Unit 2 Function Families

Content Area: **Mathematics**
Course(s): **Integrated Modern Algebra**
Time Period: **September**
Length: **4 weeks**
Status: **Published**

Transfer Skills

In this unit students will build upon the introduction of functions presented in Algebra 1. Students will work with a variety of function types at a basic level to prepare for a more in depth focus in future units on linear, exponential and quadratic functions. Students who are able to identify functions, evaluate with function notation, and are able to relate the domain of a function to the quantitative relationship it describes will be prepared for future study of functions.

Instructional Notes: Students should be exposed to the following function types: linear, exponential, quadratic, square root, cube root, piecewise, step and absolute value functions. Future units will be dedicated to linear and quadratic functions and a final unit will review all function types and properties.

Enduring Understandings

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

Functions can be represented in a variety of ways, such as graphs, tables, equations, or words. Each representation is particularly useful in certain situations.

Functions are used to analyze change in various contexts and model real-world phenomena.

Essential Questions

What is a function?

What are the different methods for representing functions?

How can functions be used to model real world situations?

Content

Vocabulary

relation

function

domain

range

mapping

vertical line test

function notation

linear function

exponential function

quadratic function

square root function

cube root function

piecewise function

step function

absolute value function

Skills

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.)

Use the vertical line test to determine whether a graph represents a function.

Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Identify families of functions considering linear, exponential, and quadratic functions.

Identify key features for linear, exponential and quadratic functions.

Create graphs for linear, exponential and quadratic functions by generating a table of values.

Create graphs for linear, exponential and quadratic functions using key features of the function type.

Introduce the square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

Resources

Standards

CCSS.Math.Content.HSA-CED	Creating Equations
CCSS.Math.Content.HSA-CED.A	Create equations that describe numbers or relationships
CCSS.Math.Content.HSA-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
CCSS.Math.Content.HSA-REI	Reasoning with Equations and Inequalities
CCSS.Math.Content.HSA-REI.D	Represent and solve equations and inequalities graphically
CCSS.Math.Content.HSA-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).
CCSS.Math.Content.HSF-IF	Interpreting Functions
CCSS.Math.Content.HSF-IF.A	Understand the concept of a function and use function notation
CCSS.Math.Content.HSF-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 $y = f(x)$.
CCSS.Math.Content.HSF-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.
CCSS.Math.Content.HSF-IF.B	Interpret functions that arise in applications in terms of the context
CCSS.Math.Content.HSF-IF.B.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.
CCSS.Math.Content.HSF-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
CCSS.Math.Content.HSF-IF.C	Analyze functions using different representations
CCSS.Math.Content.HSF-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
CCSS.Math.Content.HSF-IF.C.7.b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
CCSS.Math.Practice.MP1	Make sense of problems and persevere in solving them.
CCSS.Math.Practice.MP4	Model with mathematics.
CCSS.Math.Practice.MP5	Use appropriate tools strategically.
CCSS.Math.Practice.MP7	Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.