**Unit 3: Functions**

**(3 Weeks)**

**UNIT OVERVIEW**

Students are introduced to the concept of a function in the first investigation of this unit.

After identifying relationships that are or are not functions, they learn how to define the domain and range of a function.

Investigation Two provides practice applying the concept of a function through various contextual problems. Students organize and analyze data in tables and graphs and use the information to describe relationships such as that between Fahrenheit and Celsius measurements of temperature.

**Investigation Three introduces function notation using the concept of a function machine and students use function notation in a variety of contextual situations.**

The last investigation introduces students to a variety of parent functions and gives additional contexts in which students look at multiple representations of functions and consolidate their understanding of independent and dependent variables and function notation. Emphasis is on distinguishing between linear functions (which are studied in greater depth in the next unit) and non-linear functions (which appear later in this course and in subsequent courses).

The unit concludes with a performance task based on an experiment with pendulums. Students collect data, make a table, and graph the data. They identify the function as a square root function based on the graph and compare the predicted value from a formula with their empirical results.

**Essential Questions**

* What is a function?
* What are the different ways in which functions may be represented?
* How can functions be used to model real world situations, make predictions, and solve problems?

**Enduring Understandings**

* Functions are a mathematical way to describe relationships between two quantities that vary.

**Unit Contents**

Investigation 1: Relations and Functions (2 days)

Investigation 2: What Is a Function? (3 days)

Investigation 3: Function Notation and Evaluating Functions (2 days)

Investigation 4: Multiple Representations and Applications of Functions (4 days)

Performance Task: Functions in the Real World (3 days)

End of Unit Test (2 days including review)

**Common Core Standards**

*Mathematical Practices #1 and #3* *describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning. Practices in bold are to be emphasized in the unit.*

1. Make sense of problems and persevere in solving them.

2. Reason abstractly and quantitatively.

3. Construct viable arguments and critique the reasoning of others.

**4. Model with mathematics.**

**5. Use appropriate tools strategically.**

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

**Standards Overview**

* Create equations that describe numbers or relationships
* Represent and solve equations and inequalities graphically
* Understand the concept of a function and use function notation
* Interpret functions that arise in applications in terms of the context
* Analyze functions using different representations

**Standards with Priority Standards in Bold**

8F 1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.1

8F 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.*

8F 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.

**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 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-IF 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 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 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....*\***

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 factory, then the positive integers would be an appropriate domain for the function.*\*

F-IF 7b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions

F-IF 9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

**Vocabulary**

Dependent Variable

Domain

Equation of a Function

Evaluating a Function

Function

Function Notation

Graph of a Function Independent Variable

Input

Linear Function

Mapping Diagram

Non-linear Function

Ordered Pair

Output

Parabola

Range

Relation

Table

Vertical Line Test

**Assessment Strategies**

**Performance Task: Pendulums**

Students work in groups to discover how the period of a pendulum is related to its length. They identify the function as belonging to the square root family and use a formula to test their predictions.

**Other Evidence (Formative and Summative Assessments)**

* Exit slips
* Class work
* Homework assignments
* Math journals
* Unit 3 Test