4 Minding Your Ps and Qs

Constant of Proportionality in Multiple Representations

WARM UP

Solve each equation.

1. $5p = 2.5$
2. $\frac{1}{3}j = 9$
3. $0.12k = 10.08$
4. $8k = 0$

LEARNING GOALS

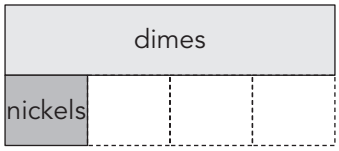
- Determine if relationships represented in words, tables, equations, or graphs are proportional.
- Interpret the meaning of linear proportional relationships represented in words, tables, equations, and graphs.
- Determine and interpret the constant of proportionality for quantities that are proportional and represented in words, tables, equations, and graphs.

You have learned how to determine the constant of proportionality. How can you solve problems using this constant in tables, graphs, and diagrams?

Penny's Nickels Are a Quarter of Her Dimes

Penny collects only nickels and dimes. She has one-quarter as many nickels as dimes.

A diagram can represent this problem situation.



All together she has 40 coins. How much money does she have?

1. **Explain how you can use the diagram to solve the problem. Determine the solution.**

2. **Write an equation to represent the proportional relationship between:**

   a. **the number of nickels and the number of dimes.**

   b. **the number of dimes and the total number of coins.**

   c. **the number of nickels and the total number of coins.**

3. **Identify the constant of proportionality in each proportional relationship described in Question 2.**

ACTIVITY
4.1

Using a Graph to Write an Equation

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The graph shows Natasha's total number of free throw attempts and the total number of free throws made.

1. **Explain how you know the graph represents a relationship that is proportional.**

2. **Determine the constant of proportionality and describe what it represents in this problem situation.**

3. **If Natasha attempted 30 free throws, how many would she probably make? First, use your graph to estimate the answer. Then, verify your answer by using an equation.**

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ACTIVITY 4.2

Using an Equation to Create a Table

Another example of a proportional relationship is the relationship between the number of hours a worker works and their wages earned in dollars.

The amount of money (m) Shaylah earns varies directly with the number of hours (h) she works. The equation describing this relationship is $m = 9.25h$.

1. What does the constant of proportionality represent in this situation?

2. Complete the table based on the equation given. Include the constant of proportionality in the table.

Hours Worked	Earnings (dollars)
0	
	112.85
40	

During the summer, Fernando works as a movie attendant. The number of hours he works varies each week.

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3. Write an equation to represent this situation. Then complete the table based on your equation and include the constant of proportionality.

Hours Worked	Earnings (dollars)
3	26.88

4. What is the constant of proportionality? What does it mean in this problem situation?

ACTIVITY
4.3 Using a Table to Create a Scenario

Analyze the given table.

Number of Windows	Amount of Window Cleaner (ounces)
0	0
2	16
3	24
4	32
5	40
6	48

1. **Describe one possible situation that could be represented by this table of values. Include how the quantities relate to each other.**

2. **What is the constant of proportionality and what does it represent in your situation?**

3. **If the table values were used to create a graph, how would the points appear?**

ACTIVITY
4.4

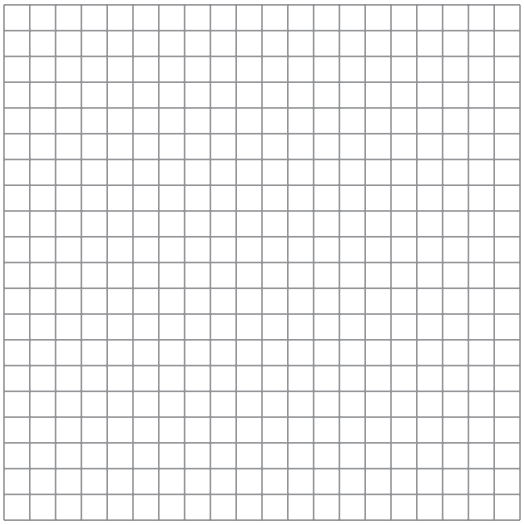
Using a Scenario to Write an Equation

A baby elephant nurses for the first two years of its life. It drinks about 10 liters of milk every day.

1. **Define variables and write an equation to represent the relationship between the amounts of milk the baby elephant consumes and the time it spends consuming the milk. Assume the elephant maintains the same rate of consumption.**

2. **Identify the constant of proportionality and describe what it means in this situation.**

3. **Create a graph to represent this situation.**

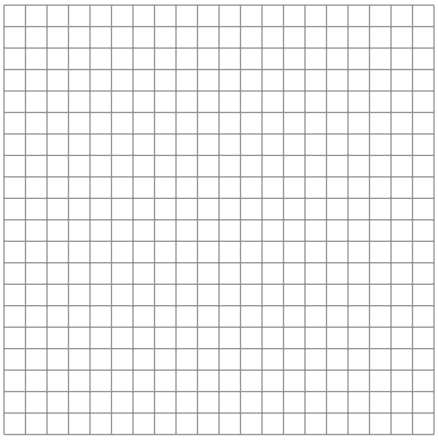


The weight of an object on Earth varies directly with the weight of an object on the Moon. A 150-pound object would weigh approximately 25 pounds on the Moon.

4. Define variables and write an equation to represent the relationship between the weight of an object on Earth and the weight of the object on the Moon.

5. Identify the constant of proportionality and describe what it means in this situation.

6. Create a graph to represent this situation.



ACTIVITY
4.5 Multiple Representations of Proportional Relationships

Suppose q varies directly with p.

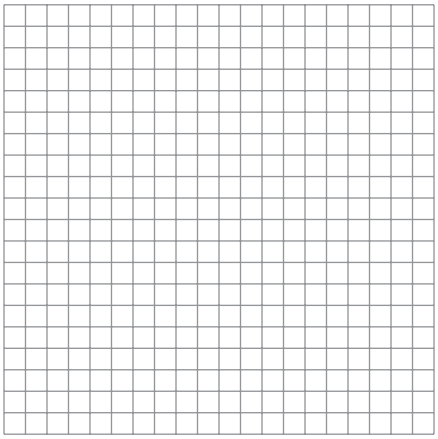
1. Complete the table for variables p and q.

p	q
0	
2	6
4	12
0.25	
	3
1.5	4.5

2. Write an equation that represents the relationship between p and q.

3. Summarize how you can write the equation that represents the relationship between two variables that vary directly if you are given a ratio table.

4. **Graph your equation. Label your axes.**



5. **Summarize how to draw a graph from the equation representing the relationship between two quantities that vary directly.**

6. **Summarize how you can write the equation representing the relationship between two quantities that vary directly if you are given a graph.**

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TALK the TALK

Every Which Way

You have seen how to represent proportional relationships in scenarios, on graphs, in tables, and with equations.

1. **Write an equation and sketch a graph to represent each relationship. Label your axes and identify the constant of proportionality on the graph.**

   a. **Suppose the quantity *p* varies directly with the quantity *q*.**

   b. **Suppose the quantity *q* varies directly with the quantity *p*.**

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2. **Write a scenario which describes a proportional relationship between two quantities. Represent this relationship using an equation, a graph, and a table. For each model, identify the constant of proportionality and explain how the model shows that the relationship is proportional.**