

# TOPIC 3

## Use Functions to Model Relationships

In this topic, students learn about *functions*, which are mathematical relationships with exactly one output (result) for each input.

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## CONNECT THE MATH

A *function* is a rule that produces one output for every input. Functions model many real-world situations. This topic focuses mostly on *linear* functions (which have graphs that are lines) but also includes some *nonlinear* functions (which have graphs that are curves).

The cost to park at a meter is a function of the amount of time you park at the meter. The number of gallons of water that come out of the kitchen faucet is a function of the amount of time the faucet is on. The height of a building is a function of the number of floors the building has. The perimeter of a square is a linear function of the side length, while the area of a square is a nonlinear function of the side length.

Look for relationships with two variables that can be represented by a function. Discuss these situations as a family. Which are likely to be linear? Which are nonlinear?





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## LESSON 3-1

### Understand Relations and Functions

A relation is a set of ordered pairs. A function is a relation in which each input, or  $x$ -value, has exactly one output, or  $y$ -value. Arrow diagrams and tables can be used to determine whether a relation is a function.

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#### LESSON OBJECTIVES

- Identify whether a relation is a function.
- Interpret a function.

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#### HOW CAN YOU HELP WITH HOMEWORK

##### Review Lesson Content

Watch and share these video tutorials with your student:

- [How is a Function Defined?](#)
- [What Is a Function?](#)

### Review Key Vocabulary

Review key vocabulary from this lesson in your student's glossary:

- [function](#)
- [relation](#)

You can use these search terms and phrases to help your student find additional help online:

- identifying a function from an arrow diagram
- identifying a function from a table

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## LESSON 3-2

### Connect Representations of Functions

Different representations, such as equations, tables, and graphs, can help determine that a relation is a function. The graph of a linear function is a straight line; the graph of a nonlinear function is not a straight line.

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#### LESSON OBJECTIVES

- Identify functions by their equations, tables, and graphs.
- Represent linear and non-linear functions with graphs.

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#### HOW CAN YOU HELP WITH HOMEWORK

## Review Lesson Content

Watch and share these video tutorials with your student:

- [What Is a Linear Function?](#)
- [How Do You Use the Vertical Line Test to Figure Out If a Graph Is a Function?](#)

## Review Key Vocabulary

Review key vocabulary from this lesson in your student's glossary:

- [rate of change](#)
- [initial value](#)
- [linear function](#)
- [nonlinear function](#)

You can use these search terms and phrases to help your student find additional help online:

- determining whether a function is linear or nonlinear
- determining whether or not a relation is a linear function
- identifying functions from graphs



## LESSON 3-3

### Compare Linear and Nonlinear Functions

Two functions presented in different representations can be compared by looking at their properties; initial value and constant rate of change.

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#### LESSON OBJECTIVE

- Use different representations to compare linear and nonlinear functions.

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## HOW CAN YOU HELP WITH HOMEWORK

### Review Lesson Content

Watch and share these video tutorials with your student:

- [How Do You Find the Rate of Change Between Two Points on a Graph?](#)
- [How Can You Tell if a Function is Linear or Nonlinear From a Table?](#)

You can use these search terms and phrases to help your student find additional help online:

- compare two linear functions
- compare properties of linear functions
- compare a linear and a nonlinear function

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## LESSON 3-4

### Construct Functions to Model Linear Relationships

A function that represents a linear relationship between two quantities can be represented by an equation written in the form  $y = mx + b$ .

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### LESSON OBJECTIVES

- Write an equation in the form  $y = mx + b$  to describe a linear function.

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## HOW CAN YOU HELP WITH HOMEWORK

## Review Lesson Content

Watch and share these video tutorials with your student:

- [How Do You Use the Graph of a Linear Equation to Solve a Word Problem?](#)
- [How Do You Write an Equation of a Line in Slope-Intercept Form If You Have a Graph?](#)

You can use these search terms and phrases to help your student find additional help online:

- writing a function from a graph
- writing a function from two values
- interpret a function from a graph

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## LESSON 3-5

### Intervals of Increase and Decrease

The relationship between two quantities on a graph can be represented in a qualitative graph that shows the behavior of the function in different intervals.

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#### LESSON OBJECTIVE

- Describe the behavior of a function in different intervals.

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#### HOW CAN YOU HELP WITH HOMEWORK

## Review Lesson Content

Watch and share these video tutorials with your student:

- [How Do You Make an Approximate Graph from a Word Problem?](#)

- [How Do You Figure Out a Situation That a Graph Represents?](#)

### Review Key Vocabulary

Review key vocabulary from this lesson in your student's glossary:

- [interval](#)

You can use these search terms and phrases to help your student find additional help online:

- Interpreting a qualitative graph
- interpreting the graph of a nonlinear function
- describing the relationship of quantities

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## LESSON 3-6

### Sketch Functions from Verbal Descriptions

Understanding the behavior of a function in different intervals allows for a sketch of the qualitative graph of the function.

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#### LESSON OBJECTIVES

- Draw a sketch of a graph for a function that has been described verbally.
- Analyze and interpret the sketch of a graph of a function.

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#### HOW CAN YOU HELP WITH HOMEWORK

##### Review Lesson Content

Watch and share this video tutorial with your student:

- [How Do You Make an Approximate Graph from a Word Problem?](#)

You can use these search terms and phrases to help your student find additional help online:

- sketching the graph of a linear function
- analyzing the graph of a nonlinear function
- sketching the graph of a nonlinear function