Unit Title	Home on the Range – Part 2		**Length of Unit**	3 weeks
Focusing Lens(es)	Representation	**Standards and Grade Level Expectations Addressed in this Unit**	MA10-GR.HS-S.2-GLE.1 MA10-GR.HS-S.2-GLE.4	
Inquiry Questions (Engaging-Debatable):	• How does the same melody in a different key relate to a function being translated or scaled? (MA10-GR.HS-S.2-GLE.1-EO.e.i)			
Unit Strands	Number and Quantity: Quantities Algebra: Reasoning with Equations and Inequalities Functions: Interpreting Functions Functions: Building Functions			
Concepts	Functions, translations, scaling, graph, equations, coordinate plane, set of all solutions, curve, line, coordinate plane, key features, domain, range, maxima, minima, intercepts, symmetry, end behavior, average rate of change, prediction, effects, values of k, f(x) by f(x) + k, k f(x), f(kx), f(x + k), quantity			

Generalizations **My students will Understand that…**	**Guiding Questions** **Factual**	**Conceptual**
Functions, translated and scaled, enhance the application of similar functions to multiple situations. (MA10-GR.HS-S.2-GLE.1-EO.e.i)	How do you shift a function up or down? How do you shift a function right or left? How do you stretch a function?	When a melody repeats in music, is that analogous to a function being translated or scaled? What does the same melody in a different key represent?
Equations graphed in the coordinate plane provide a visual representation of the set of all solutions to the equation as curve (which could be a line). (MA10-GR.HS-S.2-GLE.4-EO.e.i	How do graphs represent all the solutions to an equation?	Why are graphs important tools for visualizing the solutions to an equation?

The visualization of a variety of functions on a coordinate plane helps interpretation of key features, such as domain, range, maxima, minima, intercepts, symmetry, end behavior and average rate of change. (MA10-GR.HS-S.2-GLE.1-EO.c)	What are important characteristics of a function that can be seen on a graph? What do the graphs of linear, exponential, square root, cube root, step and absolute value functions look like? What is the relationship between an average rate of change of any function and the slope of a linear function? How can you identify zeros of polynomial functions from a graph?	Why are multiple types of functions needed to model real world phenomena? How does visualizing a function help interpret the relationship between two variables? How is the graph of an equation related to its solutions?
Mathematicians can predict the effects on a graph when 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). (MA10-GR.HS-S.2-GLE.1-EO.e.i)	What is the impact 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)?	Why are the effects on a graph predictable when 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)?
Mathematicians interpret the average rate of change of a function over a specified interval to investigate the rate at which one quantity changes with respect to another quantity. (MA10-GR.HS-S.2-GLE.1-EO.b.iii)	How can you investigate the average rate of when a function is presented graphically, symbolically or as a table? What is average rate of change? What is another name for the average rate of change of linear functions?	Why is the average rate of change important when investigating a function? Why do some functions require average rates of change to be investigating over a specified interval versus the entire function? Why is average of change not synonymous with slope?

Key Knowledge and Skills: **My students will…**	*What students will know and be able to do are so closely linked in the concept-based discipline of mathematics. Therefore, in the mathematics samples what students should know and do are combined.*

- Interpret key features of graphs and tables in terms of the quantities, for functions that model a relationship between two quantities (linear, quadratic, square root, cube root, piece wise, exponential with a domain in integers), 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. (MA10-GR.HS-S.2-GLE.1-EO.b.i)
- 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. (MA10-GR.HS-S.2-GLE.1-EO.b.iii)
- Graph linear and quadratic functions and show intercepts, maxima and minima. (MA10-GR.HS-S.2-GLE.1-EO.c.ii)
- Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. (MA10-GR.HS-S.2-GLE.1-EO.c.iii)
- Compare properties of two functions (linear, quadratic, square root, cube root, piece wise, exponential with a domain in integers) each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). (MA10-GR.HS-S.2-GLE.1-EO.c.vi.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 and experiment with cases and illustrate an explanation of the effects on the graph using technology for linear and quadratic functions. (MA10-GR.HS-S.2-GLE.1-EO.e.i)

Critical Language: includes the Academic and Technical vocabulary, semantics, and discourse which are particular to and necessary for accessing a given discipline. EXAMPLE: A student in Language Arts can demonstrate the ability to apply and comprehend critical language through the following statement: *"Mark Twain exposes the hypocrisy of slavery through the use of satire."*	
A student in _____ can demonstrate the ability to apply and comprehend critical language through the following statement(s):	*Key features of a graph include domain, range, maxima, minima, intercepts and rate of change.* *Functions can be shifted, stretched, or shrunk.*
Academic Vocabulary:	Relationship, increasing, decreasing, graph, line, key features, prediction, effects, identity, compare, calculate, interpret, estimate, illustrate, experiment,
Technical Vocabulary:	Functions, scale, translate, translations, scaling, equations, coordinate plane, set of all solutions, curve, coordinate plane, domain, range, maxima, minima, intercepts, symmetry, average rate of change, values of k, transformation, units, algebraically, graphically, verbally, axes, intervals,