Lesson 7-5
Compare Proportional Relationships

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I can...
compare proportional relationships represented in different ways.

Solve & Discuss It!

Mei Li is going apple picking. She is choosing between two apple orchards. The cost of a basket of apples at each orchard is shown.

Which orchard should Mei Li choose? Explain.

Construct Arguments
What information provided can be used to support your answer?

Focus on math practices

Model with Math Which representation did you use to compare prices? Explain why.

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Essential Question How can you compare proportional relationships represented in different ways?

EXAMPLE 1 Compare Proportional Relationships Represented by Tables and Graphs

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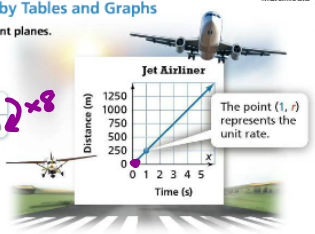
Meera is researching cruising speeds of different planes. Which airplane has a greater cruising speed?

Cessna 310

Time (min)	5	15	30	45	60
Distance (km)	40	120	240	360	480

×8



STEP 1 Find the cruising speed of the Cessna.

Distance (km)	40	120	240	360	480
Time (min)	5	15	30	45	60
Distance (km) / Time (min)	$\frac{40}{5}=8$	$\frac{120}{15}=8$	$\frac{240}{30}=8$	$\frac{360}{45}=8$	$\frac{480}{60}=8$

÷8

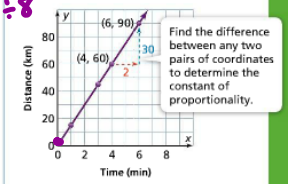
Find the constant of proportionality.

The Cessna has a cruising speed of 8 kilometers per minute.

$y = 8x$

$d = 8t$

STEP 2 Find the cruising speed of the Boeing 747.



Find the difference between any two pairs of coordinates to determine the constant of proportionality.

The Boeing 747 has a cruising speed of 15 kilometers per minute. The Boeing 747 has a greater cruising speed than the Cessna.

Try It!

The graph represents the rate at which Marlo makes origami birds for a craft fair. The equation $y = 2.5x$ represents the number of birds, y, Josh makes in x minutes. Who makes birds at a faster rate?

Convince Me! If you were to graph the data for Josh and Marlo on the same coordinate plane, how would the two lines compare?

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EXAMPLE 2 Compare Proportional Relationships Represented by Graphs and Equations

The graph on the right represents the rate at which Daniel earns points in his video game. The rate at which Brianna earns points in her video game is represented by the equation $y = 2x$, where y is the number of points and x is the time in minutes. At these rates, who will earn 100 points first?

Find Brianna's rate.

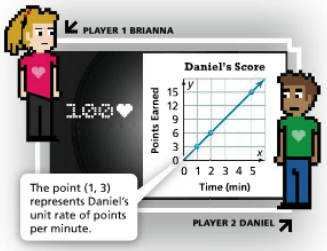
$y = 2x$

$y = 2(1)$ Substitute 1 for x to find the unit rate.

$y = 2$

Brianna earns 2 points per minute.

Daniel earns 3 points per minute.
Daniel will earn 100 points first.



EXAMPLE 3 Compare Proportional Relationships Represented by Graphs and Verbal Descriptions

The graph represents the cost per ounce of a granola cereal. A 15-ounce box of a raisin cereal costs $3.90. Which cereal costs more per ounce?

Use an equivalent ratio to find the cost per ounce of the raisin cereal.

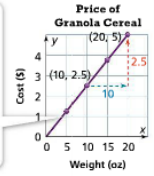
$\frac{\$3.90}{15 \text{ oz}} = \frac{\$0.26}{1 \text{ oz}}$

The raisin cereal costs $0.26 per ounce.
The granola cereal costs $0.25 per ounce.

The raisin cereal costs more per ounce.

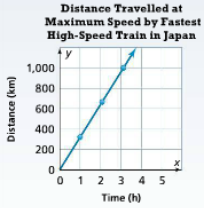
Find the difference between the coordinates of two sets of ordered pairs to determine the constant of proportionality:

$\frac{5-2.5}{20-10} = \frac{\$2.50}{10 \text{ oz}} = \frac{\$0.25}{1 \text{ oz}}$



Try It!

The distance covered by the fastest high-speed train in Japan traveling at maximum speed is represented on the graph. The fastest high-speed train in the United States traveling at maximum speed covers 600 kilometers in $2\frac{1}{2}$ hours. Which train has a greater maximum speed? Explain.



KEY CONCEPT

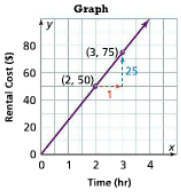
To compare proportional relationships represented in different ways, find the unit rate, or the constant of proportionality, for each representation.

The representations below show the rental cost per hour for canoes at three different shops.

Table

Rental Cost ($)	18	27	36	54
Time (hr)	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{2}$
Rental Cost ($) / Time (hr)	$\frac{18}{0.5} = 36$	$\frac{27}{0.75} = 36$	$\frac{36}{1} = 36$	$\frac{54}{1.5} = 36$

Graph



Equation

$c = 28t$

To find the unit cost, determine the value of c when $t = 1$.

Do You Understand?

1. **Essential Question** How can you compare proportional relationships represented in different ways?

2. How can you find the unit rate or constant of proportionality for a relationship represented in a graph?

3. **Generalize** Why can you use the constant of proportionality with any representation?

Do You Know How?

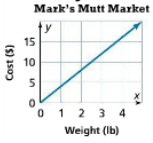
4. Amanda babysits and Petra does yard work on weekends. The graph relating Amanda's earnings to the number of hours she babysits passes through the points (0, 0) and (4, 24). The table below relates Petra's earnings to the number of hours she does yard work.

Petra's Earnings

Hours	3	6	9
Earnings ($)	15	30	45

Who earns more per hour?

5. Milo pays $3 per pound for dog food at Pat's Pet Palace. The graph below represents the cost per pound of food at Mark's Mutt Market. At which store will Milo pay a lower price per pound for dog food?



Name: _____

Practice & Problem Solving

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Leveled Practice For 6 and 7, complete the information to compare the rates.

6. Sam and Bobby want to know who cycled faster. The table shows the total miles Sam traveled over time. The graph shows the same relationship for Bobby. Who cycled faster?

Sam

Hours	2	3	4	5
Distance (miles)	20	30	40	50

Find the unit rate (constant of proportionality) for Sam.

$\frac{\text{distance}}{\text{time}} = \frac{20}{2} = 10$ $\frac{\text{miles}}{\text{hour}}$

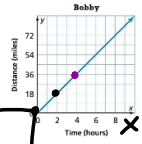
Find the unit rate (constant of proportionality) for Bobby.

Use (2, 18) and (4, 36) to find the constant of proportionality. → slope

The unit rate (constant of proportionality) is 9 $\frac{\text{miles}}{\text{hour}}$.

So Sam cycled faster. by 1 mph.

Bobby



$\frac{36+18}{4+2}$ $\frac{18}{2} = 9$

$\frac{20}{2}$ $\frac{30}{3}$ $\frac{40}{4}$ $\frac{50}{5}$

10 mph

Sam

(x, y)

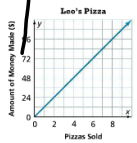
7. **Model with Math** The equation $y = 15x$ can be used to determine the amount of money, y, Pauli's Pizzeria makes by selling x pizzas. The graph shows the money Leo's Pizzeria takes in for different numbers of pizzas sold. Which pizzeria makes more money per pizza?

Pauli's Pizzeria takes in _____ per pizza.

Leo's Pizzeria takes in _____ per pizza.

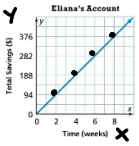
_____'s Pizzeria takes in more money per pizza.

Leo's Pizza



8. The graph shows the amount of savings over time in Eliana's account. Lana, meanwhile, puts $50 each week into her savings account. If they both begin with $0, who is saving at the greater rate?

Eliana's Account



Lana

x	y
0	0
1	50
2	100
3	150
4	200
5	250
6	300
7	350
8	400

$y = 50x$

x	y
2	94
4	188
6	282
8	376

9. **Make Sense and Persevere** Beth, Manuel, and Petra are collecting sponsors for a walk-a-thon. The equation $y = 20x$ represents the amount of money Beth raises for walking x miles. The table shows the relationship between the number of miles Manuel walks and the amount of money he will raise. Petra will earn $15 for each mile that she walks.

WALK-A-THON SPONSOR SHEET — RUN OR WALK

NAME: Manuel

MILES WALKED	MONEY RAISED
3	$45
5	$75
7	$105
9	$135

a. In order to compare the proportional relationships, what quantities should you use to find the unit rate?

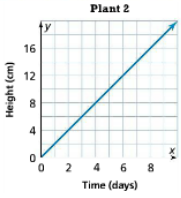
b. Compare the amount of money raised per mile by the three people.

10. **Higher Order Thinking** Winston compares the heights of two plants to see which plant grows more per day. The table shows the height of Plant 1, in centimeters, over 5 days. The graph shows the height of Plant 2, in centimeters, over 10 days. Winston says that since Plant 1 grows 6 cm per day and Plant 2 grows 4 cm per day, Plant 1 grows more per day.

Plant 1

Days	2	3	4	5
Height (cm)	6	9	12	15

Plant 2



a. Do you agree with Winston? Explain your response.

b. What error might Winston have made?

Assessment Practice

11. Ashton, Alexa, and Clara want to know who types the fastest. The equation $y = 39x$ models the rate at which Ashton can type, where y is the number of words typed and x is the time in minutes. The table shows the relationship between words typed and minutes for Alexa. The graph shows the same relationship for Clara. Who types the fastest?

Alexa's Typing Rate

Minutes	2	3	4	5
Words Typed	78	117	156	195

Clara's Typing Rate