| L | esson 10 Inderstand |
|--------|--|
| P | Proportional Relationships |
| | Prerequisite: How do you find equivalent ratios? |
| S e | tudy the example problem showing how to find quivalent ratios. Then solve problems 1–7. |
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| S | tudy the example problem showing how to find quivalent ratios. Then solve problems 1–7. Example There are 3 counselors assigned to a group of 24 campers. At this rate, how many counselors are needed for 40 campers? |



From the table you can see that 5 counselors are needed for 40 campers.

- Explain how to use the unit rate to make the table in the example.
- 2 One ordered pair from the table is plotted on the coordinate plane. Finish plotting the ordered pairs.



3 Suppose you had 9 counselors available. How many campers could you have?



Name:

Solve.

4 In 10 seconds, Jamal travels 550 feet on his bicycle. At this speed, how many feet can he travel in 1 minute? Explain.

5 Cala uses 2 pounds of Feed-All fertilizer for a 100-foot row of vegetables at her farm. At this rate, how many pounds of fertilizer would she use for a 450-foot row of vegetables? Explain.

6 The directions for Grow Better fertilizer say that the 25-pound bag covers a 1,000-foot row of vegetables. Which brand would Cala need more of to fertilize her vegetables? Explain.

Giselle has a catering business. There is a proportional relationship between the number of people and the amount of meat she uses for an event. The graph shows the amount of meat Giselle uses for 10 people. Find the amount of meat needed for 20, 30, 40, and 50 people. Finish labeling the graph and plotting ordered pairs. Finally, explain how to calculate the amount of meat needed for a party of 75 people.



Identify Proportional Relationships

Study the example showing one way to test whether a relationship is proportional. Then solve problems 1–7.

Example

The tables show the prices for ordering photo mugs from two different companies. You can use the information to write ratios showing the relationship between the cost and the corresponding number of mugs.

| Company | Α |
|---------|---|
|---------|---|

| Number of Mugs | | 5 | 10 | 25 | 50 | |
|---------------------------------|---------------------|-----------------|-----|------------------|-------------------|--|
| Cost (\$) | | 15 | 30 | 75 | 150 | |
| $\frac{15}{5} = 3$ | $\frac{30}{10} = 3$ | <u>75</u> 25 | = 3 | <u>150</u> 50 | $\frac{0}{0} = 3$ | |
| These ratios are all equivalent | | | | | | |

This relationship is proportional.

| Company B | | | | | | | | |
|---|----|----|----|-----|--|--|--|--|
| Number of Mugs | 5 | 10 | 25 | 50 | | | | |
| Cost (\$) | 20 | 35 | 80 | 155 | | | | |
| $\frac{20}{5} = 4 \ \frac{35}{10} = 3.5 \ \frac{80}{25} = 3.2 \ \frac{155}{50} = 3.1$ | | | | | | | | |
| These ratios are not all equivalent. | | | | | | | | |

This relationship is not proportional.

Explain how you can tell whether a group of ratios represents a proportional relationship.

- 2 Look at the ratios for Company A in the example. What is the constant of proportionality and what does it mean?
- 3 Write an equation to represent the relationship between the number of mugs and cost for Company A. Use *c* for cost and *m* for the number of mugs.
- 4 Complete the table to show a proportional relationship. Write the constant of proportionality.

| Number of Yoga Classes | 2 | 4 | 6 | 8 |
|------------------------|---|----|---|---|
| Cost (\$) | | 60 | | |

constant of proportionality: ____



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relationship.

Solve.

5 Plot a point for some of the ordered pairs from the example problem shown at the right. Model the relationships by drawing a line from the *y*-axis through each point. Explain how the graphs show which relationship is proportional and which is not proportional.

Company A: (5, 15), (10, 30), (25, 75) **Company B:** (5, 20), (10, 35), (25, 80)



6 Determine whether each equation below does or does not represent a proportional relationship. Support your answer using either a table or a graph.

Equation A: y = x

Equation B: y = x + 2

Zahra has paper rectangles of different sizes. Every rectangle is 5 centimeters longer than it is wide. Is there a proportional relationship between the lengths and widths of these rectangles? Explain.

Reason and Write

Study the example. Underline two parts that you think make it a particularly good answer and a helpful example.

Example

Describe a relationship involving some product or service and its cost that is NOT proportional. Explain how you know that it is not a proportional relationship.

Show your work. Use tables, graphs, words, and numbers to explain your answer.

Best Bike Rentals rents bikes by the day. The longer you rent the bike, the better their rate is. The table shows the cost of renting a bike for up to 7 days. The ratios of cost to days in this table are not equivalent because the relationship is not proportional.

| Number of Days | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|----------------|----|-----|-----|-----|-----|-----|-----|
| Cost (\$) | 60 | 100 | 130 | 150 | 170 | 180 | 190 |

For example, $\frac{60}{1} = 60$, $\frac{100}{2} = 50$, and $\frac{130}{3} = 43\frac{1}{3}$. These

three ratios are not equivalent. The rate of dollars per day is less the longer you keep the bike.

I can also plot the ordered pairs from the table on a coordinate grid.

The points cannot be connected with a straight line that goes through the origin. This is another way to show that the relationship is not proportional.



Where does the example . . .

- answer both parts of the problem?
- use a table or graph to explain?
- use numbers to explain?
- use words to explain?
- give details?

Solve the problem. Use what you learned from the model.

Describe a relationship involving some product or service and its cost that IS proportional. Explain why it is a proportional relationship, and identify the constant of proportionality.

Show your work. Use tables, graphs, words, and numbers to explain your answer.

Did you . . .

- answer both parts of the problem?
- use a table or graph to explain?
- use numbers to explain?
- use words to explain?
- give details?

