A Picture Is Worth a Thousand Words

1.1

Understanding Quantities and Their Relationships

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

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.

Circle the independent variable or mark it with an "I" and underline the dependent variable or mark it with a "D".

- (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.)

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

Independent quantity = stands alone and is not changed by other quantities.
Dependent quantity = depends on or is affected by the independent quantity.
The independent quantity causes a change in the dependent quantity.

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

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:

  time (minutes)

- dependent quantity:

  water (gallons)

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:

  time (weeks)

- dependent quantity:

  interest (dollars)

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:

  time (minutes)

- dependent quantity:

  distance (feet)

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:

  number of cuts

- dependent quantity:

  length of each piece of rope (feet)

Baton Twirling

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:
  time (seconds)

- dependent quantity:
  height of baton (feet)

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:
  number of songs

- dependent quantity:
  cost (dollars)

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:

  time (minutes)

- dependent quantity:

  distance traveled (miles)

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:
  number of jelly beans guessed

- dependent quantity:
  number of jelly beans the guess is off by