Unit 2
Functions

Algebra I

Unit Description:

Students will study functions and function concepts, including domain, range, slope as rate of change, intercepts, and direct variation. Students will write linear functions given a point and a slope, two points, a table of values, and arithmetic sequence or a graph. Students will express equations in a variety of forms including slope-intercept and standard. Additionally, they will collect and model data with linear, quadratic, or exponential functions.

Standards for Mathematical Practice

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Louisiana Student Standards for Mathematics (LSSM)

Parts of standards that are addressed in later units have been ~~crossed out~~.

REI – Reasoning with Equations and Inequalities	
D. Represent and solve equations and inequalities graphically.	
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).
F – Functions **IF – Interpreting Functions**	
A. Understand the concept of a function and use function notation.	
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

F-IF.A.3	Recognize that sequences are functions whose domain is a subset of the integers. Relate arithmetic sequences to linear functions and geometric sequences to exponential functions.
B. Interpret functions that arise in application in terms of the context.	
F-IF.B.4	For linear, ~~piecewise linear (to include absolute value),~~ and exponential functions that model 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; and end behavior. ★
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.* ★
F-IF.B.6	Calculate and interpret the average rate of change of a linear, ~~piecewise linear (to include absolute value)~~, and exponential function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★
C. Analyze functions using different representations.	
F-IF.C.7.a	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 functions and show intercepts, maxima, and minima.
F-IF.C.9	Compare properties of two functions (linear, quadratic, ~~piecewise linear [to include absolute value]~~ or exponential) 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, determine which has the larger maximum.*
LE – Linear, Quadratic, and Exponential Models	
A. Construct and compare linear, quadratic, and exponential models and solve problems.	
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.
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). ★
B. Interpret expressions for functions in terms of the situation they model.	
F-LE.B.5	Interpret the parameters in a linear, quadratic, or exponential function in terms of a context.
BF – Building Functions	
A. Build a function that models a relationship between two quantities.	
F-BF.A.1	Write a linear, quadratic, or exponential function that describes a relationship between two quantities. ★
B. Build new functions from existing functions.	
F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x)+k$, $\cancel{kf(x), f(kx),}$ and $f(x+k)$ for specific values of k (both positive and negative). Without technology, find the value of k given the graphs of linear and quadratic functions. With technology, experiment with cases and illustrate an explanation of the effects on the graph that include cases where $f(x)$ is a linear, quadratic, ~~piecewise linear (to include absolute value)~~, or exponential function.
N-Q Quantities	
A. Reason quantitatively and use units to solve problems.	
N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

★**As defined by LSSM, the basic modeling cycle involves:**
1. identifying variables in the situation and selecting those that represent essential features,
2. formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables,
3. analyzing and performing operations on these relationships to draw conclusions,
4. interpreting the results of the mathematics in terms of the original situation,
5. validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable,
6. reporting on the conclusions and the reasoning behind them.

Choices, assumptions, and approximations are present throughout this cycle.

Enduring Understandings:
*New functions can be created from parent functions through a series of transformations.
*Real world phenomena often involve non-linear relationships.
*Non-constant rates of change denote non-linear relations.
*Algebraic representations can be used to generalize patterns in mathematics.
*Mathematical functions are relationships that assign each member of one set to a unique member of another set and the relationship is recognizable across representations.

Essential Questions:
*When quantities share a relationship, how can I use that relationship to determine reasonable values for the quantities?
*How can the characteristics of a function be determined from a graph or a given function?
*What types of real-life situations involve non-constant rates of change?
*How do linear and non-linear relationships differ? How are they the same?
*Why are linear functions useful in real-world settings?
*How can an equation, table, and graph be used to analyze the rate of change and other applicable information, related to a real-world problem and the representative function?