Unit 2 - *Relations and Functions*

Overview

In this unit we move from working with single variables to multiple variables in equations. Functions and function notation will be the focus of this unit and every unit after this unit. Students will understand the concept of function, function notation, types of functions, transformations of functions, operations on functions, inverse functions and graphing functions. Students will be able to identify the domain and range of a function. Students should be able to work with functions in multiple representations: algebraic, graph and table of values.

21st Century Capacities: Analyzing, Presentation

Stage 1 - Desired Results

ESTABLISHED GOALS/ STANDARDS

MP2 Reason abstractly and quantitatively
MP4 Model with Mathematics
MP6 Attend to precision

A.CED.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.
A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
A.CED.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.
F.IF.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

Transfer:

Students will be able to independently use their learning in new situations to...

1. Model relationships among quantities.
2. Draw conclusions about graphs, equations. (Analyzing)
3. Make sense of a problem, initiate a plan, execute it, and evaluate the reasonableness of the solution. (Analyzing)
4. Justify reasoning using clear and appropriate mathematical language. (Presentation)

Meaning:

UNDERSTANDINGS: *Students will understand that:*

1. Mathematicians can describe patterns, relations, and/or functions to access strategies to solve problems.
2. Mathematicians use models to represent and make meaning of quantitative relationships.
3. Mathematicians analyze change and make predictions in various contexts.

ESSENTIAL QUESTIONS: *Students will explore & address these recurring questions:*

A. How do you express and describe a pattern and use it to make predictions and solve a problem?
B. How can change be described?
C. How do I interpret this mathematical model?

Acquisition:

Students will know…

1. What a linear function is and different representations--verbally, graphically,

Students will be skilled at…

1. Graphing two variable equations and inequalities

function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.★ F.IF.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.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. F.IF.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.1 Write a function that describes a relationship between two quantities.* b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. F.BF.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. F.BF.4 Find inverse functions. a. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) = 2 x3 or f(x) = (x+1)/(x-1) for x ≠ 1.	numerically, and algebraically 2. The relationship between the slopes of parallel and perpendicular lines 3. Input, output can be swapped to find inverses through graphs, tables and algebraically 4. What an absolute value function is and different representations--verbally, graphically, numerically, and algebraically 5. How the parameters of the equations of an absolute value function transformations the parent function 6. The horizontal line test to determine if a function is one-to-one 7. Vocabulary: domain, range, input, output, constraint, relation, function, inverse function, interval notation, inequalities, piecewise, parent functions	2. Writing linear equations in slope-intercept, point-slope, and standard forms 3. Comparing parameters of two functions including those represented in a different way 4. Identifying the slope (unit rate of change) and y-intercept 5. Given a graph writing the equation and vice versa 6. Given a problem statement, writing the equation (and solve if appropriate) 7. Determining the domain and range from a graph 8. Determining solutions from a graph 9. Evaluating functions given the input or output 10. Identifying direct, inverse and joint variation 11. Solving linear systems of 2 and 3 variables using substitution, elimination and/or graphing 12. Modeling using a system of linear equations 13. Using linear program to solve application problems 14. Determining the domain of a function 15. Analyzing graphs of functions (domain, range, intercepts, continuous, symmetry, increasing, decreasing) 16. Graphing piecewise functions from the equations 17. Determining the equations from a piecewise graph 18. Algebraically writing inverse functions 19. Recognizing parent functions and transform them 20. Composing a new function by f(g(x)) and g(f(x)) 21. Using inverse of a function to determine the range of a function