Unit F - *Graphing Lines*

Overview

Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions (y/x = m or y = mx) as special linear equations (y = mx + b), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount m·A. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). Students interpret components of the relationship (such as slope and y-intercept) in terms of the situation.

Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

21st Century Capacities: Synthesizing, Product Creation

Stage 1 - Desired Results

ESTABLISHED GOALS/ STANDARDS	***Transfer:***
MP 1 Make sense sense of problems and persevere in solving them **MP4** Model with Mathematics **MP7** Look for and make use of structure **MP8** Look for and express regularity in repeated reasoning Define, evaluate, and compare functions. **.8.F.A.1** Understand that a function is a rule that assigns to each input	*Students will be able to independently use their learning in new situations to...* 1. Model relationships among quantities. (Synthesizing) 2. Manipulate equations/expressions or objects to create order and establish relationships. 3. Represent and interpret patterns in numbers, data and objects. (Product Creation)

exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.1

.8.F.A.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change*.

.8.F.A.3 Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line*.

Use functions to model relationships between quantities.
.8.F.B.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

.8.F.B.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Understand the connections between proportional relationships, lines, and linear equations.
.8.EE.B.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

Meaning:

UNDERSTANDINGS: *Students will understand that:*

1. Mathematicians use numbers, ways of representing numbers, relationships among numbers, and number systems to build meaning.
2. Mathematicians represent and analyze mathematical situations and structures using algebraic symbols to communicate thinking.
3. Mathematicians use models to represent and make meaning of quantitative relationships.
4. Mathematicians analyze change and make predictions in various contexts.

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

A. How can I explain this mathematically?
B. How do you express and describe a pattern?
C. How do predictable patterns help us?
D. How can I interpret this graph?
E. What does the solution tell me?

Acquisition:

Students will know…

1. The meaning of the components of an equation written in slope intercept form
2. That some functions are linear and some are non-linear
3. Some lines are horizontal and some are vertical
4. The intersection of two lines represents the solution of the system
5. A system of equations may have one, no or infinite solutions

Students will be skilled at…

1. Graphing a function using a table
2. Determining if a function is leanear or nonlinear
3. Identifying when a function is linear vs nonlinear
4. Identifying if a graph is increasing or decreasing
5. Graphing x=c and y = c lines
6. Finding the slope of a graph
7. Graphing a line given the slope and a point

8.EE.B.6 Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation *y = mx + b* for a line intercepting the vertical axis at *b*. **CC.8.EE.8** Analyze and solve pairs of simultaneous linear equations. **CC.8.EE.8a** Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. **CC.8.EE.8b** Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6. **CC.8.EE.8c** Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersect	6. Vocabulary: linear, nonlinear, parallel, horizontal, vertical, slope, intercept, system of equations, intersection	8. Converting an equation into y = mx + b form 9. Identify the slope and y-intercept of an equation 10. Determining parallel lines from equations 11. Graphing a pair of equations to determine the solution 12. Solve a system of equations by substitution 13. Solve a system of equations by elimination (if time allows) 14. Solving real world problem involving systems of equations