

Understanding Quantities and Their Relationships



Learning Goals:

Identify the independent and dependent quantities for a problem situation.
Label the independent and dependent quantities of a graph.

Problem 1 - What's the Dependency? (Page 4)

Have you ever planned a party? You may have to grocery shop, select music, make food, or even clean 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? 1^{st} - you grocery \rightarrow 2^{nd} you make the food
shop the food

1. Consider the relationship between two quantities. Mark "D" above the dependent quantity and "I" above the independent quantity. "D" depends on "I"

- a. $\overset{I}{\text{The number of hours worked}}$ and $\overset{D}{\text{the money earned}}$. \$ earned depends on # of hours worked.
- b. $\overset{D}{\text{Your grade on a test}}$ and $\overset{I}{\text{the number of hours you studied}}$. 1^{st} - you study, 2^{nd} - test grade
- c. $\overset{I}{\text{The number of people working on a particular job}}$ and $\overset{D}{\text{the time it takes to complete the job}}$.
- d. $\overset{I}{\text{The number of games played}}$ and $\overset{D}{\text{the number of points scored}}$. more people results in less time
- e. $\overset{D}{\text{The speed of a car}}$ and how far $\overset{I}{\text{the driver pushes down on the gas pedal}}$.

The driver pushing on the gas pedal causes the cars speed to change.

Two quantities are changing in each situation. When one quantity **depends on** or is affected by another in a problem situation, it is called the dependent quantity. The quantity that stands alone or is not changed by other quantities is called the independent quantity.

Think "Cause and Effect".

The result.

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. Happens 1^{st} . Input or Domain.

dependent quantity = depends on or is affected by the independent quantity. Happens 2^{nd} . Output or Range.

Rate of change = $\frac{\text{dependent}}{\text{independent}}$

Table or equation
x - independent
y - dependent

Graph
x-axis independent
y-axis dependent

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

a. 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. First, 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)

What quantity does Candice have control over? Water, so its the dependent quantity.
 Rate = $\frac{10 \text{ gallons}}{\text{minute}}$ = dependent / independent

b. Smart Phone, but Is It a Smart Deal?

You've had your eye on an upgraded smart phone, but you don't have the money to purchase it. You cousin will loan you the money as long as you pay him back with interest. He tells you that you only need to pay \$1 in interest initially. Then, the interest doubles each week after that. You consider his offer and wonder: is this really a good deal?

- ◆ Independent quantity = time (week)
- ◆ Dependent quantity = interest (dollars)

What 2 quantities are changing?
 Interest and time.
 Each like per is a buzz word for rate.

Loan is a set amount, It is paid only once.

c. Can't Wait to Hit the Slopes!

Andrew loves skiing, but hates the ski lift ride up the mountaintop. 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 again.

- ◆ Independent quantity = time (minutes)
- ◆ Dependent quantity = distance (feet)

Our rate of change is $\frac{83 \text{ feet}}{\text{minute}}$ ← per, each, every

Rate of change = $\frac{\text{dependent}}{\text{independent}}$

d. It's Magic

The Amazing Aloysius is practicing one of his tricks. He cuts a rope into many pieces, then magically puts the rope pieces back together. He begins the trick with a 20-foot rope, then cuts it in $\frac{1}{2}$. He takes one of the halves and cuts that piece in $\frac{1}{2}$. He repeats this process until he is left with a piece that is so small he can no longer cut it. He wants to know how many cuts he can make and the length of each remaining piece of rope after the cuts.

- ◆ Independent quantity = # of cuts
- ◆ Dependent quantity = length of each piece of rope (feet)

What 2 quantities are changing?
 # of cuts and rope length.
 cause → effect
 cut the rope 1st → length of rope changes 2nd

e. Baton Twirling

Jill is a drum major for the Altadena High School marching band. She's 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 the baton (feet)
- what 2 quantities change?
 time and the height of the baton
 In most cases, -
 time = independent quantity

f. 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 = # of songs
 - ◆ Dependent quantity = cost (dollars)
- Rate = $\frac{\$1}{\text{song}}$ ← per

g. A Trip to School

On Monday morning, Myra began her 1.3-mile walk to school. After a few minutes, 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 (miles)
- what 2 quantities change?
 As time passes, Myra walks to school.
 Again, time = independent

h. 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 = # of jelly beans guessed
 - ◆ Dependent quantity = # of jelly beans the guess is off by.
- 2 quantities
 cause → effect
 # of jelly beans guessed (1st) → # of jelly beans the guess was off by (2nd)