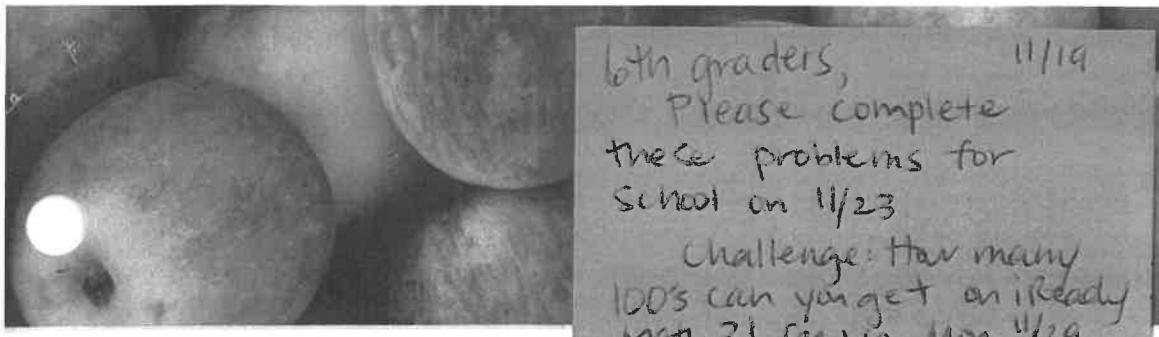


6th graders, 11/19
Please complete these problems for school on 11/23
Challenge: How many 100's can you get on iReady Math?! See you Mon. 11/29.
♡ Kumu Jess

LESSON 15

Understand Rate Concepts

Dear Family,

This week your student is exploring rates. You may be familiar with rates such as *miles per hour, words per minute,* or *price per pound.*

A **rate** is a ratio that compares the number of units of one quantity to 1 unit of another quantity. You can write two rates to represent a given ratio relationship.

Ratio of cost to pounds of apples
$4 for every 2 pounds

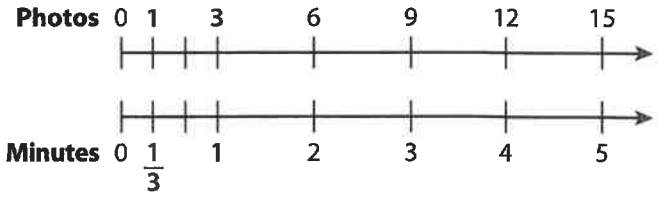
Rate per pound	**Rate per dollar**
$2 for every 1 pound	0.5 pound for every $1
$2 per pound	0.5 pound per dollar

Your student will be modeling rates for ratio relationships like the one below.

> A computer uploads 15 photos every 5 minutes.

➤ **ONE WAY** to model the two rates for a ratio relationship is to use a double number line.

The double number line shows the number of photos uploaded in **1 minute** and the number of minutes needed to upload **1 photo**.



➤ **ANOTHER WAY** is to use a table of equivalent ratios.

Divide both quantities in the ratio 15 : 5 by 5 to make the second quantity 1.

Then divide both quantities in the ratio 3 : 1 by 3 to make the first quantity 1.

	Photos	**Minutes**	
÷ 5	15	5	÷ 5
	3	1	
÷ 3	1	$\frac{1}{3}$	÷ 3

Both models show that you can think of the uploading rate as 3 photos per minute or as $\frac{1}{3}$ minute per photo.

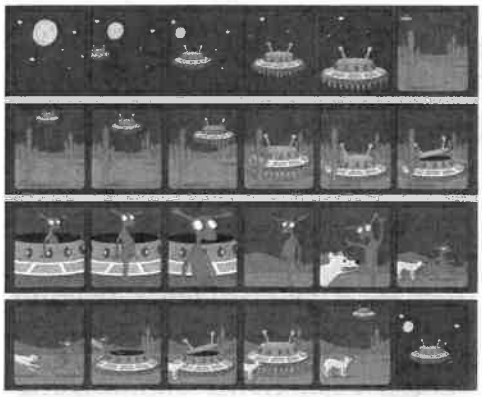
Use the next page to start a conversation about rates.

Activity Thinking About Rates in the World Around You

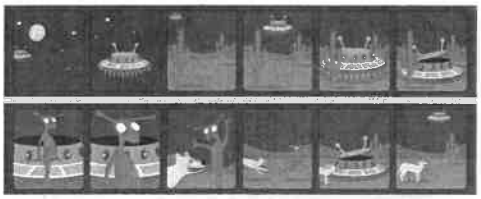
➤ **Do this activity together to investigate rates in the real world.**

When making a movie, directors must consider how many frames per second they want audiences to see. The rate *frames per second* represents how many images flash across the screen in one second.

Many movie directors use 24 frames per second because this makes the movie scenes look smooth. Have you ever noticed some movie scenes look very choppy? It may seem like the camera is shaking, but this choppiness is actually caused by the movie director choosing 12 frames per second instead of 24!



24 frames per second



12 frames per second

? Where else do you see rates in the world around you?

UNDERSTAND: What are rates and what do they tell you?

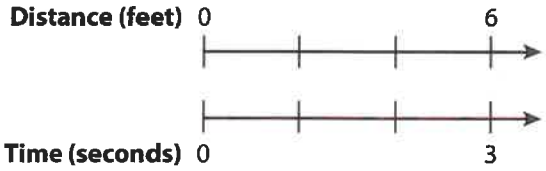
Explore Rate Concepts

RED TEAM	BLUE TEAM
6 feet every 3 seconds	12 feet every 4 seconds

Model It

➤ **Complete the problems about equivalent ratios.**

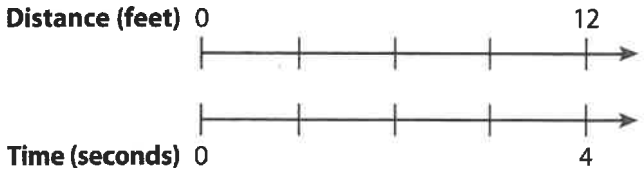
1. Teams of students in Ms. Seda's class make robots. The Red Team's robot travels 6 feet every 3 seconds. The model shows the ratio 6 : 3. Complete the model to show the equivalent ratio that tells how far the Red Team's robot travels in 1 second.



2. A ratio that compares the number of units of one quantity to 1 unit of another quantity is a **rate**. You can use the word ***per,*** which means *for each* or *for every,* to write a rate. A speed in *feet per second* is a rate that compares distance to time.

   a. The Red Team's robot travels at a rate of _____ feet per second.

   b. The Blue Team's robot travels 12 feet every 4 seconds. Complete the model to show this robot's rate in feet per second.



The Blue Team's robot travels at a rate of _____ feet per second.

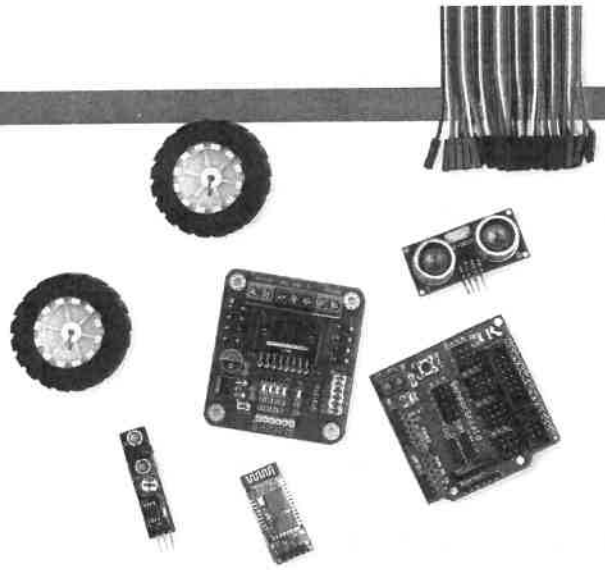
DISCUSS IT

Ask: How do your models show each robot's rate?

Share: Other rates I have heard of are *dollars per pound, . . .*

Learning Target SMP 2, SMP 3, SMP 7

Understand the concept of a unit rate $\frac{a}{b}$ associated with a ratio $a : b$ with $b \neq 0$, and use rate language in the context of a ratio relationship.

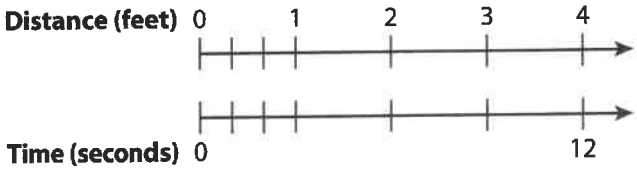


Model It

➤ **Complete the problems about rates.**

3 The Yellow Team's robot is not working properly. It travels only 4 feet every 12 seconds.

a. Complete the model to show the robot's rate in feet per second.



b. Does your model show that the Yellow Team's robot travels *more than 1 foot* or *less than 1 foot* in 1 second? Explain.

c. Use your model to complete the sentences.

In 1 second, the Yellow Team's robot travels _____ foot.

The robot travels at a rate of _____ foot per second.

d. The Red Team, the Blue Team, and the Yellow Team race their robots. Which robot will win? Justify your answer.

DISCUSS IT

Ask: How can division help you write a rate?

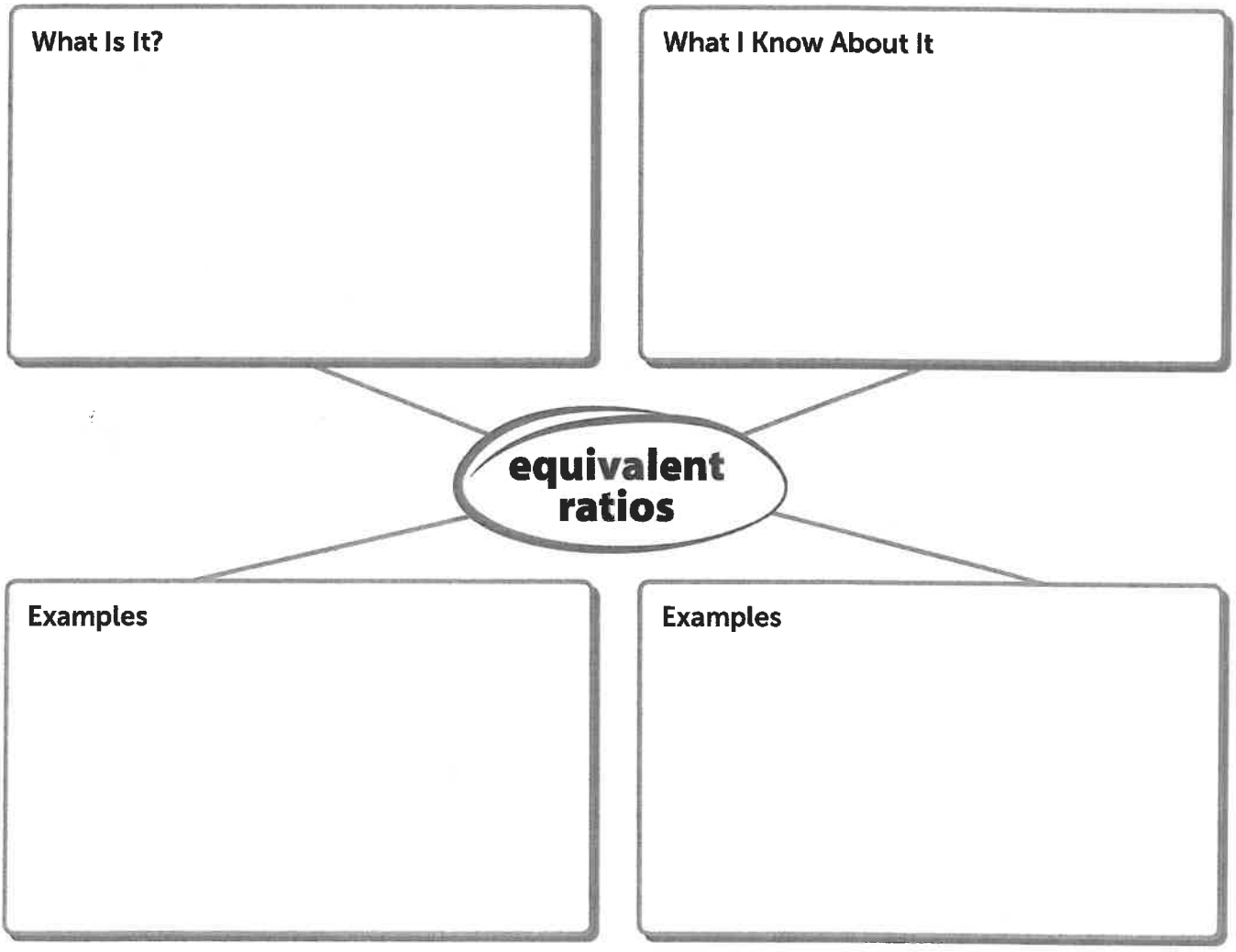
Share: A rate will include a fraction when . . .

4 **Reflect** How is writing a rate related to what you know about writing equivalent ratios?

 Name:

Prepare for Understanding Rate Concepts

1. Think about what you know about ratios. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can.

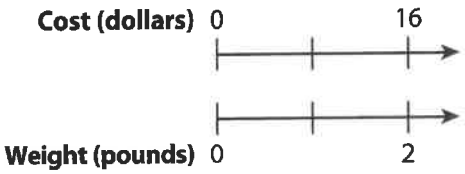


2. The ratio of minutes to gallons of water flowing through a garden hose is 2 to 12. Carlota says that an equivalent ratio of minutes to gallons is 6 to 1. Is Carlota correct? Explain how you know.

➤ **Complete problems 3–5.**

3 Three friends are buying food for an end-of-school party. Adrian spends $16 for 2 pounds of sliced turkey.

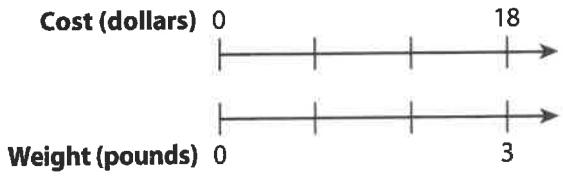
a. Complete the model to show the cost for 1 pound of turkey.



b. The turkey costs $ _____ per pound.

4 Gabriel spends $18 for 3 pounds of sliced cheese.

a. Complete the model to show how much the cheese costs per pound.

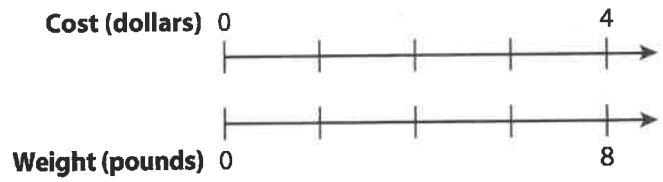


b. The cheese sells at a rate of $ _____ per pound.

c. How can you use the rates you found in problems 3b and 4b to tell whether turkey or cheese is less expensive per pound?

5 Jia spends $4 for 8 pounds of bananas.

a. Complete the model to show the cost of the bananas per pound.



b. The bananas sell at a rate of $ _____ per pound.

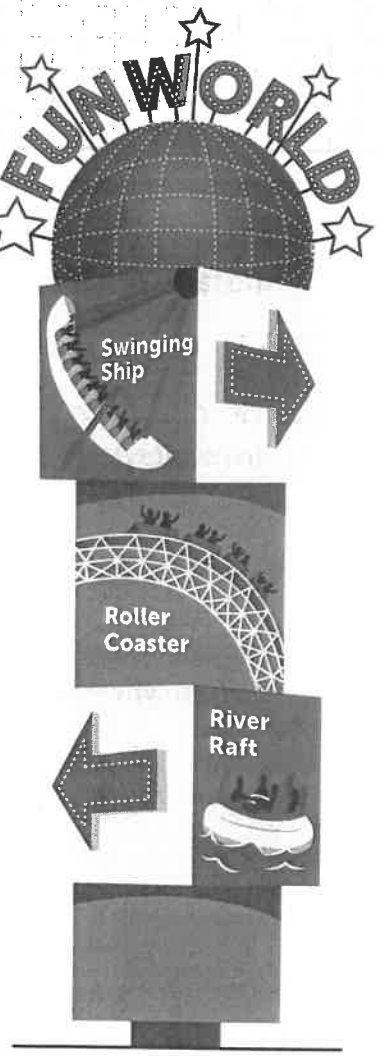
Vocabulary

rate
a ratio that tells the number of units of one quantity for 1 unit of another quantity.

per
for each or *for every*. The word *per* can be used to express a rate, such as $2 per pound.

UNDERSTAND: What are rates and what do they tell you?

Develop Understanding of Rate Concepts

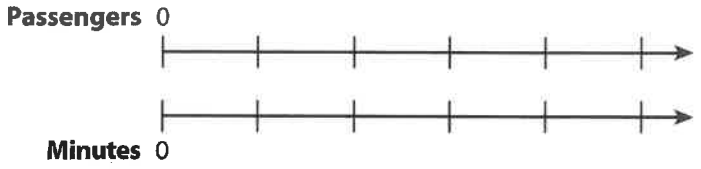


Model It: Compare Rates

➤ **Try these two problems involving rates.**

1. At a theme park, passengers are waiting in line for three rides.

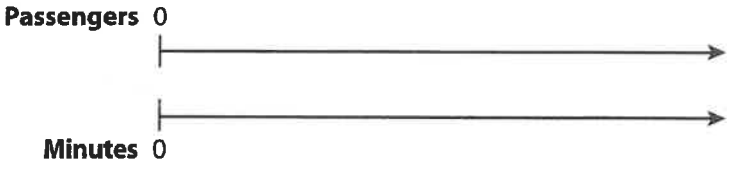
   a. The Roller Coaster can load 60 passengers every 5 minutes. Complete the model to show the rate at which passengers are loaded per minute.



   b. The loading rate is _____ passengers per minute.

   c. The Swinging Ship can load more passengers than the Roller Coaster in the same amount of time. Is the loading rate for the Swinging Ship faster or slower than the rate for the Roller Coaster?

2. **a.** Every 8 minutes, the River Raft can load 88 passengers. Complete the model to show the rate at which passengers are loaded per minute.



   b. The loading rate is _____ passengers per minute.

   c. Suppose the same number of passengers are in line for the Roller Coaster, the Swinging Ship, and the River Raft. If you want to get on a ride as quickly as possible, which line should you get in? Explain how you know.

DISCUSS IT

Ask: How can you determine whether the Swinging Ship or the River Raft has a faster loading rate?

Share: I think that a faster rate means . . .

Model It: Two Rates for a Ratio Relationship

➤ **Try this problem about rates.**

3 You can write two rates for any ratio relationship.

a. It takes Adriana 20 minutes to walk 5 blocks to the library. Complete the table of equivalent ratios to show Adriana's two rates.

Minutes	Blocks
20	5
1	
	1

b. Describe the rate that Adriana walks in *blocks per minute* and in *minutes per block*.

c. Adriana wants to know how many blocks she can walk in 45 minutes. Explain why she can use her rate in *blocks per minute* to find the answer.

DISCUSS IT

Ask: How does the table of equivalent ratios show two rates?

Share: I can write two rates for any ratio relationship by . . .

CONNECT IT

➤ **Complete the problems below.**

4 Suppose Adriana walks faster on her way home from the library. How will this change affect her rate in *blocks per minute*? Explain.

5 Use a model to show the snail's rate in *centimeters per minute* and its rate in *minutes per centimeter*. Describe each rate in words.

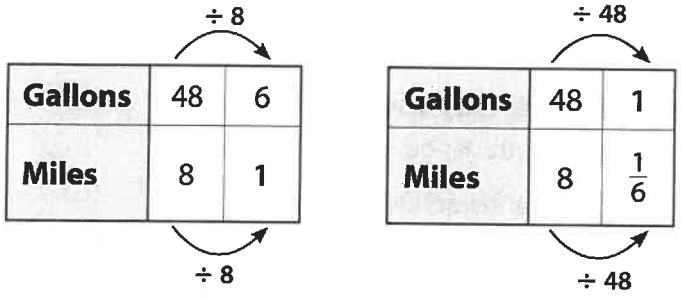
Practice Rate Concepts

Study how the Example shows writing two rates for a ratio relationship. Then solve problems 1–5.

Example

A train uses 48 gallons of fuel for every 8 miles it travels. Write the train's rate of fuel use in *gallons per mile* and in *miles per gallon*.

Write equivalent ratios that make comparisons to 1 unit.

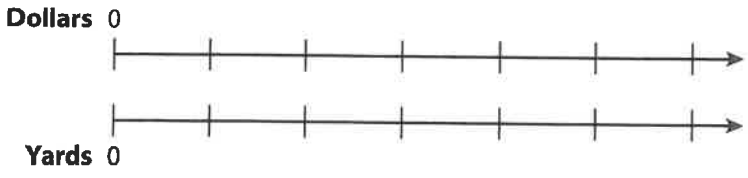


The ratio 6 to 1 shows that the train uses 6 gallons per mile.

The ratio $\frac{1}{6}$ to 1 shows that the train travels $\frac{1}{6}$ mile per gallon.

1. The Example shows how to use division to write equivalent ratios that make comparisons to 1 unit. How do you know what numbers to divide by?

2. Edward buys 6 yards of fabric for $15. He says that the fabric costs $0.40 per yard. Complete the model to show cost of fabric per yard. Do you agree with Edward? Explain.



Vocabulary

rate
a ratio that tells the number of units of one quantity for 1 unit of another quantity. Rates are often expressed using the word *per*, such as 5 miles per hour or 2 cups per serving.

per
for each or *for every*.

3 An elevator in the Seattle Space Needle can rise 100 meters in 50 seconds. Use a model to show the elevator's rate of travel in *meters per second* and in *seconds per meter*. Describe each rate in words.

The Space Needle is an observation tower in Seattle, Washington.

4 Zahara rides with her dad to her grandmother's house. They travel 159 miles in 3 hours. Her uncle, Jorge, drives there separately from his home.

a. At what speed does Zahara's dad drive, in miles per hour? Draw a model to show your work.

SOLUTION _____

b. Jorge's trip takes the same amount of time as Zahara's, but he travels a shorter distance. Does Jorge drive faster or slower than Zahara's dad?

5 A store changes the cost of a package of batteries. Now customers pay more money for the same number of batteries. Did the cost per battery increase, decrease, or stay the same? Explain how you know.