Instructional Design

A single authorship team from Kindergarten through Algebra 2 results in a seamless articulation of focused topics with meaningful coherence from course to course.

Every chapter and every lesson contain a rigorous balance of conceptual understanding, procedural fluency, and application.

FOCUS

A focused program emphasizes the major work of each course, the widely applicable prerequisites needed for you to be college and career ready.

Determining Whether Relations Are Functions

A **relation** pairs inputs with outputs. When a relation is given as ordered pairs, the x-coordinates are inputs and the y-coordinates are outputs. A relation that pairs each input with *exactly* one output is a **function**.

Finding the Domain and Range of a Function

KEY IDEA

The Domain and Range of a Function

The **domain** of a function is the set of all possible input values.
The **range** ...

EXAMPLE

Identifying Independent and Dependent Variables

The variable that represents the input values of a function is the **independent var** because it can be *any* value in the domain. The variable that represents the output values of a function is the **dependent variable** because it *depends* on the value of the independent variable. When an equation represents a function, the dependent variable is defined in terms of the independent variable. The statement "y is a function of x" means that y varies depending on the value of x.

$y = -x + 10$

dependent variable, y   independent variable, x

3.1   Functions

Learning Target   Understand the concept of a function.

Success Criteria
- I can determine whether a relation is a function.
- I can find the domain and range of a function.
- I can distinguish between independent and dependent variables.

Learning targets, success criteria, and content headings through each section focus the learning into manageable chunks.

The authors gave careful thought to how the learning should progress from prior chapters and grades to future ones, as shown in the Teaching Edition progressions charts.

COHERENCE Through the Grades

Prior Learning	Current Learning	Future Learning
Middle School	**Chapter 3**	**Algebra 1**
• Translate, reflect, and rotate figures in the coordinate plane.	• Understand the definition of a function and use function notation.	• Create equations of linear functions using points and slopes.
• Use similar triangles to explain why the slope is the same between any two distinct points on a nonvertical line.	• Sketch a graph of a function from a verbal description.	• Graph piecewise, exponential, quadratic, square root, and cube root functions, and show key features of the graph.
• Graph proportional relationships, interpreting the unit rate as the slope of ...	• Compare properties of two functions each represented in a different way.	• Solve systems of linear equations by ...
	• Graph linear and absolute value and show key features of ...	

You have used *linear regression* to find an equation of the line of best fit. Similarly, you can use *exponential regression* to find an exponential function that best fits a data set.

EXAMPLE 6   Modeling Real Life

The table shows the temperatures y (in degrees Fahrenheit) of coffee x minutes after pouring a cup. Use technology to find a function that fits the data. Predict the temperature of the coffee 10 minutes after it is poured.

SOLUTION

Step 1 Enter the data from the table into a tech ... of the data.

Throughout the course, you will build on prior learning as you learn new concepts.

COHERENCE

A coherent program has intentional progression of content between courses (building new understanding on foundations from prior years) and within the course (connecting concepts throughout).

RIGOR

A rigorous program provides a balance of three important building blocks.

- **Conceptual Understanding**
  Discovering why
- **Procedural Fluency**
  Learning how
- **Application**
  Knowing when to apply

EXPLORE IT!   **Describing Relations**

Work with a partner. You buy an item from the vending machine.

a. Describe two possible relations associated with the vending machine.

b. Think about each relation in part (a).
- What are the inputs?
- What are the outputs?
- Does each input pair with *exactly* one output? Explain.

In mathematics, a **function** is a relation that pairs each input with exactly one output.

c. How can you use a coordinate plane to represent a relation? What are the inputs? What are the outputs?

Math Practice

Contextualize Relationships

Can you think of any mathematical relations? Are any of these relations functions?

Conceptual Understanding
Explore, question, explain, and persevere as you discover foundational concepts central to the learning target of each section.

Conceptual Understanding
Understand the ideas behind key concepts, see them from varied perspectives, and explain their meaning.

42. **WRITING** A quadratic function is increasing when $x < 2$ and decreasing when $x > 2$. Is the vertex the highest or lowest point on the parabola? Explain.

53. **MP** **NUMBER SENSE** Without evaluating, order $(7 \cdot 7)^5$, $(7 \cdot 7)^{-8}$, and $(7 \cdot 7)^0$ from least to greatest. Explain your reasoning.

EXAMPLE 1   Graphing $f(x) = a(x - p)(x - q)$

Graph $f(x) = -(x + 1)(x - 5)$. Find the domain and range.

SOLUTION

Step 1 Identify the x-intercepts. Because the x-intercepts are $p = -1$ and $q = 5$, plot $(-1, 0)$ and $(5, 0)$.

Step 2 Find and graph the axis of symmetry.
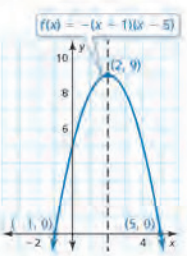$$x = \frac{p + q}{2} = \frac{-1 + 5}{2} = 2$$

Step 3 Find and plot the vertex. The x-coordinate of the vertex is 2. To find the y-coordinate of the vertex, substitute 2 for x and evaluate.
$$f(2) = -(2 + 1)(2 - 5) = 9$$
So, the vertex is $(2, 9)$.

Step 4 Draw a parabola through the vertex and the points where the x-intercepts occur.

▶ The domain is all real numbers. The range is $y \le 9$.

Procedural Fluency
Learn with clear, stepped-out teaching and examples, and become fluent through *Self-Assessment*, *Practice*, and *Review & Refresh*.

EXAMPLE 6   Modeling Real Life

A jellyfish emits about 1.25×10^8 particles of light, or photons, in 6.25×10^{-4} second. How many photons does the jellyfish emit each second? Write your answer in scientific notation and in standard form.

SOLUTION

Divide to find the unit rate in photons per second.

$$\frac{1.25 \times 10^8 \text{ photons}}{6.25 \times 10^{-4} \text{ seconds}}$$ Divide the number of photons by the number of seconds.

$$= \frac{1.25}{6.25} \times \frac{10^8}{10^{-4}}$$ Rewrite.

$$= 0.2 \times 10^{12}$$ Simplify.

$$= 2 \times 10^{11}$$ Write in scientific notation.

▶ The jellyfish emits 2×10^{11}, or 200,000,000,000 photons per second.

Application
Make meaning of mathematics in problem-solving contexts and real-life applications.