

LESSON 5

Objective

Construct a function to model a linear relationship.

Common Core State Standards

- **8.F.4** Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

Functions

Constructing Functions

In this activity, students have the opportunity to write the equation of a line that is graphed using problem-based data. This activity can be used as a quick review of rate of change and y-intercept, as well as of linearity.

Try It! Perform the Try It! activity on the next page.

Talk About It

Discuss the Try It! activity.

- **Ask:** What is the value of y for $x = 0$? Why?
- **Ask:** Do you find it easier to determine the rate of change of a line from a table of values or from a graph? Explain.
- **Ask:** How do you know for sure that the equation is $y = \frac{4}{3}x$?

Solve It

Reread the problem with students. After students have graphed the coordinate pairs and determined the equation, have them substitute values for y . **Ask:** Day camp costs \$36. How much of this fee will Joe pay, and how much will his grandfather pay?

More Ideas

For other ways to teach about constructing functions to model linear relationships—

- Have students use Algeblocks® sets to represent various linear and nonlinear relationships and write equations from the representations.
- Extend the activity to include a constant by giving students the points $(0, 2)$, $(3, 4)$, and $(6, 6)$ and challenging them to graph the points and write the equation of the line.

Formative Assessment

Have students try the following problem.

Jaimie is participating in a fundraiser for school. For every 5 magazines she sells, her mother will purchase 2. Write an equation to represent Jaimie's total magazine sales.

A. $y = 5x + 2$

B. $y = \frac{5}{2}x$

C. $y = \frac{7}{5}x$

D. $y = 2x + 5$

Try It!

20 minutes | Pairs

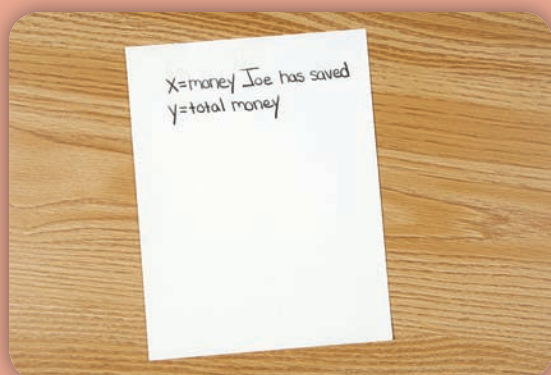
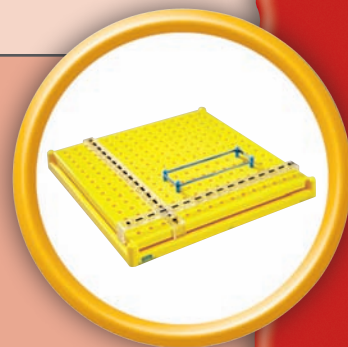
Here is a problem about constructing a function to model a linear relationship.

Joe wants to save money so that he can go to day camp this summer. His grandfather promises him that for every \$3 he saves, he'll give him a dollar. Construct a model for the total amount of money Joe has for camp as a function of the amount he saves.

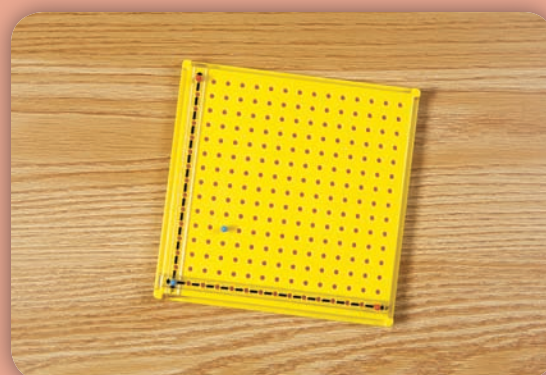
Introduce the problem. Then have students do the activity to solve the problem. Distribute the materials.

Materials

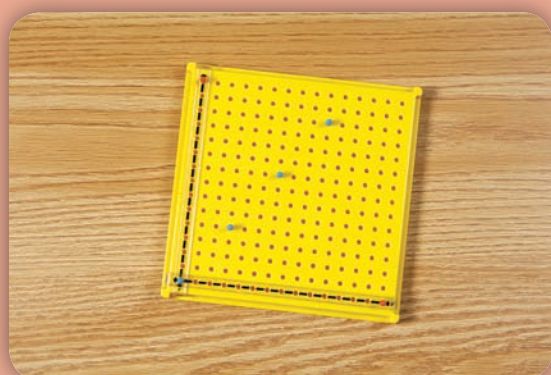
- XY Coordinate Pegboard



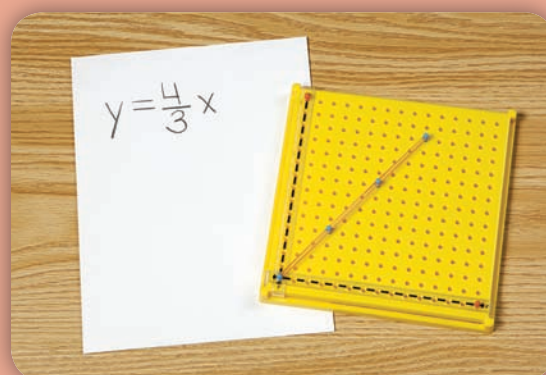
1. Discuss with students how to set up their graphs. **Say:** The x-axis will represent how much money Joe has saved, and the y-axis will represent the total amount of money he has, including the money his grandfather gives him.



2. Ask: At which coordinate pair should the graph begin? Elicit from students that the graph should start at (0, 0), because if Joe doesn't save any money, he won't receive any from his grandfather. **Ask:** How much money will Joe have if he saves \$3? After students have stated their answer, have them peg the coordinate (3, 4).



3. Say: Determine the rate of change based on the two coordinate pairs. Make sure students see that the rate is "up 4, over 3." **Ask:** How much should each peg be worth on the x-axis? On the y-axis? Make sure students understand that each peg should be worth \$3 on the x-axis and \$4 on the y-axis. Have students peg an additional ordered pair.



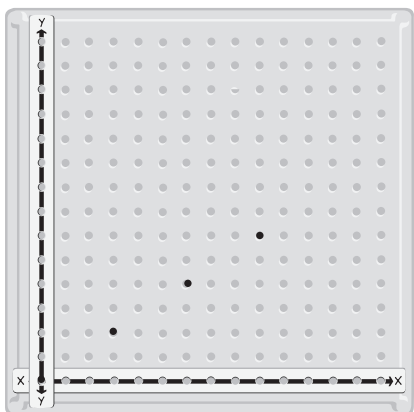
4. Have students write the equation of the line they formed.

$$y = \frac{4}{3}x$$

Use an XY Coordinate Pegboard to model the line determined by the points shown on the grid. Write the equation for the line. Answer each question.

(Check students' work.)

1.



equation: $y = \frac{2}{3}x$

What is the ordered pair for the point on the line when $x = 30$? $(30, 20)$

What is the ordered pair for the point on the line when $x = 90$? $(90, 60)$

Using an XY Coordinate Pegboard, model the line determined by the ordered pairs given. Write an equation for the line. Answer each question.

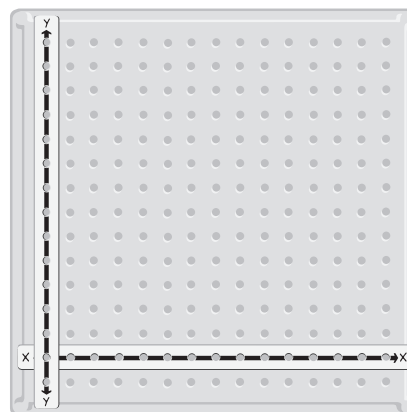
(Check students' models.)

2. $(0, 2)$, $(1, 6)$, and $(3, 14)$

equation: $y = 4x + 2$

What is the ordered pair for the point on the line when $x = 2$? $(2, 10)$

What is the ordered pair for the point on the line when $x = 6$? $(6, 26)$



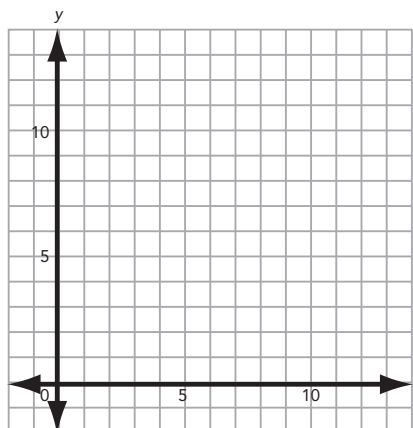
Graph the line that passes through the given points. Write the equation of the line. Answer each question.

3. $(0, 1)$, $(2, 2)$, and $(4, 3)$

equation: $y = \frac{1}{2}x + 1$

What is the ordered pair for the point on the line when $x = 6$? $(6, 4)$

What is the ordered pair for the point on the line when $x = 20$? $(20, 11)$



Answer Key

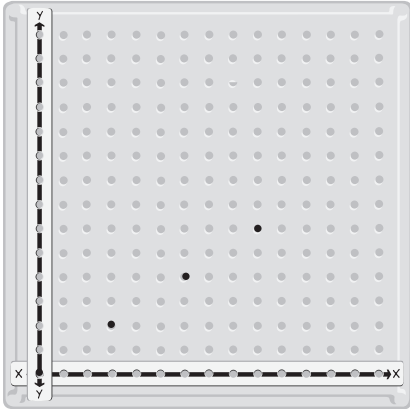
Challenge! What information do you need to write the equation for a line? After you have the equation, how can you find additional points on the line when given a value for x ?

Challenge: (Sample) To write the equation of the line you need the rate of change and the y-intercept. After you have the equation, substitute a value in for x and solve for y .

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Use an XY Coordinate Pegboard to model the line determined by the points shown on the grid. Write the equation for the line. Answer each question.

1.



equation: _____

What is the ordered pair for the point on the line when $x = 30$? _____

What is the ordered pair for the point on the line when $x = 90$? _____

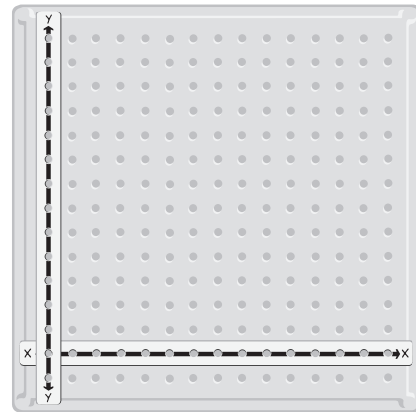
Using an XY Coordinate Pegboard, model the line determined by the ordered pairs given. Write an equation for the line. Answer each question.

2. (0, 2), (1, 6), and (3, 14)

equation: _____

What is the ordered pair for the point on the line when $x = 2$? _____

What is the ordered pair for the point on the line when $x = 6$? _____



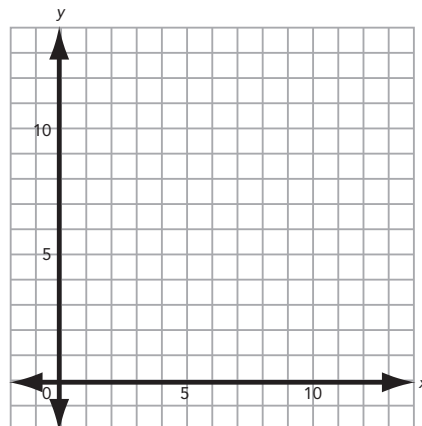
Graph the line that passes through the given points. Write the equation of the line. Answer each question.

3. (0, 1), (2, 2), and (4, 3)

equation: _____

What is the ordered pair for the point on the line when $x = 6$? _____

What is the ordered pair for the point on the line when $x = 20$? _____



Challenge! What information do you need to write the equation for a line? After you have the equation, how can you find additional points on the line when given a value for x ?

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