

Proportional and Nonproportional Relationships

ISG Interactive Study Guide

- See pages 105–106 for:
- Getting Started
 - Real-World Link
 - Notes

EQ Essential Question

How can you identify and represent proportional relationships?

CCSS Common Core State Standards

Content Standards
7.RP.2, 7.RP.2a, 7.RP.2b,
7.RP.2c

Mathematical Practices
1, 3, 4

ABC Vocabulary

proportional
constant of proportionality
nonproportional

What You'll Learn

- Identify proportional and nonproportional relationships in tables and graphs.
- Describe a proportional relationship using an equation.



Real-World Link

Dances A middle school student advisory council is planning a spring dance with a Glow-in-the-Dark theme. The “tickets” will be glow-in-the-dark wristbands. Students on the council found the cost of the wristbands from two companies. Proportions can be used to compare the costs.



Identify Proportional Relationships

Two quantities are **proportional** if they have a constant ratio or rate. The constant ratio is called the **constant of proportionality**.

$$\frac{\text{Total Cost (\$)}}{\text{Number of Wristbands}} = \frac{6}{4} = \frac{9}{6} = \frac{12}{8} = \frac{3}{2} \quad \frac{\text{Total Cost (\$)}}{\text{Number of Necklaces}} = \frac{6}{4} \neq \frac{10}{5} \neq \frac{15}{6}$$

The total cost is proportional to the number of wristbands purchased. The constant of proportionality is $\frac{3}{2}$. However, the rates for the necklaces are not constant. For relationships in which the ratios or rates are *not* constant, the two quantities are said to be **nonproportional**.

Example 1

Determine whether the cost of coffee is proportional to the number of pounds. If the relationship is proportional, identify the constant of proportionality. Explain your reasoning.

Write the rate of cost to pounds of coffee for each column in the table. Simplify each fraction.

$$\frac{3}{1} \quad \frac{6}{2} = \frac{3}{1} \quad \frac{9}{3} = \frac{3}{1} \quad \frac{12}{4} = \frac{3}{1} \quad \text{All the rates are equal.}$$

The rates are equal, so the cost is proportional to the number of pounds of coffee. The constant of proportionality is 3.

Coffee (pounds)	Cost (dollars)
1	3
2	6
3	9
4	12

Tutor



Got It? Do this problem to find out.

- Determine whether the number of legs are proportional to the number of spiders. If the relationship is proportional, identify the constant of proportionality. Explain your reasoning. **Yes; 8; each rate is equal to 8.**

Number of Spiders	1	2	3	4
Number of Legs	8	16	24	32



Example 2

Determine whether the distance is proportional to the time traveled. If the relationship is proportional, identify the constant of proportionality. Explain your reasoning.

Write the rate of distance to time for each hour in simplest form.

$$\frac{50}{1}, \quad \frac{70}{2} = \frac{35}{1}, \quad \frac{90}{3} = \frac{30}{1} \quad \text{The rates are not equal.}$$

The distance is *not* proportional to the time.

Time (hours)	Distance (miles)
1	50
2	70
3	90

Got It? Do this problem to find out.

2. Determine whether the number of ice cubes is proportional to the number of drinks. If the relationship is proportional, identify the constant of proportionality. Explain your reasoning.

Drinks	1	2	3
Ice Cubes	6	14	22

No; $\frac{6}{1}$, $\frac{14}{2}$, and $\frac{22}{3}$ are not equal.

Use Proportional Relationships

Proportional relationships can also be described using equations of the form $y = kx$, where k is the constant ratio or the constant of proportionality.

Constant of Proportionality

The constant of proportionality is also called the unit rate.

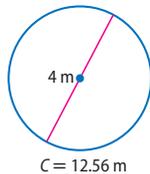


Example 3

A circle's circumference is proportional to its diameter. Use the figure to find the constant of proportionality. Then write an equation relating the circumference of the circle to its diameter. What is the circumference of a circle with a 6-inch diameter?

Find the constant of proportionality.

$$\frac{\text{circumference}}{\text{diameter}} = \frac{12.56}{4} \text{ or } 3.14$$



Words The circumference is about 3.14 times the diameter.

Variable Let C = circumference and d = diameter.

Equation $C = 3.14d$

$$C = 3.14d \quad \text{Write the equation.}$$

$$= 3.14(6) \quad \text{Replace } d \text{ with } 6.$$

$$= 18.84 \quad \text{Multiply.}$$

The circumference is about 18.84 inches.

Got It? Do this problem to find out.

2.88; $c = 2.88w$; \$11.52

3. The cost for $2\frac{1}{2}$ pounds of meat is \$7.20. Find the constant of proportionality. Then write an equation relating cost to pounds. How much will 4 pounds cost?