A Picture Is Worth a Thousand Words

Understanding Quantities and Their Relationships

1.1

LEARNING GOALS

In this lesson, you will:

- Understand quantities and their relationships with each other.
- Identify the independent and dependent quantities for a problem situation.
- Match a graph with an appropriate problem situation.
- Label the independent and dependent quantities on a graph.
- Review and analyze graphs.
- Describe similarities and differences among graphs.

KEY TERMS

- dependent quantity
- independent quantity

How interesting would a website be without pictures or illustrations? Does an inviting image on a magazine cover make you more likely to buy it? Pictures and images aren't just for drawing your attention, though. They also bring life to text and stories.

There is an old proverb that states that a picture is worth a thousand words. There is a lot of truth in this saying—and images have been used by humans for a long time to communicate. Just think: would you rather post a story of your adventure on a social media site, or post one picture to tell your thousand-word story in a glance?

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PROBLEM 1 What's the Dependency?

Have you ever planned for a party? You may have purchased ice, gone grocery shopping, selected music, made food, or even cleaned in preparation. Many times, these tasks depend on another task being done first. For instance, you wouldn't make food before grocery shopping, now would you?

Let's consider the relationship between:

- the number of hours worked and the money earned.
- your grade on a test and the number of hours you studied.
- the number of people working on a particular job and the time it takes to complete a job.
- the number of games played and the number of points scored.
- the speed of a car and how far the driver pushes down on the gas pedal.

There are two quantities that are changing in each situation. When one quantity depends on another in a problem situation, it is said to be the **dependent quantity**. The quantity that the dependent quantity depends upon is called the **independent quantity**.

1. Circle the independent quantity and underline the dependent quantity in each statement.

2. Describe how you can determine which quantity is the independent quantity and which quantity is the dependent quantity in any problem situation.

3. Read each scenario and then determine the independent and dependent quantities. Be sure to include the appropriate units of measure for each quantity.

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Something's Fishy

Candice is a building manager for the Crowley Enterprise office building. One of her responsibilities is cleaning the office building's 200-gallon aquarium. For cleaning, she must remove the fish from the aquarium and drain the water. The water drains at a constant rate of 10 gallons per minute.

- independent quantity:

- dependent quantity:

Smart Phone, but Is It a Smart Deal?

You have had your eye on an upgraded smart phone. However, you currently do not have the money to purchase it. Your cousin will provide the funding, as long as you pay him interest. He tells you that you only need to pay $1 in interest initially, and then the interest will double each week after that. You consider his offer and wonder: is this *really* a good deal?

- independent quantity:

- dependent quantity:

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Can't Wait to Hit the Slopes!

Andrew loves skiing—he just hates the ski lift ride back up to the top of the hill. For some reason the ski lift has been acting up today. His last trip started fine. The ski lift traveled up the mountain at a steady rate of about 83 feet per minute. Then all of a sudden it stopped and Andrew sat there waiting for 10 minutes! Finally, the ski lift began to ascend up the mountain to the top.

- independent quantity:

- dependent quantity:

It's Magic

The Amazing Aloysius is practicing one of his tricks. As part of this trick, he cuts a rope into many pieces and then magically puts the pieces of rope back together. He begins the trick with a 20-foot rope and then cuts it in half. He then takes one of the halves and cuts that piece in half. He repeats this process until he is left with a piece so small he can no longer cut it. He wants to know how many total cuts he can make and the length of each remaining piece of rope after the total number of cuts.

- independent quantity:

- dependent quantity:

Baton Twirling

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Jill is a drum major for the Altadena High School marching band. She has been practicing for the band's halftime performance. For the finale, Jill tosses her baton in the air so that it reaches a maximum height of 22 feet. This gives her 2 seconds to twirl around twice and catch the baton when it comes back down.

- independent quantity:

- dependent quantity:

Music Club

Jermaine loves music. He can lip sync almost any song at a moment's notice. He joined *Songs When I Want Them*, an online music store. By becoming a member, Jermaine can purchase just about any song he wants. Jermaine pays $1 per song.

- independent quantity:

- dependent quantity:

PROBLEM 2 Matching Graphs and Scenarios

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While a person can describe the monthly cost to operate a business, or talk about a marathon pace a runner ran to break a world record, graphs on a coordinate plane enable people to *see* the data. Graphs relay information about data in a visual way. If you read almost any newspaper, especially in the business section, you will probably encounter graphs.

Points on a coordinate plane that are or are not connected with a line or smooth curve model, or represent, a relationship in a problem situation. In some problem situations, all the points on the coordinate plane will make sense. In other problem situations, not all the points will make sense. So, when you model a relationship on a coordinate plane, it is up to you to consider the situation and interpret the meaning of the data values shown.

1. Cut out each graph on the following pages. Then, analyze each graph, match it to a scenario, and tape it next to the scenario it matches. For each graph, label the *x*- and *y*-axes with the appropriate quantity and unit of measure. Then, write the title of the problem situation on each graph.

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A Trip to School

On Monday morning, Myra began her 1.3-mile walk to school. After a few minutes of walking, she walked right into a spider's web—and Myra hates spiders! She began running until she ran into her friend Tanisha. She stopped and told Tanisha of her adventurous morning and the icky spider's web! Then they walked the rest of the way to school.

- independent quantity:

- dependent quantity:

Jelly Bean Challenge

Mr. Wright judges the annual Jelly Bean Challenge at the summer fair. Every year, he encourages the citizens in his town to guess the number of jelly beans in a jar. He keeps a record of everyone's guesses and the number of jelly beans that each person's guess was off by.

- independent quantity:

- dependent quantity:

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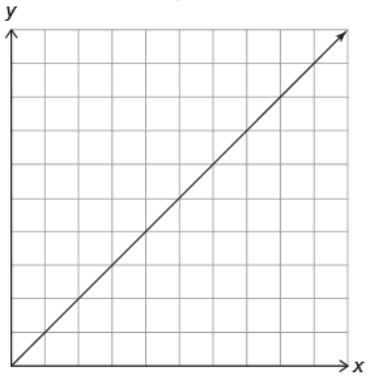
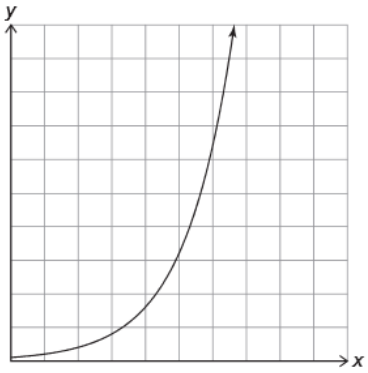
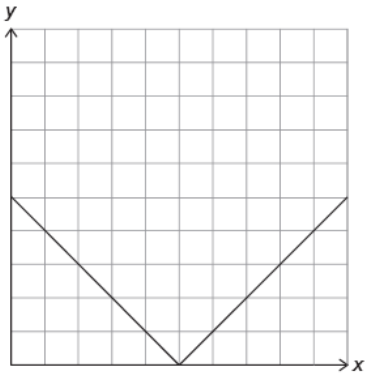
Graph A



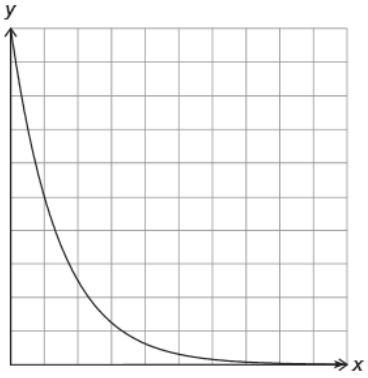
Graph B



Graph C



Graph D



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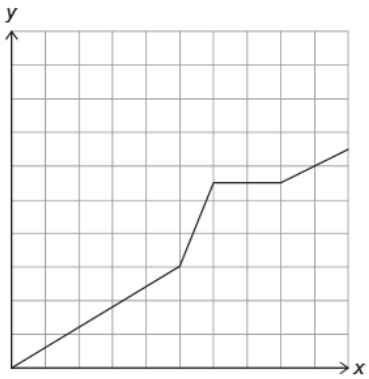
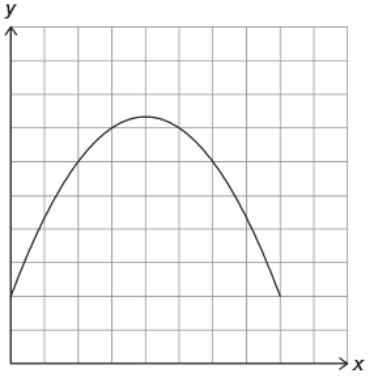
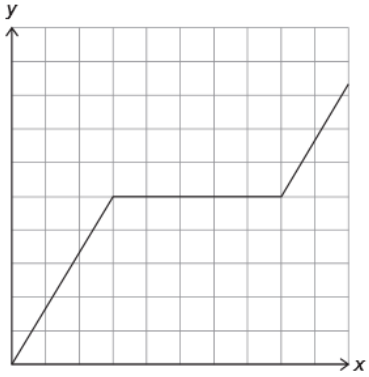
Graph E



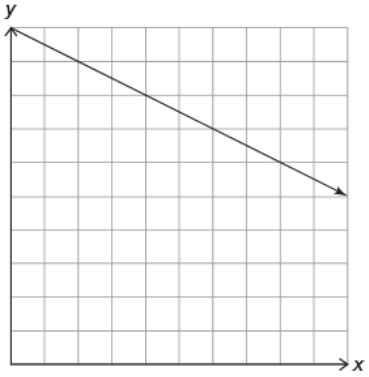
Graph F



Graph G



Graph H



PROBLEM 3 Oh, Say, Can You See (in the Graphs)!

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Now that you have matched a graph with the appropriate problem situation, let's go back and examine all the graphs.

1. What similarities do you notice in the graphs?

2. What differences do you notice in the graphs?

3. How did you label the independent and dependent quantities in each graph?

4. Analyze each graph from left to right. Describe any graphical characteristics you notice.

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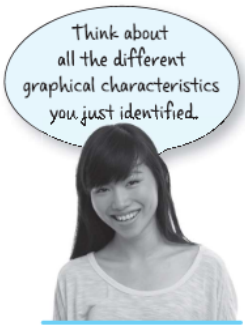
5. Compare the graphs for each scenario given and describe any similarities and differences you notice.



a. *Smart Phone, but Is It a Smart Deal?* and *Music Club*

b. *Something's Fishy* and *It's Magic*

c. *Baton Twirling* and *Jelly Bean Challenge*

6. Consider the scenario *A Trip to School*.

a. Write a scenario and sketch a graph to describe a possible trip on a different day.

Scenario **Graph**

b. Compare your scenario and sketch with your classmates' scenarios and sketches. What similarities do you notice? What differences do you notice?

Be prepared to share your solutions and methods.