


Explore It!

A group of college students developed a solar-powered car and entered it in a race. The car travels at a constant speed of 100 meters per 4 seconds.



Lesson 7-7

Analyze Linear Equations: $y = mx$

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I can...
write equations to describe linear relationships.

A. What representation can show the distance the car will travel over time?

B. What expression can show the distance the car will travel over time?

C. Compare the representation and the expression. Which shows the distance traveled over time more clearly? Explain.

Focus on math practices

Be Precise How would the representation or expression change if the speed was converted to miles per minute?

433

Essential Question

How does slope relate to the equation for a proportional relationship?

INTERACTIVE ANSWERS

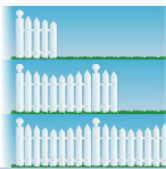
EXAMPLE 1

Relate Constant of Proportionality to Slope

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The students in Meg's class are building a fence around the class garden. How can they use the pricing for the different lengths of fencing to determine the cost for 50 feet of fencing?

Look for Relationships What is the relationship between the length of fencing and the cost?

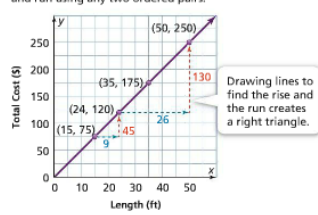


6 ft, \$30

15 ft, \$75

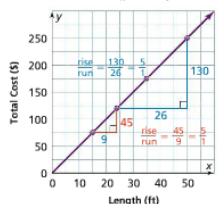
24 ft, \$120

STEP 1 Write the length and cost as an ordered pair. Graph the ordered pairs and find the rise and run using any two ordered pairs.



Drawing lines to find the rise and the run creates a right triangle.

STEP 2 Analyze the two right triangles. Notice that the ratios of the $\frac{\text{rise}}{\text{run}}$ are equivalent, so the slope of the line is constant. For any ordered pair (x, y) on the line the slope, m , is constant. That is, $\frac{y}{x} = m$ or $y = mx$.



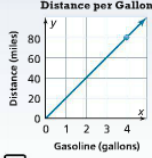
Meg and her classmates can use the equation $y = 5x$ to find the cost.
 $y = 5(50) = 250$, so 50 feet of fencing will cost \$250.

Try It! Write an equation to describe the relationship shown in the graph.

$\frac{\text{rise}}{\text{run}} = \frac{80 - \square}{\square - 3} = \square$. The equation of the line is $y = \square x$.

Convince Me! How do the equations $y = mx$ and $y = kx$ compare?

Distance per Gallon



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434 7-7 Analyze Linear Equations: $y = mx$

EXAMPLE 2 Write a Linear Equation from Two Points

A drone descends into a mining cave. The graph relates its distance below ground to time. Write an equation that describes the relationship.

STEP 1 Find the slope of the line.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{-750 - (-500)}{3 - 2}$$

$$= \frac{-250}{1}$$

$$= -250$$

Substitute the coordinates.

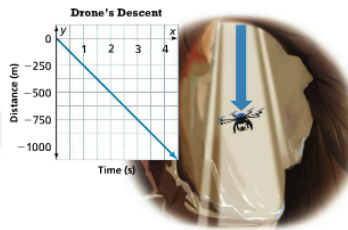
The slope is -250 . The drone descends 250 meters per second.

STEP 2 Write the equation of the line.

$$y = mx$$

$$y = -250x$$

The equation of the line describing the drone's distance over time is $y = -250x$.



Generalize Lines that slant upward from left to right have **positive** slopes. Lines that slant downward from left to right have **negative** slopes.

EXAMPLE 3 Graph an Equation of the Form $y = mx$

A recipe for trail mix calls for 1 cup of raisins for every 2 cups of granola. Write an equation that describes the relationship between raisins and granola. Graph the line.

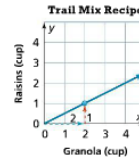
STEP 1 Find the equation of the line.

$$y = mx$$

$$y = \frac{1}{2}x$$

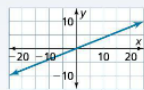
Substitute $\frac{1}{2}$ for m .

STEP 2 Graph the line by plotting the point $(0, 0)$ and using the slope to plot another point.

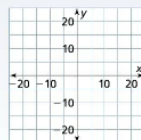


Try It!

a. Write the equation of the line.



b. Graph the line $y = -3x$.

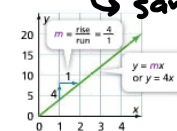


KEY CONCEPT

The equation for a proportional relationship is $y = mx$ where m represents the slope of the line.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$y = kx$
 constant of proportionality
 same as slope (m)



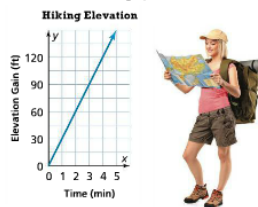
Do You Understand?

- Essential Question** How does slope relate to the equation for a proportional relationship?
- Look for Relationships** What do the graphs of lines in the form $y = mx$ have in common? How might they differ?
- Use Structure** The table below shows the distance a train traveled over time. How can you determine the equation that represents this relationship?

Time (s)	Distance (m)
2	25
4	50
6	75
8	100

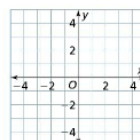
Do You Know How?

- The relationship between a hiker's elevation and time is shown in the graph.



- Find the constant of proportionality of the line. Then find the slope of the line.
- Write the equation of the line.

- Graph the equation $y = \frac{1}{2}x$.



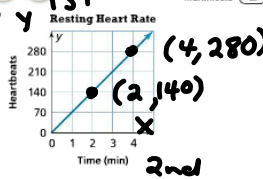
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Practice & Problem Solving



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6. Leveled Practice Resting heart rate is a measure of how fast the heart beats when a person is not performing physical activity. The graph shows the number of heartbeats over time for a given person.



- a. Use two sets of coordinates to write an equation to describe the relationship.

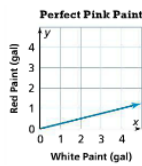
$$m = \frac{280 - 140}{4 - 2} = \frac{140}{2}$$

$$y = 70$$

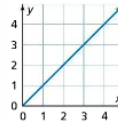
- b. Interpret the equation in words.

The heart's resting heart rate is 70 beats each minute.

7. Model with Math The graph relates the number of gallons of white paint to the number of gallons of red paint Jess used to make the perfect pink.

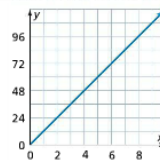


8. Critique Reasoning Franco made this graph to show the equation $y = -x$. Is the graph correct? Explain.

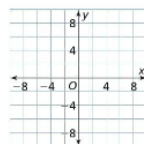


9. The graph shows a proportional relationship between the variables x and y .

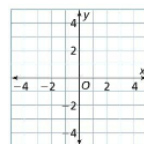
- a. Write an equation to model the relationship.
 b. Reasoning Explain how you know if an equation or a graph represents a proportional relationship.



10. Model with Math Graph the equation $y = -5x$ on the coordinate plane.



11. Graph the equation $y = \frac{3}{5}x$ on the coordinate plane.



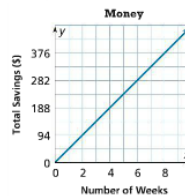
12. Higher Order Thinking A movie theater sends out a coupon for 70% off the price of a ticket.

- a. Write an equation for the situation, where y is the price of the ticket with the coupon and x is the original price.
 b. Graph the equation and explain why the line should only be in the first quadrant.



Assessment Practice

13. The graph shows a proportional relationship between a person's total savings in dollars and the number of weeks they have been saving. Write an equation that models the savings.



14. Car X travels 186 miles in 3 hours.

- a. Write the equation of the line that describes the relationship between distance and time.
 b. Which graph represents the relationship between distance and time for Car X? Explain.

