exponential functions, including geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table) ▪ interpret the parameters (vertical intercept and base) of exponential function in terms of a context ▪ sequences are functions, sometimes defined recursively, whose domain is a subset of the integers ▪ construct arithmetic sequences given a graph, a description of a relationship, or two input-output pairs (include reading these from a table) ▪ construct geometric sequences given a graph, a description of a relationship, or two input-output pairs (include reading these from a table)

Algebra 1 – Quadratic Modeling – Unit 3

Rationale

The focus of unit 3 is modeling quadratic relationships. As with linear and exponential functions in Unit 2, learners relate the domain of quadratic functions to their graphs, sketch quadratic graphs showing key features, and interpret key features of graphs and tables. They use the process of factoring and completing the square produce equivalent forms of quadratic expressions, revealing properties of quadratic functions such as zeros, extreme values, and symmetry.

Algebra 1 learners create quadratic equations in one variable to model a situation and solve them by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. To conclude the unit, they graph quadratic functions, compare properties of two quadratic functions represented in different ways, and revisit transformations on graphs, applying similar reasoning to quadratic functions.

Algebra 1 – Unit 3, Module A

Standard	Student Learning Objectives We are learning to … / We are learning that …
A.APR.A.1 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. **A.SSE.A.2** Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.*	▪ polynomials form a system comparable to the integers ▪ the sum, difference, and product of two polynomials is a polynomial ▪ add and subtract polynomials ▪ multiply polynomials ▪ use the structure of an expression to identify ways to rewrite it

Standard	Student Learning Objectives We are learning to … / We are learning that …
A.SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.	▪ factor a quadratic expression in order 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 1 – Unit 3, Module B

Standard	Student Learning Objectives We are learning to … / We are learning that …
F.IF.B.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.	▪ for functions that model a quadratic relationship, interpret key features of graphs and tables in the context of the problem ▪ sketch graphs of a quadratic functions, showing key features given a verbal description of the relationship
F.IF.B.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*	▪ relate the domain of a quadratic function to its graph and to the quantitative relationship it describes in the context of the problem**

Standard	Student Learning Objectives We are learning to … / We are learning that …
F.IF.B 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.	▪ calculate the average rate of change of a quadratic function, represented as a table of values, over a specified interval and interpret it in the context of the problem ▪ estimate the average rate of change of a quadratic function, represented by a graph, over a specified interval and interpret it in the context of the problem ▪ calculate the average rate of change of a quadratic function, defined by an expression, over a specified interval and interpret it in the context of the problem
A.REI.B.4 Solve quadratic equations in one variable. a. 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. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), 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 $a \pm bi$ for real numbers a and b.	▪ solve quadratic equations by completing the square ▪ use completing the square to rewrite a quadratic equation in the form $(x - p)^2 = q$ ▪ use the form $(x - p)^2 = q$ to derive the quadratic formula ▪ solve quadratic equations by using the quadratic formula ▪ recognize, using the discriminant, when the quadratic formula gives complex solutions and write them as $a \pm bi$
A.CED.A.1 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 quadratic equations in one variable to model a problem or situation ▪ use quadratic equations in one variable to solve problems

Algebra 1 – Unit 3, Module C

Standard	Student Learning Objectives We are learning to … / We are learning that …
☐ **F.IF.C.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.	▪ graph quadratic functions expressed symbolically and show intercepts, maxima or minima
☐ **F.LE.A.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.	▪ use graphs and tables to observe that a quantity that increases exponentially eventually exceeds a quantity that increases quadratically
☐ **F.IF.C.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.	▪ use the process of factoring in a quadratic function to show and interpret the zeros of the function in the context of the problem ▪ use the process of completing the square in a quadratic function to show extreme values and symmetry of the graph and interpret these in the context of the problem
☐ **F.IF.C.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.*	▪ compare properties of two quadratic functions each represented in different ways (numerically, graphically, algebraically, or verbally)

Standard	Student Learning Objectives We are learning to … / We are learning that …
F.BF.B.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.	▪ 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, and illustrate an explanation of the effects on the graph using technology ▪ identify the effect on the graph of quadratic functions by replacing $f(x)$ by $kf(x)$ and $f(kx)$ for specific values of k, and illustrate an explanation of the effects on the graph using technology ▪ find the value of k given graphs of quadratic functions ▪ experiment with all cases, $f(x) + k$, $f(x + k)$, $kf(x)$ and $f(kx)$, and illustrate an explanation of the effects on the graph using technology ▪ recognize even and odd functions from their graphs and algebraic expressions for them

Algebra 1 – Other Nonlinear Graphs and One Variable Statistics – Unit 4

Rationale

In this final unit, learners apply the skills obtained analyzing linear, exponential, and quadratic functions to construct rough graphs for and analyze polynomial functions. Those skills are also extended graphing and identifying key features of square root, cube root, and piece-wise defined functions. Learners use any of these function types when finding approximate solutions to the general equation $f(x) = g(x)$, using technology to graph the functions, make tables of values, and find successive approximations.

In the final module of Algebra 1, learners revisit the concept of association from grade 8 when analyzing two-way frequency tables and interpreting joint, marginal, and conditional relative frequencies in context. They analyze and represent data distributions with dot plots, histograms, and box plots on the real number line. Learners use statistics appropriate to the shape of the data distribution to compare shape, measures of center, and measures of spread of two or more different data sets, interpreting differences in the context of the data sets.

Algebra 1 – Unit 4, Module A

Standard	Student Learning Objectives We are learning to … / We are learning that …
☐ **A.APR.B.3** 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. ☐ **F.IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.	▪ identify the zeros of a polynomial function when suitable factorizations are available ▪ use the zeros to construct a rough graph of the function defined by the polynomial ▪ graph polynomial functions showing end behavior
☐ **F.IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	▪ graph square root, cube root, and show key features of the graph ▪ graph piecewise-defined functions, including step functions and absolute value functions, and show key features of the graph

Standard	Student Learning Objectives We are learning to … / We are learning that …
A.REI.D.11 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.★	▪ in cases where $f(x)$ and/or $g(x)$ are linear, polynomial, absolute value, and exponential, explain why the x-coordinate of the point of intersection of graphs of $f(x)$ and $g(x)$ is the solution of the equation $f(x) = g(x)$ ▪ in cases where cases where $f(x)$ and/or $g(x)$ are linear, polynomial, absolute value, and exponential, find approximate solutions using technology to graph the functions, make tables, and find successive approximations in order to find the solution of the equation $f(x) = g(x)$

Algebra 1 – Unit 4, Module B

Standard	Student Learning Objectives We are learning to … / We are learning that …
S.ID.A.1 Represent data with plots on the real number line (dot plots, histograms, and box plots). **N.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; Choose and interpret units consistently in formulas; Choose and interpret the scale and the origin in graphs and data displays.	▪ represent data using dot plots on the real number line and choose an appropriate scale to represent the data ▪ represent data using histograms on the real number line and choose an appropriate scale to represent the data ▪ represent data using box plots on the real number line and choose an appropriate scale to represent the data
S.ID.A.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	▪ compare the center (mean, median) and spread (interquartile range, standard deviation) of two or more different data sets using measures appropriate to the shape of the data
S.ID.A.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	▪ interpret differences in shape, center, and spread in the context of data sets ▪ interpret the effect of outliers on the shape, center, and spread of a data set
S.ID.B.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.	▪ summarize categorical data for two categories in a two-way frequency table ▪ interpret relative frequencies, including joint, marginal, and conditional relative frequencies, in the context of the data ▪ recognize possible associations and trends in categorical data