COMPOSITION BOOK

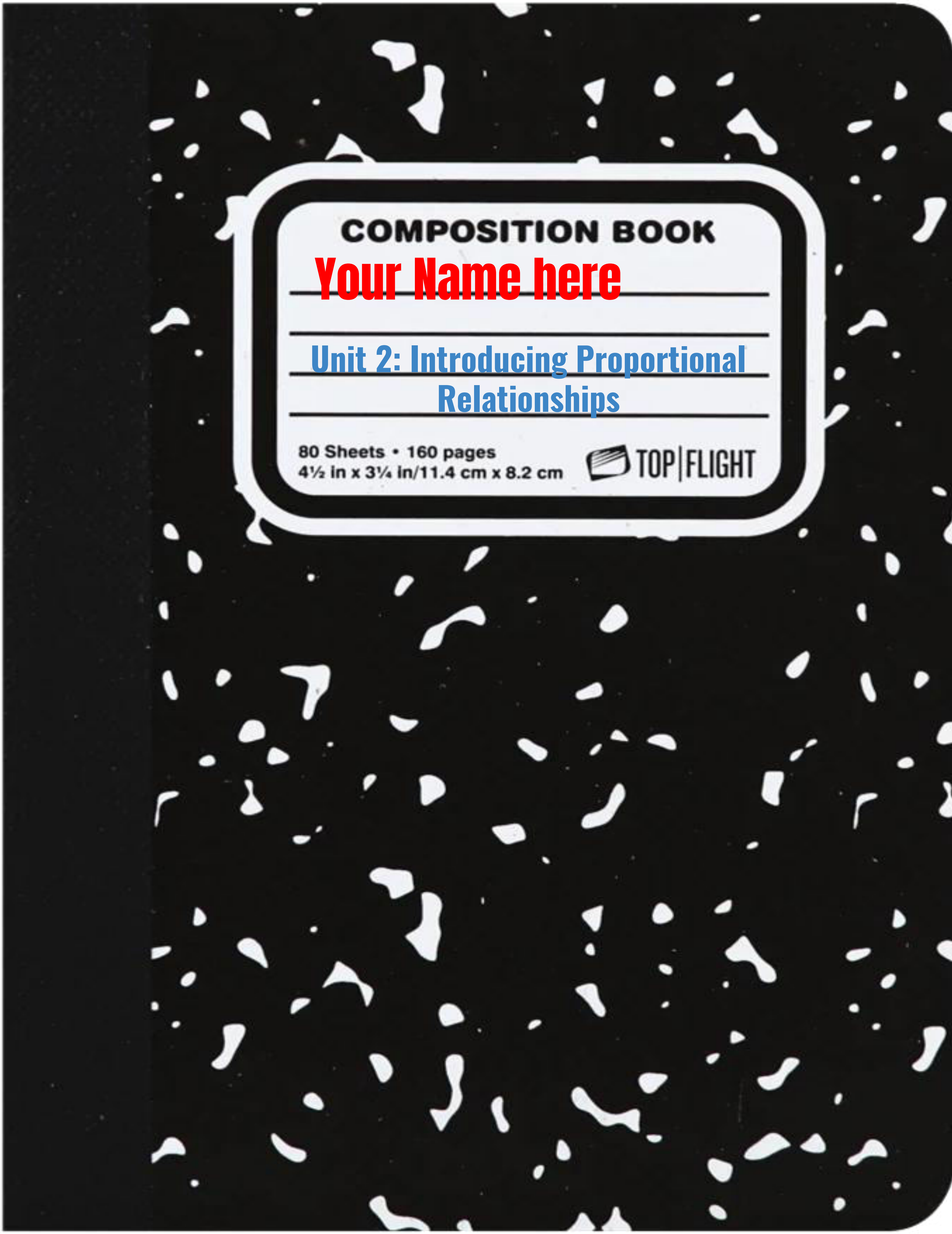
Ms. Forbes'

Math 7 Journal

Unit 2: Introducing Proportional Relationships

80 Sheets • 160 pages
4½ in x 3¼ in/11.4 cm x 8.2 cm

TOP|FLIGHT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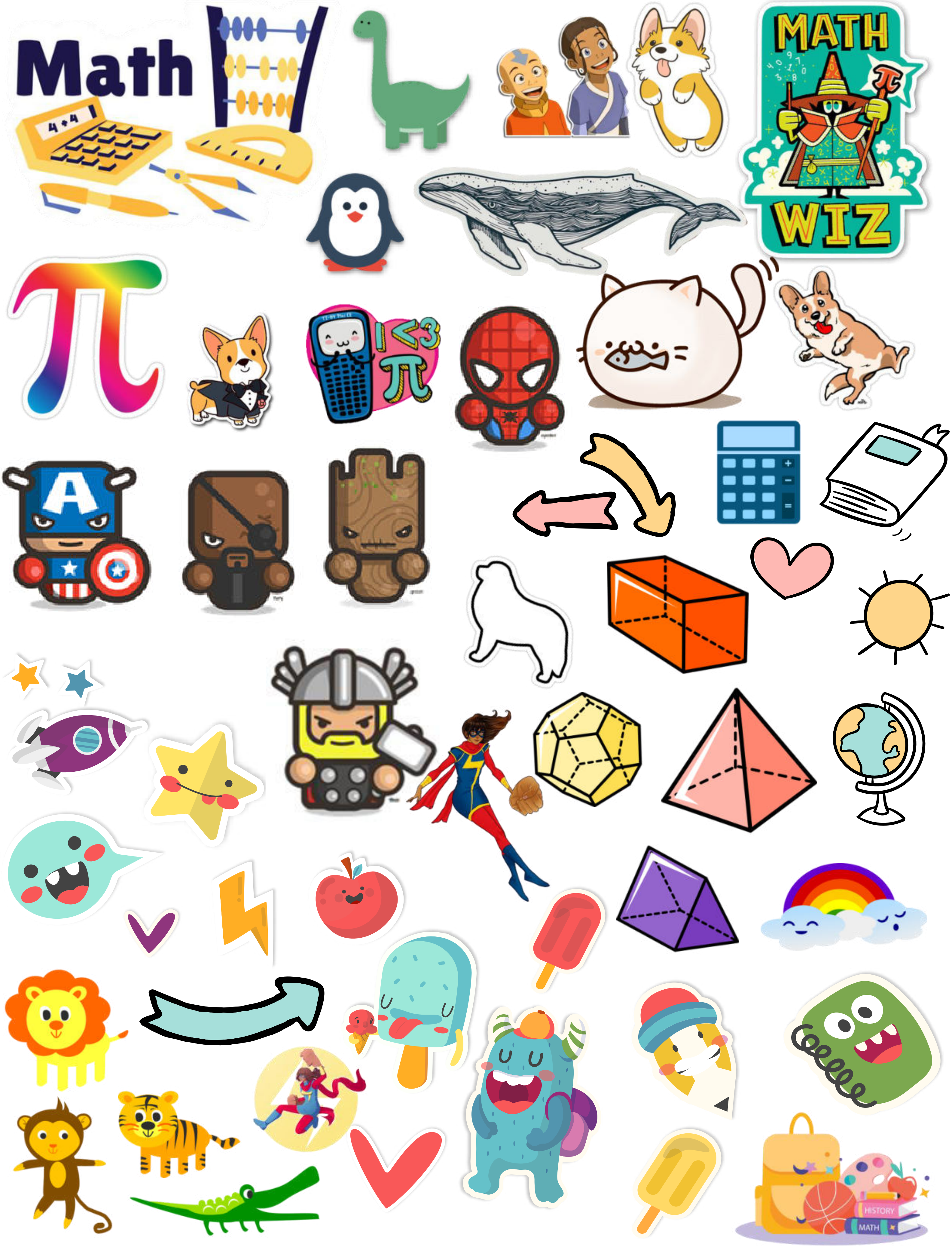
Math
4+4
MATH
WIZ
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HISTORY
MATH


OK!
STRANGER THINGS
NOPE
COMPOSITION
OMG!
LOL!
STAR WARS

Table of Contents

Lesson 1

Lesson 1: One of These Things is Not Like the Others

Mystery Mixtures

Mixture 1

Mixture 2

Mixture 3

Which mixture do you think taste different? Why do you think that?

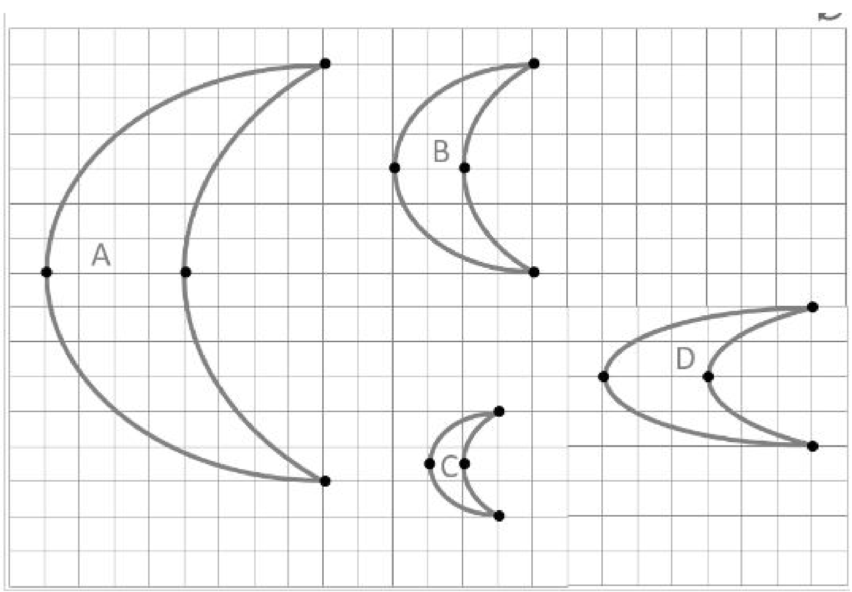
Here are the recipes that were used to make the three mixtures:

- 1 cup water with 1 ½ tsp of drink mix
- 2 cups water with ½ tsp of drink mix
- 1 cup water with ¼ tsp of drink mix

Which of these recipes is for the stronger tasting mixture? Explain how you know.

Crescent Moons

Use the applet (click picture) to look at four different crescent moon shapes.



How is moon D different than the other 3?

Use numbers to describe how moons A, B, and C are different from moon D.

Use a table to represent how moons A, B, and C are different from moon D.

moon			
C			
B			
A			
D			

Lesson 1 Summary

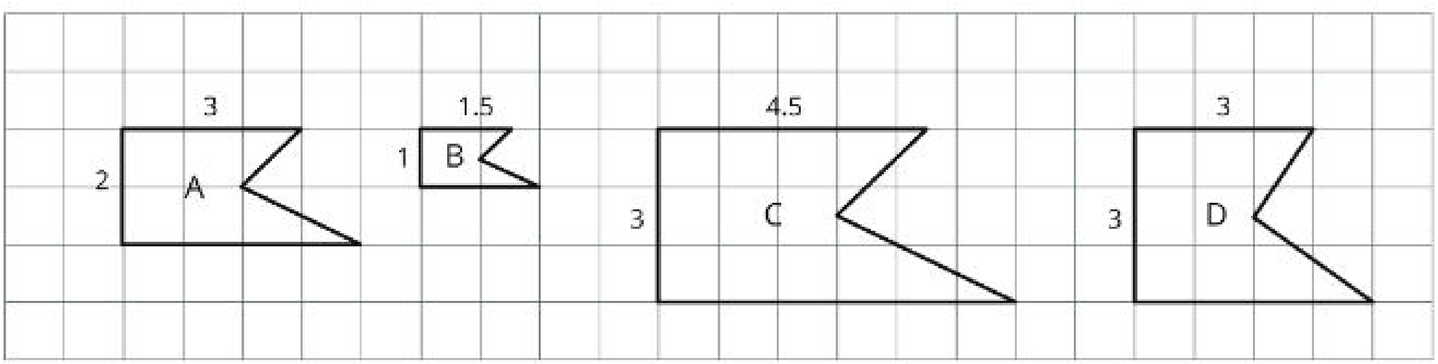
When two different situations can be described by **equivalent ratios**, that means they are alike in some important way.

An example is a recipe. If two people make something to eat or drink, the taste will only be the same as long as the ratios of the ingredients are equivalent. For example, all of the mixtures of water and drink mix in this table taste the same, because the ratios of cups of water to scoops of drink mix are all equivalent ratios.

water (cups)	drink mix (scoops)
3	1
12	4
1.5	0.5

If a mixture were not equivalent to these, for example, if the ratio of cups of water to scoops of drink mix were $6 : 4$, then the mixture would taste different.

Notice that the ratios of pairs of corresponding side lengths are equivalent in figures A, B, and C. For example, the ratios of the length of the top side to the length of the left side for figures A, B, and C are equivalent ratios. Figures A, B, and C are *scaled copies* of each other; this is the important way in which they are alike.



If a figure has corresponding sides that are not in a ratio equivalent to these, like figure D, then it's not a scaled copy. In this unit, you will study relationships like these that can be described by a set of equivalent ratios.

Lesson 2

Lesson 2: Introducing Proportional Relationships with Tables

Paper Towels by the Case

Here is a table that shows how many rolls of paper towels a store receives when they order different numbers of cases.

	number of cases they order	number of rolls of paper towels	
	1	12	
	3	36	
	5	60	
$\cdot 2$	10	120	$\cdot 2$

What do you notice about the table? What do you wonder?

Feeding a Crowd

Have you ever cooked rice? Or watched it be cooked?
Describe the process below.

Have you eaten a spring roll (AKA egg roll)? Describe what it is below.

1. A recipe says that 2 cups of dry rice will serve 6 people. Complete the table as you answer the questions.
   a. How many people will 10 cups of rice serve? How do you know?

   a. How many cups of rice are needed to serve 45 people? How do you know?

cups of rice	number of people
2	6
3	9
10	
	45

2. A recipe says that 6 spring rolls will serve 3 people. Complete the table.

number of spring rolls	number of people
6	3
30	
40	
	28

Making Bread Dough

A bakery uses 8 tablespoons of honey for every 10 cups of flour to make bread dough. Some days they bake bigger batches and some days they bake smaller batches. But they always use the same ratio of honey to flour.

Complete the table as you answer the questions.

honey (tbsp)	flour (c)
8	10
20	
13	
	20

1. How many cups of flour do they use with 20 tablespoons of honey?

1. How many cups of flour do they use with 13 tablespoons of honey?

1. How many tablespoons of honey do they use with 20 cups of flour?

1. What is the **proportional relationship** represented by this table?

Lesson 2 Summary

If the ratios between two corresponding quantities are always equivalent, the relationship between the quantities is called a **proportional relationship**.

This table shows different amounts of milk and chocolate syrup. The ingredients in each row, when mixed together, would make a different total amount of chocolate milk, but these mixtures would all taste the same.

Notice that each row in the table shows a ratio of tablespoons of chocolate syrup to cups of milk that is equivalent to $4 : 1$.

About the relationship between these quantities, we could say:

tablespoons of chocolate syrup	cups of milk
4	1
6	$1\frac{1}{2}$
8	2
$\frac{1}{2}$	$\frac{1}{8}$
12	3
1	$\frac{1}{4}$

- The relationship between amount of chocolate syrup and amount of milk is proportional.
- The relationship between the amount of chocolate syrup and the amount of milk is a proportional relationship.
- The table represents a proportional relationship between the amount of chocolate syrup and amount of milk.
- The amount of milk is proportional to the amount of chocolate syrup.

We could multiply any value in the chocolate syrup column by $\frac{1}{4}$ to get the value in the milk column. We might call $\frac{1}{4}$ a *unit rate*, because $\frac{1}{4}$ cups of milk are needed for 1 tablespoon of chocolate syrup. We also say that $\frac{1}{4}$ is the **constant of proportionality** for this relationship. It tells us how many cups of milk we would need to mix with 1 tablespoon of chocolate syrup.

Lesson 3

Lesson 3: More about Constant Proportionality

Equal Measures

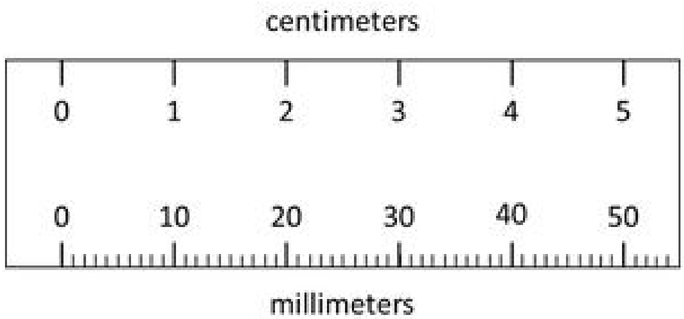
Use the number and units from the list to find as many equivalent measurements as you can. For example, you might write “30 minutes is ½ hour.”

You can use the numbers and units more than once.

1	$\frac{1}{2}$	0.3	centimeter
12	40	24	meter
0.4	0.01	$\frac{1}{5}$	hour
60	$3\frac{1}{3}$	6	feet
50	30	2	minute
			inch

Centimeters and Millimeters

There is a proportional relationship between any length measured in centimeters and the same length measured in millimeters.



There are two ways of thinking about this proportional relationship.

1. If you know the length of something in centimeters, you can calculate its length in millimeters.
   a. Complete the table.
   b. What is the constant of proportionality?

length (cm)	length (mm)
9	
12.5	
50	
88.49	

2. If you know the length of something in millimeters, you can calculate its length in centimeters..
   a. Complete the table.
   b. What is the constant of proportionality?

length (mm)	length (cm)
70	
245	
4	
699.1	

3. How are these two constants of proportionality related to each other?

4. Complete each sentence:

   a. To convert from centimeters to millimeters, you can multiply by ______________.

   a. To convert from millimeters to centimeters, you can multiply by ______________ or divide by ____________.

Pittsburgh to Phoenix

One its way from New York to San Diego, a plane flew over Pittsburgh Saint Louis, Albuquerque, and Phoenix traveling at a constant speed.

Complete the table as you answer the questions.

1. What is the distance between Saint Louis and Albuquerque?

1. How many minutes did it take to fly between Albuquerque and Phoenix?

1. What is the proportional relationships represented by this table?

1. Diego says the constant of proportionality is 550. Andre says the constant of proportionality is 9 ⅙. Do you agree with either of them? Explain your reasoning.

segment	time	distance	speed
Pittsburgh to Saint Louis	1 hour	550 miles	
Saint Louis to Albuquerque	1 hour 42 minutes		
Albuquerque to Phoenix		330 miles	

Lesson 3 Summary

When something is traveling at a constant speed, there is a proportional relationship between the time it takes and the distance traveled. The table shows the distance traveled and elapsed time for a bug crawling on a sidewalk.

distance traveled (cm)	elapsed time (sec)
$\frac{3}{2}$	1
1	$\frac{2}{3}$
3	2
10	$\frac{20}{3}$

$\cdot\frac{2}{3}$

We can multiply any number in the first column by $\frac{2}{3}$ to get the corresponding number in the second column. We can say that the elapsed time is proportional to the distance traveled, and the constant of proportionality is $\frac{2}{3}$. This means that the bug's *pace* is $\frac{2}{3}$ seconds per centimeter.

This table represents the same situation, except the columns are switched.

elapsed time (sec)	distance traveled (cm)
1	$\frac{3}{2}$
$\frac{2}{3}$	1
2	3
$\frac{20}{3}$	10

$\cdot\frac{3}{2}$

We can multiply any number in the first column by $\frac{3}{2}$ to get the corresponding number in the second column. We can say that the distanced traveled is proportional to the elapsed time, and the constant of proportionality is $\frac{3}{2}$. This means that the bug's *speed* is $\frac{3}{2}$ centimeters per second.

Notice that $\frac{3}{2}$ is the reciprocal of $\frac{2}{3}$. When two quantities are in a proportional relationship, there are two constants of proportionality, and they are always reciprocals of each other. When we represent a proportional relationship with a table, we say the quantity in the second column is proportional to the quantity in the first column, and the corresponding constant of proportionality is the number we multiply values in the first column to get the values in the second.

Lesson 4

Lesson 4: Proportional Relationships and Equations

Feeding a Crowd, Revisited

1. A recipe says that 2 cups of dry rice will serve 6 people. Complete the table as you answer the questions.
   a. How many people will 1 cup of rice serve?
   b. How many people will 3 cups of rice serve? 12 cups? 43 cups?
   c. How many people will x cups of rice serve?

cups of dry rice	number of people
1	
2	6
3	
12	
43	
x	

2. A recipe says that 6 spring rolls will serve 3 people. Complete the table as you answer the questions.

a. How many people will 1 spring roll serve?

b. How many people will 10 spring rolls serve? 16 spring rolls? 25 rolls?

c. How many people will *n* spring rolls serve?

number of spring rolls	number of people
1	
6	3
10	
16	
25	
n	

3. How was completing this table different from the previous table? How was it the same?

Denver to Chicago

A plane flew at a constant speed between Denver and Chicago. It took the plane 1.5 hours to fly 915 miles.

1. Complete the table.

time (hours)	distance (miles)	speed (miles per hour)
1		
1.5	915	
2		
2.5		
t		

1. How far does the plane fly in one hour?
2. How far would the plane fly in t hours at this speed?
3. If d represents the distance that the plane flies at this speed for t hours, write an equation that relates t and d.

1. How far would the plane fly in 3 hours at this speed? In 3.5 hours? Explain or show your reasoning.

Lesson 4 Summary

The table shows the amount of red paint and blue paint needed to make a certain shade of purple paint, called Venusian Sunset.

Note that "parts" can be *any* unit for volume. If we mix 3 cups of red with 12 cups of blue, you will get the same shade as if we mix 3 teaspoons of red with 12 teaspoons of blue.

red paint (parts)	**blue paint (parts)**
3	12
1	4
7	28
$\frac{1}{4}$	1
r	$4r$

The last row in the table says that if we know the amount of red paint needed, r, we can always multiply it by 4 to find the amount of blue paint needed, b, to mix with it to make Venusian Sunset. We can say this more succinctly with the equation $b = 4r$. So the amount of blue paint is proportional to the amount of red paint and the constant of proportionality is 4.

We can also look at this relationship the other way around.

If we know the amount of blue paint needed, b, we can always multiply it by $\frac{1}{4}$ to find the amount of red paint needed, r, to mix with it to make Venusian Sunset. So $r = \frac{1}{4}b$. The amount of blue paint is proportional to the amount of red paint and the constant of proportionality $\frac{1}{4}$.

blue paint (parts)	**red paint (parts)**
12	3
4	1
28	7
1	$\frac{1}{4}$
b	$\frac{1}{4}b$

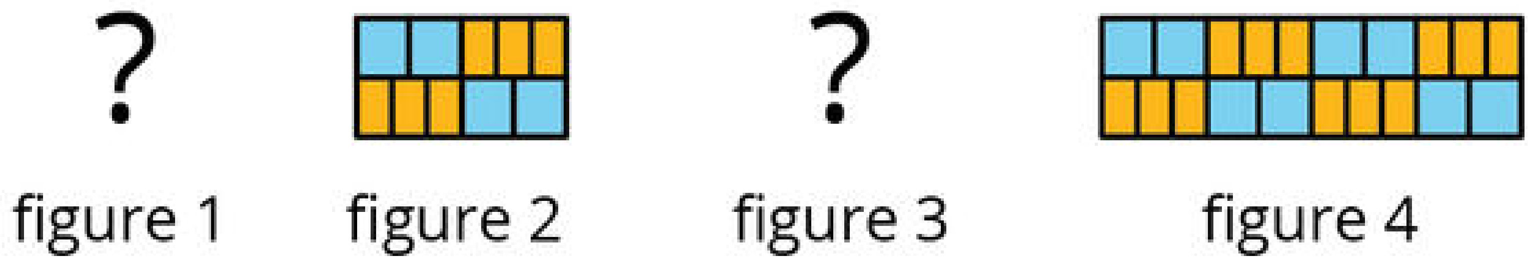
In general, when y is proportional to x, we can always multiply x by the same number k—the constant of proportionality—to get y. We can write this much more succinctly with the equation $y = kx$.

Lesson 5

Lesson 5: Two Equations for Each Relationship

Missing Figures

Here are the second and fourth figures in a pattern.



1. What do you think the first and third figures in the pattern look like?

1. Describe the 10th figure in the pattern.

Meters and Centimeters

There are 100 centimeters (cm) in every meter (m).

length (m)	length (cm)
1	100
0.94	
1.67	
57.24	
x	

length (cm)	length (m)
100	1
250	
78.2	
123.9	
y	

1. Complete the table.
2. For each table, highlight the constant of proportionality.
3. What is the relationship between these constants of proportionality?

1. For each table, write an equation for the proportional relationship. Let x represent a length measured in meters and y represent the same length measured in centimeters.

Filing a Water Cooler

It took Priya 5 minutes to fill a cooler with 8 gallons of water from a faucet that was flowing at a steady rate. Let w be the number of gallons of water in the cooler after t minutes.

1. Which of the following equations represent the relationship between w and t? Highlight **all** that apply.
   A. $w = 1.6t$
   B. $w = 0.625t$
   C. $t = 1.6w$
   D. $t = 0.625w$

1. What does 1.6 tell you about the situation?

1. What does 0.625 tell you about the situation?

1. Priya changed the rate at which water flowed through the faucet. Write an equation that represents the relationship of w and t when it takes 3 minutes to fill the cooler with 1 gallon of water.

1. Was the cooler filling faster before or after Priya changed the rate of water flow? Explain how you know.

Lesson 5 Summary

If Kiran rode his bike at a constant 10 miles per hour, his distance in miles, d, is proportional to the number of hours, t, that he rode. We can write the equation

$$d = 10t$$

With this equation, it is easy to find the distance Kiran rode when we know how long it took because we can just multiply the time by 10.

We can rewrite the equation:

$$d = 10t$$
$$\left(\frac{1}{10}\right) d = t$$
$$t = \left(\frac{1}{10}\right) d$$

This version of the equation tells us that the amount of time he rode is proportional to the distance he traveled, and the constant of proportionality is $\frac{1}{10}$. That form is easier to use when we know his distance and want to find how long it took because we can just multiply the distance by $\frac{1}{10}$.

When two quantities x and y are in a proportional relationship, we can write the equation

$$y = kx$$

and say, "y is proportional to x." In this case, the number k is the corresponding constant of proportionality. We can also write the equation

$$x = \frac{1}{k} y$$

and say, "x is proportional to y." In this case, the number $\frac{1}{k}$ is the corresponding constant of proportionality. Each one can be useful depending on the information we have and the quantity we are trying to figure out.

Lesson 6

Lesson 6: Using Equations to Solve Problems

Concert Ticket Sales

A performer expects to sell 5,000 tickets for an upcoming concert. They want to make a total of $311,000 in sales from these tickets.

1. Assuming that all tickets have the same price, what is the price for one ticket?

1. How much will they make if they sell 7,000 tickets?

1. How much will they make if they sell 10,000 tickets?
   a. 50,000 tickets?
   b. 120,000 tickets?
   c. a million tickets?
   d. x tickets?

1. If they make $379,420, how many tickets have they sold?

1. How many tickets will they have to sell to make $5,000,000?

Recycling

Aluminum cans can be recycled instead of being thrown in the garbage. The weight of 10 aluminum cans is 0.16 kilograms. The aluminum in 10 cans that are recycled has a value of $0.14.

1. If a family threw away 2.4 kg of aluminum in a month, how many cans did they throw away? Explain or show your reasoning.

1. What would be the recycled value of those same cans? Explain or show your reasoning.

1. Write an equation to represent the number of cans c given their weight w.

1. Write an equation to represent the recycled value r of c cans.

1. Write an equation to represent the recycled value r of w kilograms of aluminum.

Lesson 6 Summary

Remember that if there is a proportional relationship between two quantities, their relationship can be represented by an equation of the form $y = kx$. Sometimes writing an equation is the easiest way to solve a problem.

For example, we know that Denali, the highest mountain peak in North America, is 20,300 feet above sea level. How many miles is that? There are 5,280 feet in 1 mile. This relationship can be represented by the equation

$$f = 5{,}280m$$

where f represents a distance measured in feet and m represents the same distance measured miles. Since we know Denali is 20,310 feet above sea level, we can write

$$20{,}310 = 5{,}280m$$

So $m = \frac{20{,}310}{5{,}280}$, which is approximately 3.85 miles.

Lesson 7

Lesson 7: Comparing Relationships with Tables

Visiting the State Park

Entrance to a state park costs $6 per vehicle, plus $2 per person in the vehicle.

1. How much would it cost for a car with 2 people to enter the park? 4 people? 10 people? Record your answers in the table.

number of people in vehicle	total entrance cost in dollars
2	
4	
10	

1. For each row in the table, if each person in the vehicle splits the entrance cost equally, how much will each person pay?

1. How might you determine the entrance costs for a bus with 50 people?

1. Is the relationship between the number of people and the total entrance cost a proportional relationship? Explain how you know.

Running Laps

Han and Clare were running laps around the track. The coach recorded their times at the end of laps 2, 4, 6, and 8.

Han's run:

distance (laps)	time (minutes)	minutes per lap
2	4	
4	9	
6	15	
8	23	

Clare's run:

distance (laps)	time (minutes)	minutes per lap
2	5	
4	10	
6	15	
8	20	

1. Is Han running at a constant pace? Is Clare? How do you know?

1. Write an equation for the relationship between distance and time for anyone who is running at a constant pace.

Lesson 7 Summary

Here are the prices for some smoothies at two different smoothie shops:

Smoothie Shop A

smoothie size (oz)	price ($)	dollars per ounce
8	6	0.75
12	9	0.75
16	12	0.75
s	$0.75s$	0.75

Smoothie Shop B

smoothie size (oz)	price ($)	dollars per ounce
8	6	0.75
12	8	0.67
16	10	0.625
s	???	???

For Smoothie Shop A, smoothies cost $0.75 per ounce no matter which size we buy. There could be a proportional relationship between smoothie size and the price of the smoothie. An equation representing this relationship is

$$p = 0.75s$$

where s represents size in ounces and p represents price in dollars. (The relationship could still not be proportional, if there were a different size on the menu that did not have the same price per ounce.)

For Smoothie Shop B, the cost per ounce is different for each size. Here the relationship between smoothie size and price is definitely *not* proportional.

In general, two quantities in a proportional relationship will always have the same quotient. When we see some values for two related quantities in a table and we get the same quotient when we divide them, that means they might be in a proportional relationship—but if we can't see all of the possible pairs, we can't be completely sure. However, if we know the relationship can be represented by an equation is of the form $y = kx$, then we are sure it is proportional.

Lesson 8

Lesson 8: Comparing Relationships with Equations

More Conversions

The other day you worked with converting meters, centimeters, and millimeters. Here are some more unit conversions.

1. Use the equation $F = 9/5\ C + 32$, where F represents degrees Fahrenheit and C represents degrees Celsius, to complete the table.

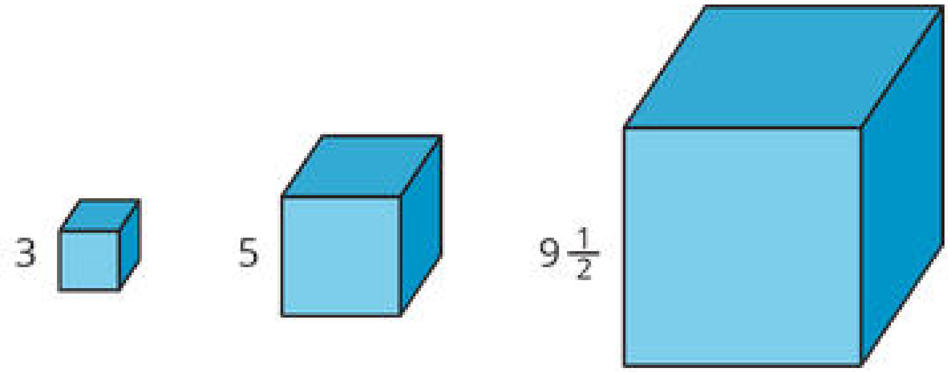
temperature (°C)	temperature (°F)
20	
4	
175	

1. Use the equation $c = 2.54n$, where c represents the length in centimeters and n represents the length in inches to complete the table.

length (in)	length (cm)
10	
8	
$3\frac{1}{2}$	

Total Edge Length, Surface Area, and Volume

Here are some cubes with different side lengths. Complete each table.



How long is the total edge length of each side?

side length	total edge length
3	
5	
$9\frac{1}{2}$	
s	

What is the surface area of each cube?

side length	surface area
3	
5	
$9\frac{1}{2}$	
s	

What is the volume of each cube?

side length	volume
3	
5	
$9\frac{1}{2}$	
s	

Which of these relationships is proportional? Explain how you know.

Write equations for the total edge length E, total surface area A, and volume V of a cube with side length s.

Lesson 8 Summary

If two quantities are in a proportional relationship, then their quotient is always the same. This table represents different values of a and b, two quantities that are in a proportional relationship.

a	b	$\frac{b}{a}$
20	100	5
3	15	5
11	55	5
1	5	5

Notice that the quotient of b and a is always 5. To write this as an equation, we could say $\frac{b}{a} = 5$. If this is true, then $b = 5a$. (This doesn't work if $a = 0$, but it works otherwise.)

If quantity y is proportional to quantity x, we will always see this pattern: $\frac{y}{x}$ will always have the same value. This value is the constant of proportionality, which we often refer to as k. We can represent this relationship with the equation $\frac{y}{x} = k$ (as long as x is not 0) or $y = kx$.

Note that if an equation cannot be written in this form, then it does not represent a proportional relationship.

Lesson 9

Lesson 9: Solving Problems about Proportional Relationships

What Do You Want to Know?

Consider the problem: A person is running a distance race at a constant rate. What time will they finish the race?

What information would you need to be able to solve the problem?

Move the box to see some information about your questions.

Now, that you have more information, solve the problem.

Biking and Rain

The following problems were done in class.

You need to look at your problem and think of questions you would ask to gain the information needed to solve it.

Info Gap: Biking and Rain

Problem Card 1

Mai and Noah each leave their houses at the same time and ride their bikes to the park.

1. For each person, write an equation that relates the distance they travel and the time.
2. Who will arrive at the park first?

Info Gap: Biking and Rain

Problem Card 2

A slow, steady rainstorm lasted all day. The rain was falling at a constant rate.

1. Write an equation that relates how much rain has fallen and how long it has been raining.
2. How long will it take for 5 cm of rain to fall?

Lesson 9 Summary

Whenever we have a situation involving constant rates, we are likely to have a proportional relationship between quantities of interest.

- When a bird is flying at a constant speed, then there is a proportional relationship between the flying time and distance flown.
- If water is filling a tub at a constant rate, then there is a proportional relationship between the amount of water in the tub and the time the tub has been filling up.
- If an aardvark is eating termites at a constant rate, then there is proportional relationship between the number of termites the aardvark has eaten and the time since it started eating.

Sometimes we are presented with a situation, and it is not so clear whether a proportional relationship is a good model. How can we decide if a proportional relationship is a good representation of a particular situation?

- If you aren't sure where to start, look at the quotients of corresponding values. If they are not always the same, then the relationship is definitely not a proportional relationship.
- If you can see that there is a single value that we always multiply one quantity by to get the other quantity, it is definitely a proportional relationship.

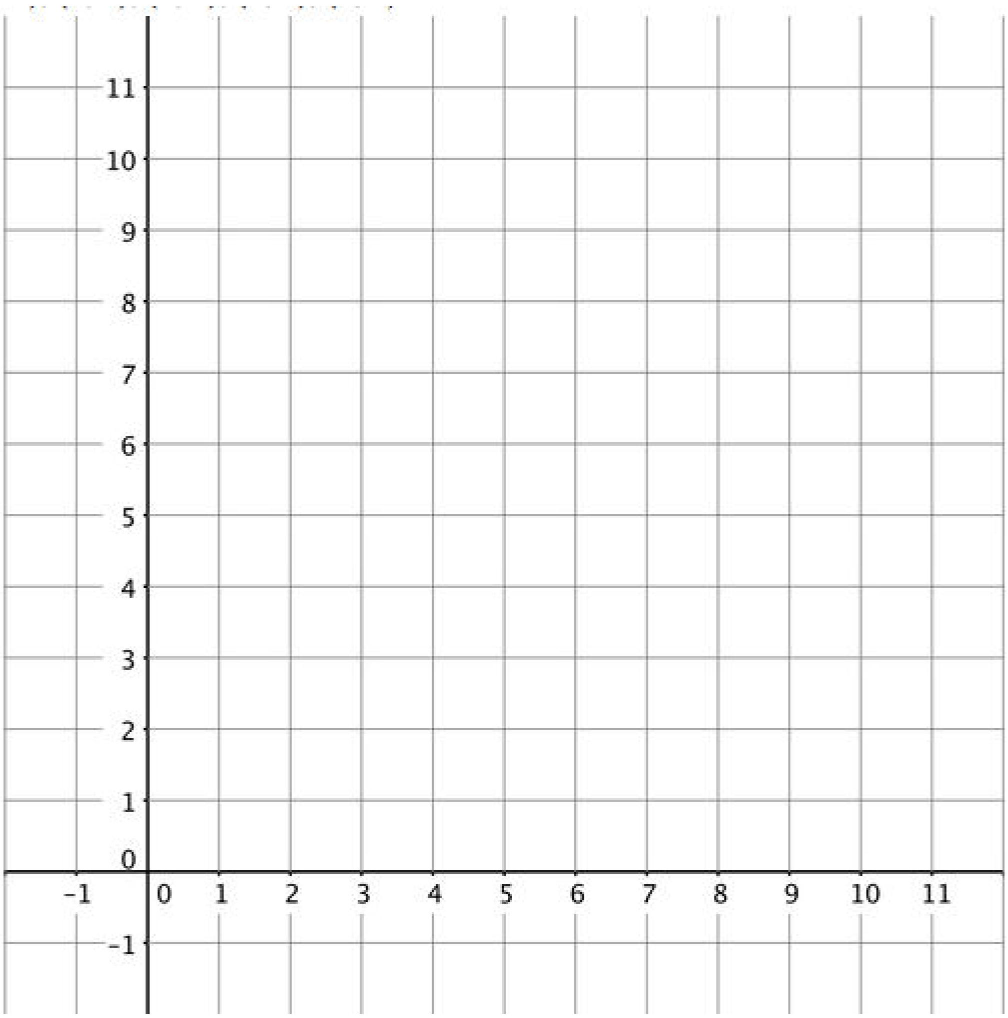
After establishing that it is a proportional relationship, setting up an equation is often the most efficient way to solve problems related to the situation.

Lesson 10

Lesson 10: Introducing Graphs of Proportional Relationships

Notice These Points

Plot the points (0,10), (1, 8), (2, 6), (3, 4), (4, 2).



What do you notice about the graph?

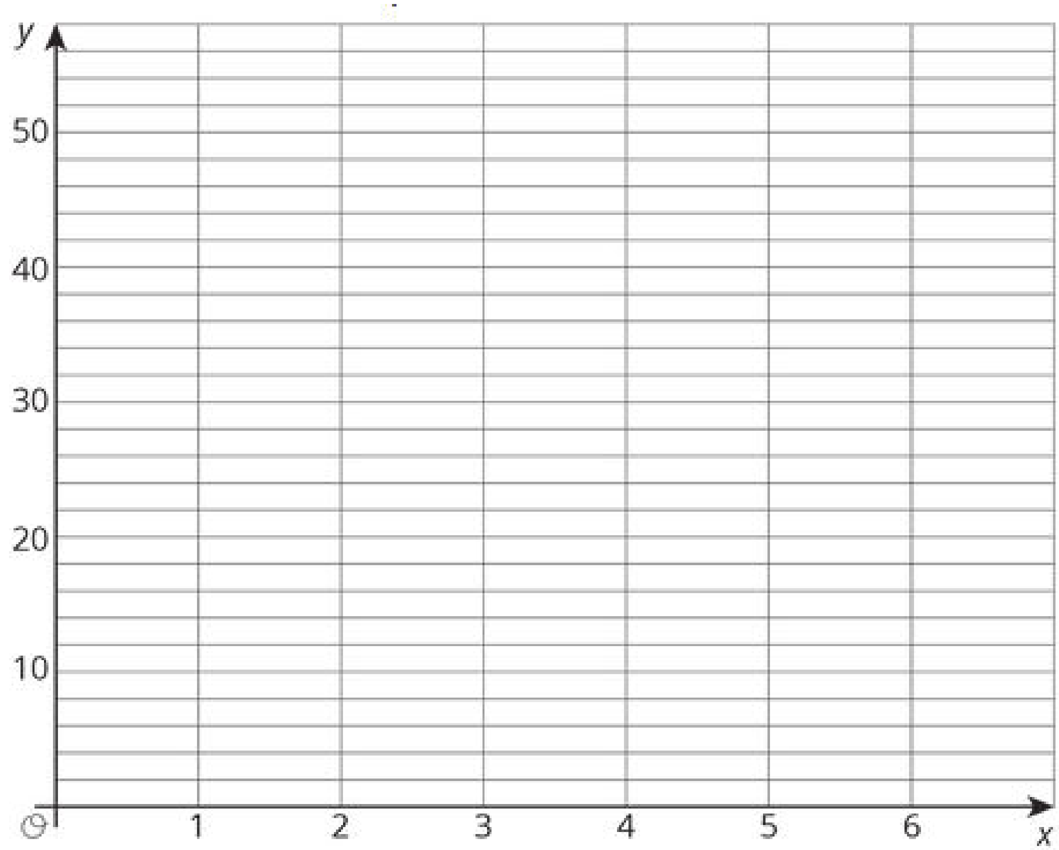
T-shirts for Sale

Some T-shirts cost $8 each.

1. Use the table to answer these questions.
   a. What does *x* represent?
   b. What does *y* represent?
   c. Is there a proportional relationship between *x* and *y*?

x	*y*
1	8
2	16
3	24
4	32
5	40
6	48

2. Plot the pairs from the table on the coordinate plane.



3. What do you notice about the graph?

Matching Tables and Graphs

Look at graphs. What is the same and what is different about the graphs.

If you sorted the graphs, what category of sorting would you choose?

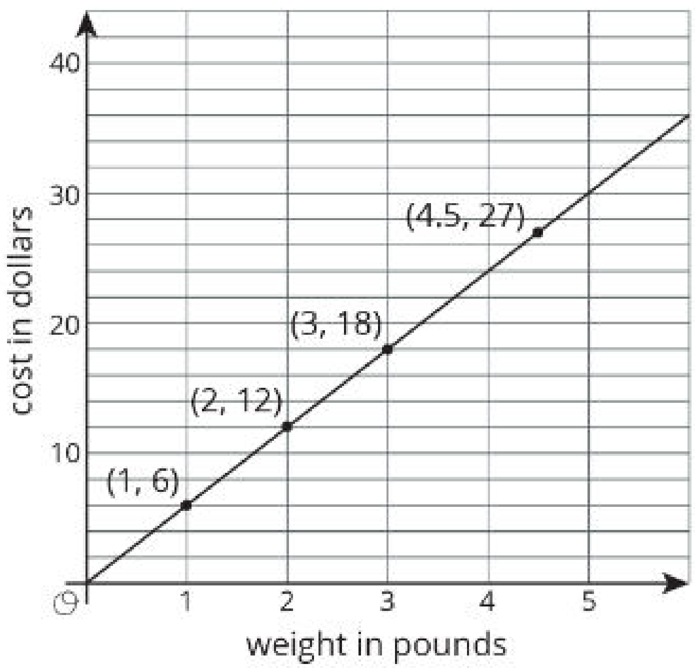
Now, match the graphs with its table.

Which of the relationships are proportional?

What have you noticed about the graphs of proportional relationships? Do you think this will hold true for all graphs of proportional relationships?

Lesson 10 Summary

One way to represent a proportional relationship is with a graph. Here is a graph that represents different amounts that fit the situation, “Blueberries cost $6 per pound.”



Different points on the graph tell us, for example, that 2 pounds of blueberries cost $12, and 4.5 pounds of blueberries cost $27.

Sometimes it makes sense to connect the points with a line, and sometimes it doesn’t. We could buy, for example, 4.5 pounds of blueberries or 1.875 pounds of blueberries, so all the points in between the whole numbers make sense in the situation, so any point on the line is meaningful.

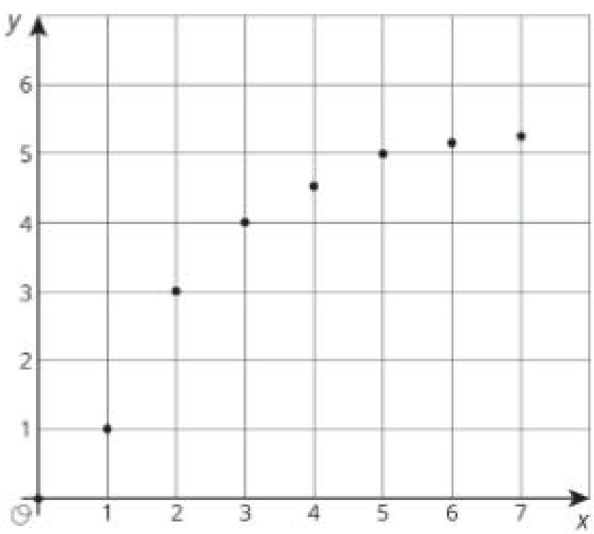
Lesson 10 Summary

If the graph represented the cost for different *numbers of sandwiches* (instead of pounds of blueberries), it might not make sense to connect the points with a line, because it is often not possible to buy 4.5 sandwiches or 1.875 sandwiches. Even if only points make sense in the situation, though, sometimes we connect them with a line anyway to make the relationship easier to see.

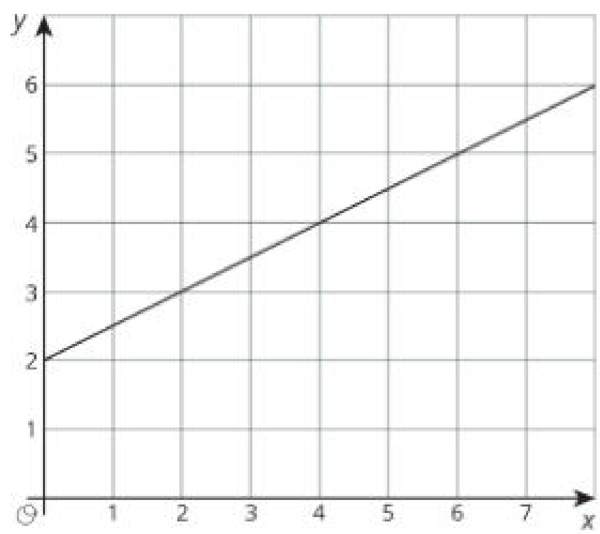
Graphs that represent proportional relationships all have a few things in common:

- Points that satisfy the relationship lie on a straight line.
- The line that they lie on passes through the **origin**, $(0, 0)$.

Here are some graphs that do *not* represent proportional relationships:



These points do not lie on a line.



This is a line, but it doesn't go through the origin.

Lesson 11

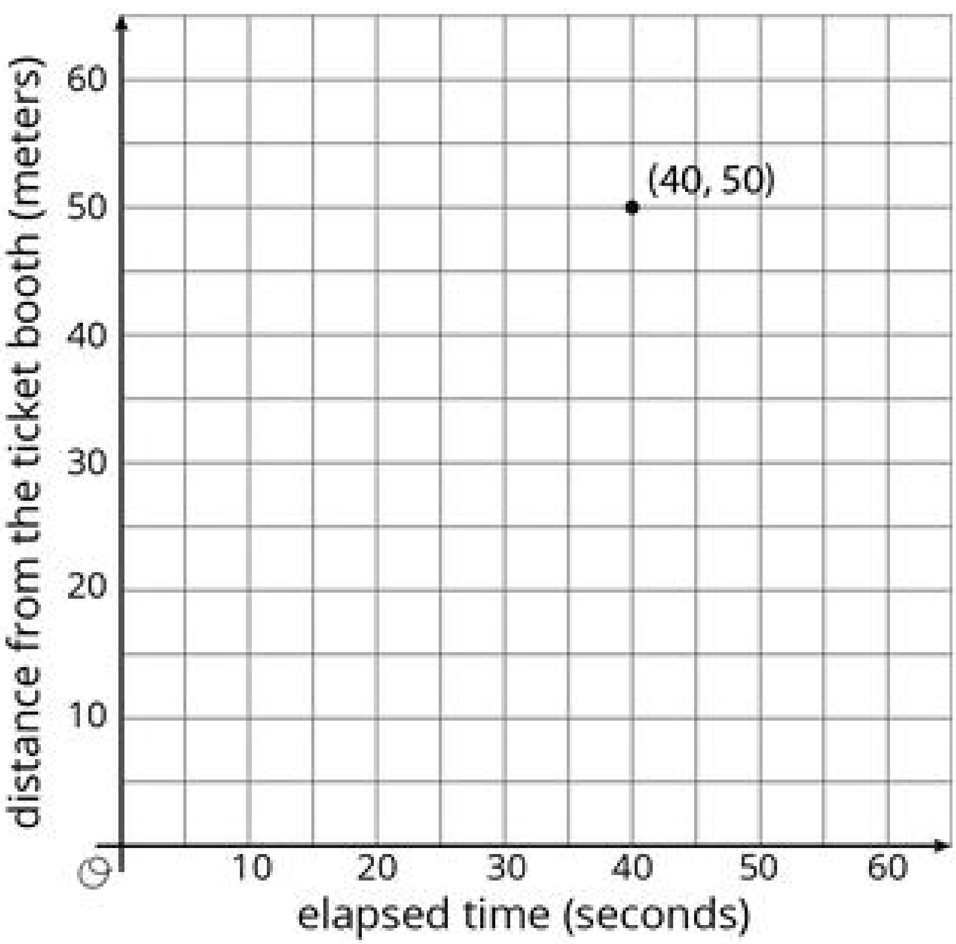
Lesson 11: Interpreting Graphs of Proportional Relationships

Tyler's Walk

Tyler was at the amusement park. He walked at a steady pace from the ticket booth to the bumper cars.

1. The point on the graph shows his arrival at the bumper cars. What do the coordinates of the point tell us about the situation?

1. The table representing Tyler's walk shows other values of time and distance. Complete the table. Next, plot the pairs of values on the grid.



time (seconds)	distance (meters)
0	0
20	25
30	37.5
40	50
1	

3. What does the point (0, 0) mean in this situation?

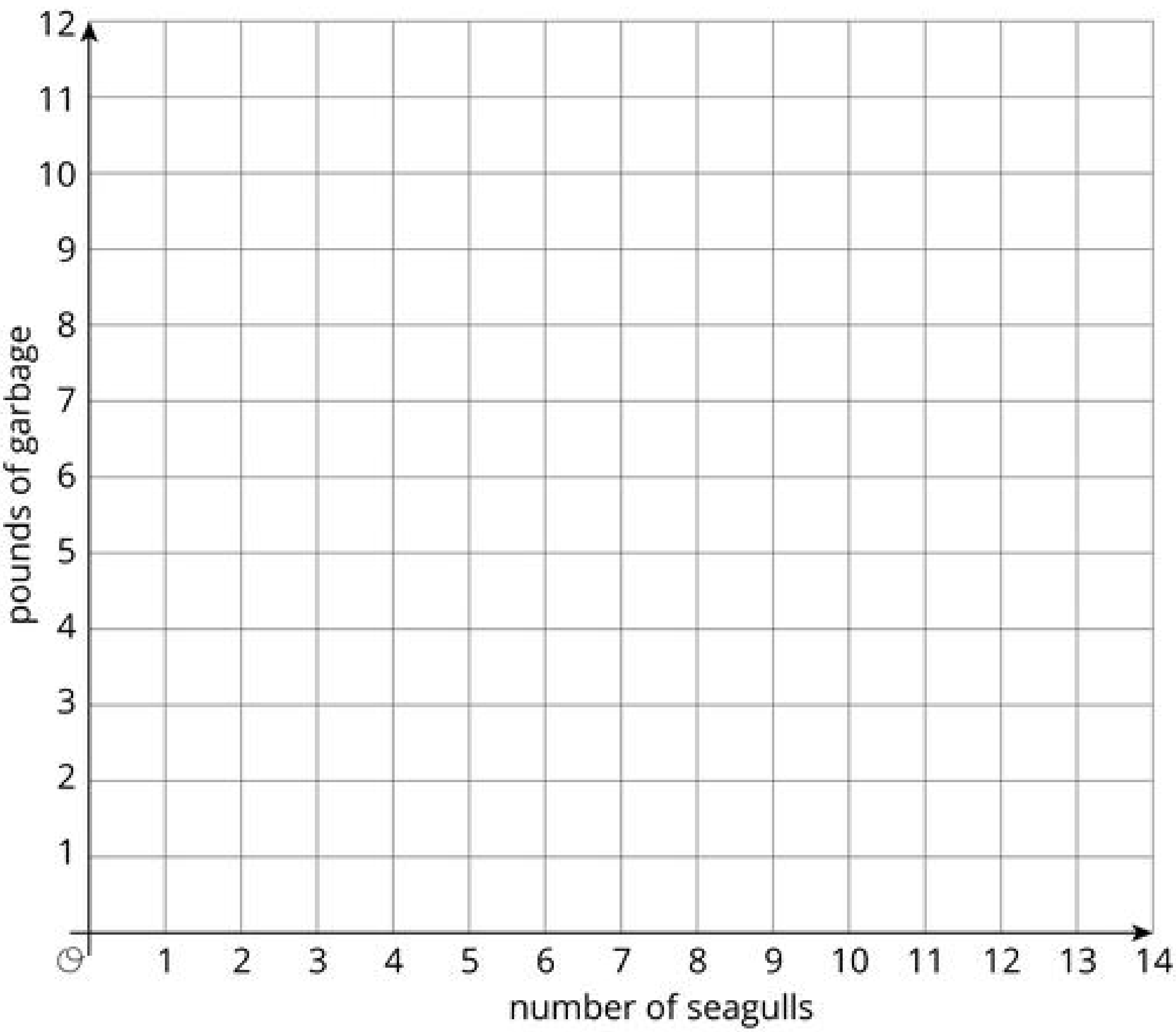
4. How far away from the ticket booth was Tyler after 1 second? Label the point on the graph that shows this information with its coordinates.

5. What is the constant of proportionality for the relationship between time and distance? What does it tell you about Tyler's walk? Where do you see it in the graph?

Seagulls Eat What?

4 seagulls ate 10 pounds of garbage. Assume this information describes a proportional relationship.

1. Plot a point that shows the number of seagulls and the amount of garbage they ate.
2. Draw a line through this point and (0, 0).
3. Plot the point (1, *k*) on the line. What is the value of *k*? What does the value of *k* tell you about this context?



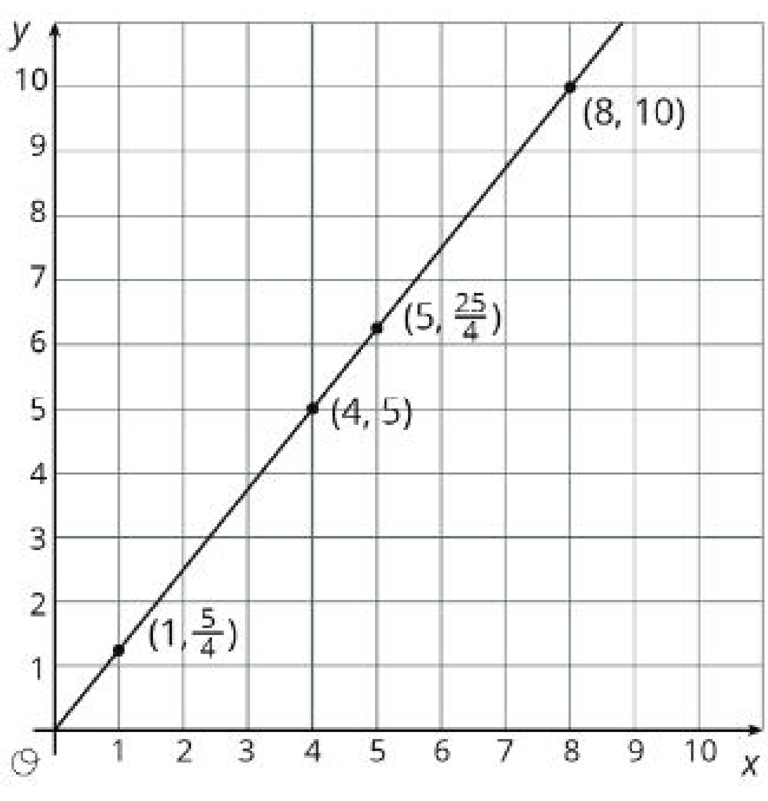
Lesson 11 Summary

For the relationship represented in this table, y is proportional to x. We can see in the table that $\frac{5}{4}$ is the constant of proportionality because it's the y value when x is 1.

The equation $y = \frac{5}{4}x$ also represents this relationship.

x	y
4	5
5	$\frac{25}{4}$
8	10
1	$\frac{5}{4}$

Here is the graph of this relationship.



If y represents the distance in feet that a snail crawls in x minutes, then the point $(4, 5)$ tells us that the snail can crawl 5 feet in 4 minutes.

If y represents the cups of yogurt and x represents the teaspoons of cinnamon in a recipe for fruit dip, then the point $(4, 5)$ tells us that you can mix 4 teaspoons of cinnamon with 5 cups of yogurt to make this fruit dip.

We can find the constant of proportionality by looking at the graph, because $\frac{5}{4}$ is the y-coordinate of the point on the graph where the x-coordinate is 1. This could mean the snail is traveling $\frac{5}{4}$ feet per minute or that the recipe calls for $1\frac{1}{4}$ cups of yogurt for every teaspoon of cinnamon.

In general, when y is proportional to x, the corresponding constant of proportionality is the y-value when $x = 1$.

Lesson 12

Lesson 12: Using Graphs to Compare Relationships

Race to the Bumper Cars

Recall Tyler from the amusement park. This problem is tied to it.

Diego, Lin, and Mai went from the ticket boot to the bumper cars. Descriptions and tables representing their journeys are below.

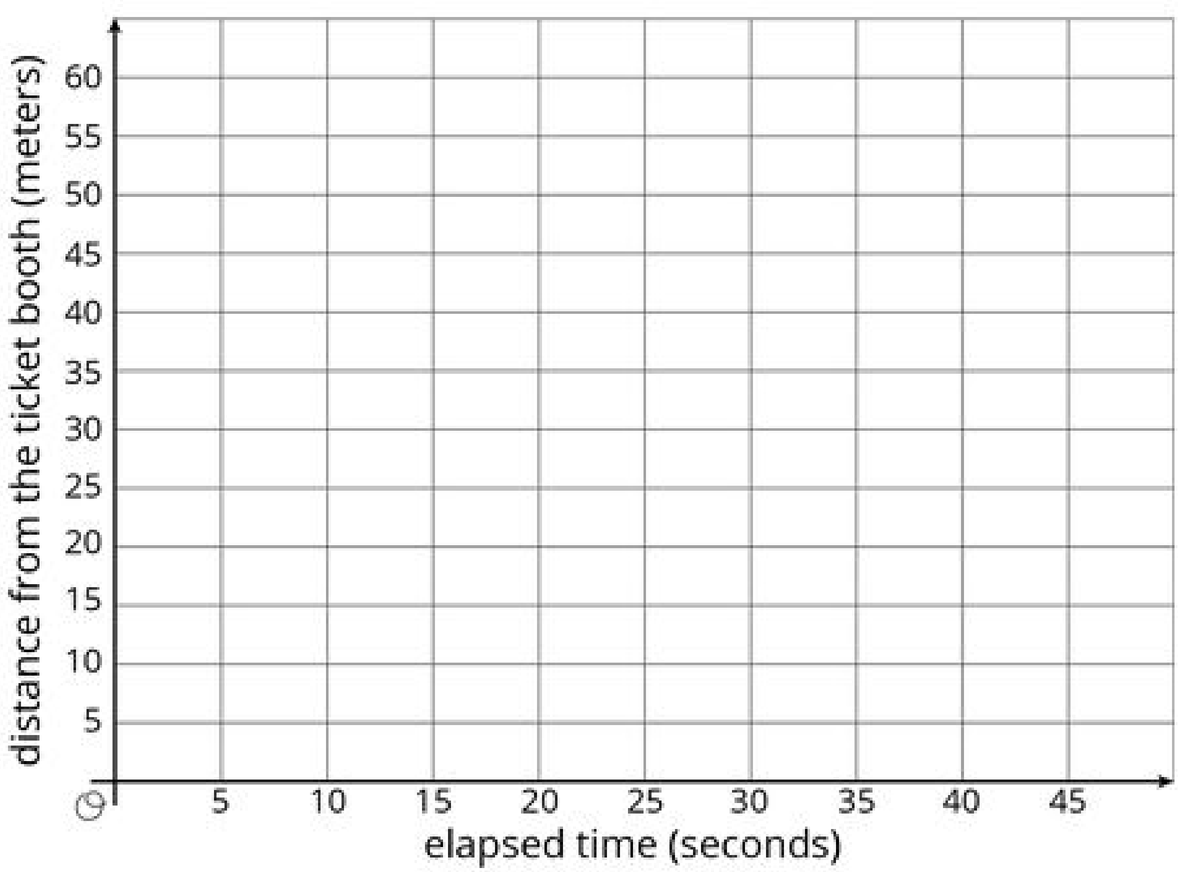
1. Read each description and complete each table.
   - Diego left the ticket booth at the same time as Tyler. Diego jogged ahead at a steady pace and reached the bumper cars in 30 second.
   - Lin left the ticket booth at the same time as Tyler. She ran at a steady pace and arrived at the bumper cars in 20 seconds.
   - Mai left the booth 10 seconds later than Tyler. Her steady jog enabled her to catch up with Tyler just as he arrived at the bumper cars.

Diego's time (seconds)	Diego's distance (meters)
0	
15	
30	50
1	

Mai's time (seconds)	Mai's distance (meters)
	0
	25
40	50
1	

Lin's time (seconds)	Lin's distance (meters)
	0
	25
20	50
1	

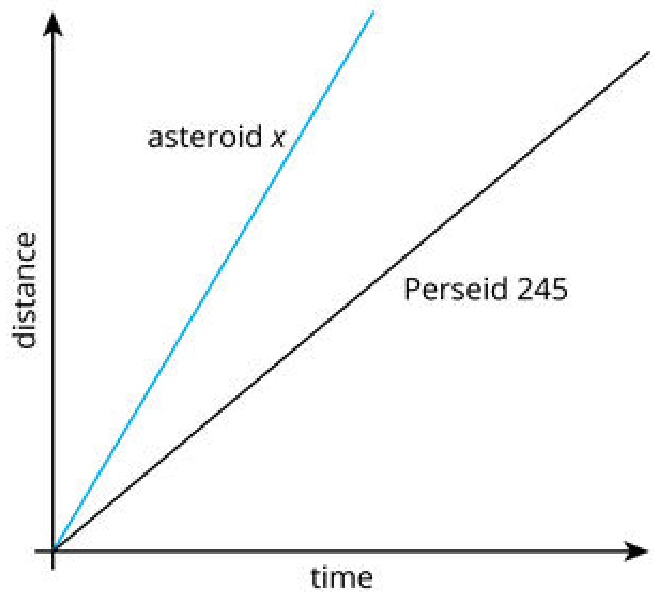
2. Using a different color for each person, draw a graph of all four people's journeys (including Tyler's from the other day). Click on the picture to use the applet.



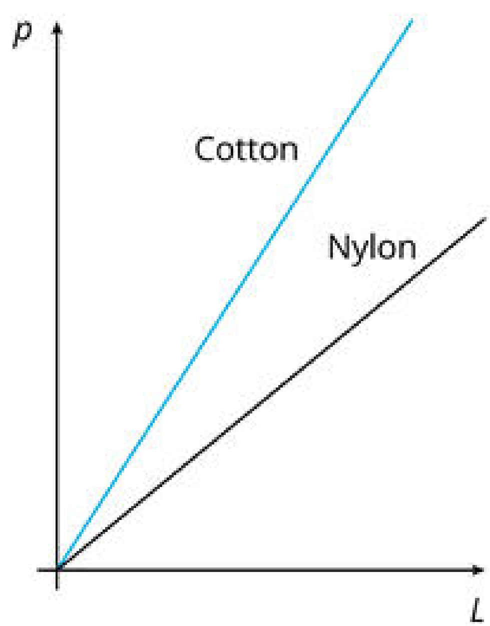
3. For Tyler, Diego, and Lin, which person is moving the most quickly? How is that reflected in the graph?

Space Rocks and the Price of Rope

1. Meteoroid Perseid 245 and Asteroid x travel through the solar system. The graph shows the distance each traveled after a given point in time.
   Is Asteroid x traveling faster or slower than Perseid 245? Explain how you know.

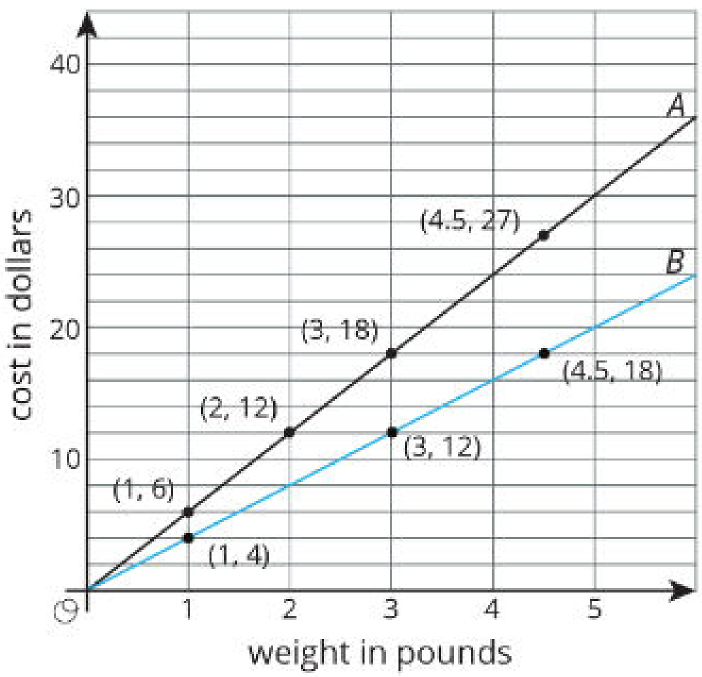


1. The graph show the price, p, of different lengths, L, of two types of rope.
   If you buy $1.00 of each kind of rope, which one will be longer? Explain how you know.



Lesson 12 Summary

Here is a graph that shows the price of blueberries at two different stores. Which store has a better price?



We can compare points that have the same x value or the same y value. For example, the points $(2, 12)$ and $(3, 12)$ tell us that at store B you can get more pounds of blueberries for the same price.

The points $(3, 12)$ and $(3, 18)$ tell us that at store A you have to pay more for the same quantity of blueberries. This means store B has the better price.

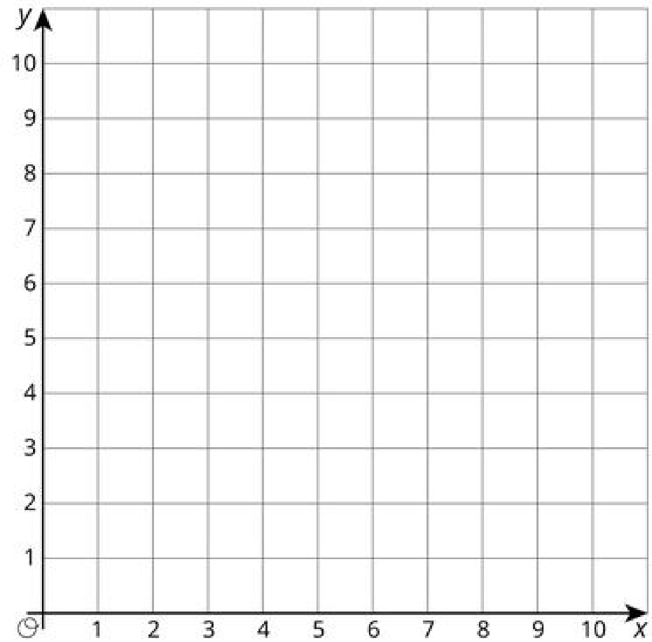
We can also use the graphs to compare the constants of proportionality. The line representing store B goes through the point $(1, 4)$, so the constant of proportionality is 4. This tells us that at store B the blueberries cost $4 per pound. This is cheaper than the $6 per pound unit price at store A.

Lesson 13

Lesson 13: Two Graphs for Each Relationship

Tables, Graphs, and Equations

You will use the applet (click picture).



Explore the graph. Notice the values in the table and the coordinates of the labeled point. Grab the point and move it around.

1. What stays the same and what changes in the table? in the equation? on the graph?

1. Chose one row in the table and write it here. To what does this row correspond on the graph?

x	y

Grab and drag the point until you see the equation y = 3/2 x.

3. Do not move the point. Choose three rows from the table, other than the origin. Record *x* and *y*, and compute *y*/*x*.

x	y	$\frac{y}{x}$

4. What do you notice? What does this have to do with the equation of the line?

5. Do not move the point. Check the box to view the coordinates (1, ?). What are the coordinates of this point? What does this correspond to in the table? What does this correspond to in the equation?

6. Drag the point to a different location. Record the equation of the line, the coordinates of three points, and the value of *y*/*x*.

Equation of the line:________________________________

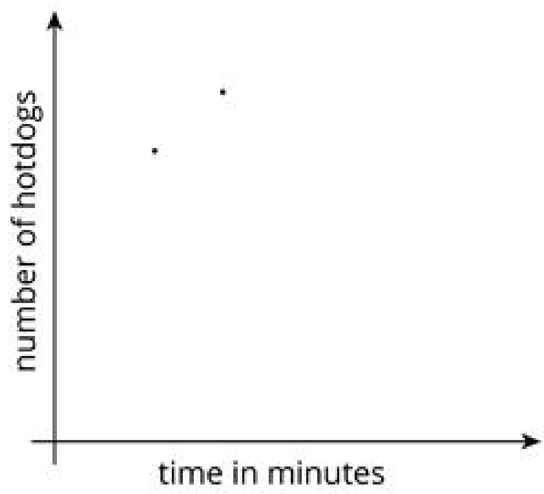
x	y	$\frac{y}{x}$

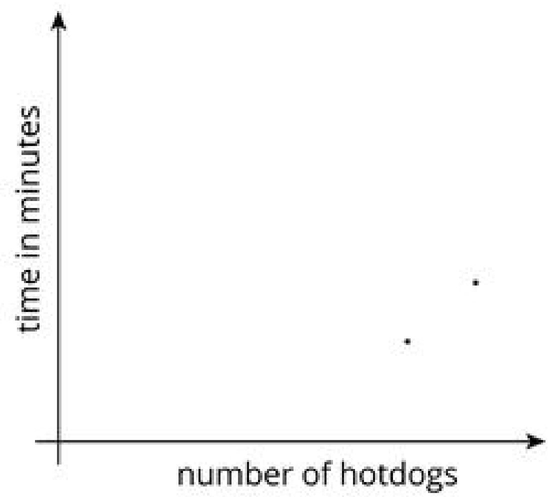
7. Based on your observations, summarize any connections you see between the table, characteristics of the graph, and the equation.

Hot Dog Eating Contest

Andre and Jada were in a hot dog eating contest. Andre ate 10 hot dogs in 3 minutes. Jada ate 12 hot dogs in 5 minutes.

Here are two different graphs that both represent this situation.





1. On the first graph, which point shows Andre's consumption and which shows Jada's consumption? Label them.
2. Draw two lines: one through the origin and Andre's point, and one through the origin and Jada's point.
3. Write an equation for each line. Use *t* to represent time in minutes and *h* to represent number of hot dogs.

1. For each equation, what does the constant of proportionality tell you?
   a
   b.

1. Repeat the previous steps for the second graph.
   a. Andre:
   b. Jada:

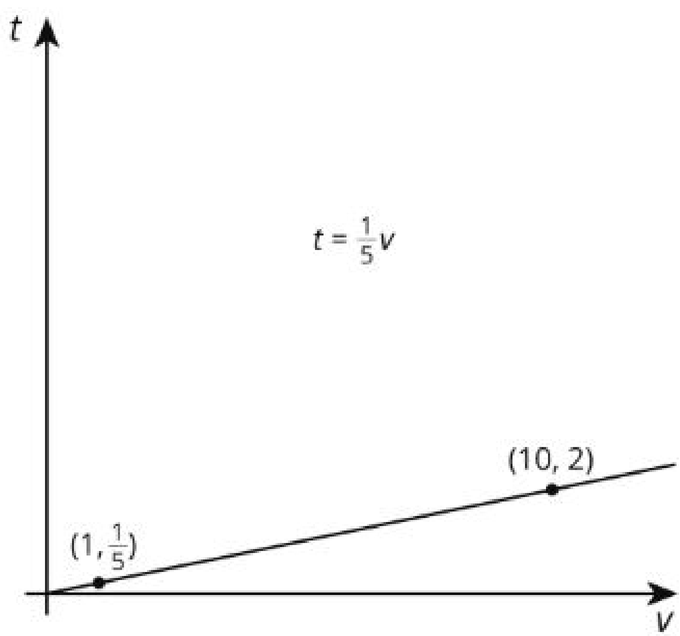
Lesson 13 Summary

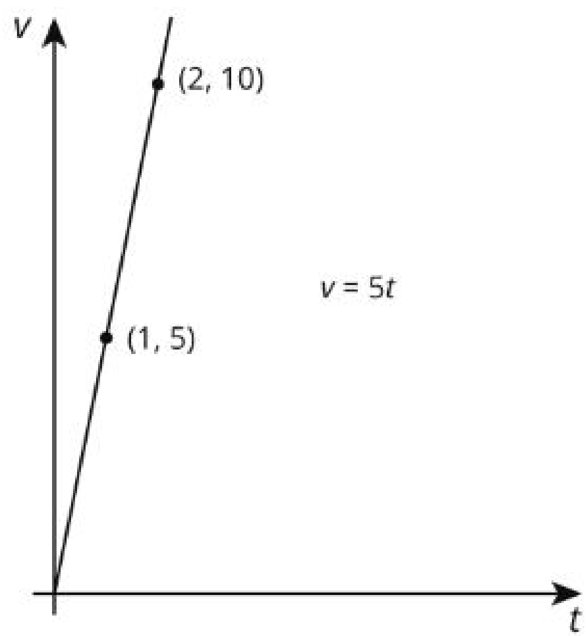
Imagine that a faucet is leaking at a constant rate and that every 2 minutes, 10 milliliters of water leaks from the faucet. There is a proportional relationship between the volume of water and elapsed time.

- We could say that the elapsed time is proportional to the volume of water. The corresponding constant of proportionality tells us that the faucet is leaking at a rate of $\frac{1}{5}$ of a minute per milliliter.

- We could say that the volume of water is proportional to the elapsed time. The corresponding constant of proportionality tells us that the faucet is leaking at a rate of 5 milliliters per minute.

Let's use v to represent volume in milliliters and t to represent time in minutes. Here are graphs and equations that represent both ways of thinking about this relationship:





Even though the relationship between time and volume is the same, we are making a different choice in each case about which variable to view as the independent variable. The graph on the left has v as the independent variable, and the graph on the right has t as the independent variable.