

Essential Question How do linear models help you to make a prediction?

Scan for Multimedia

EXAMPLE 1

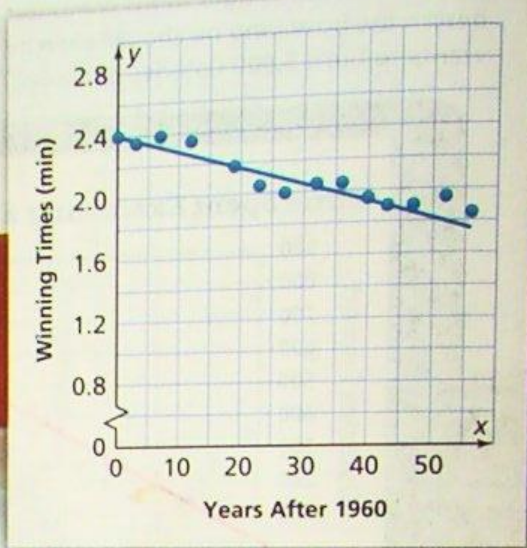
Use the Slope to Make a Prediction

Michaela is a speed skater and hopes to compete in future Olympic games. She researched the winning times of the past 50 years. If the trend in faster speeds continues at the same rate, how can she use the information to predict what might be the time to beat in 2026?



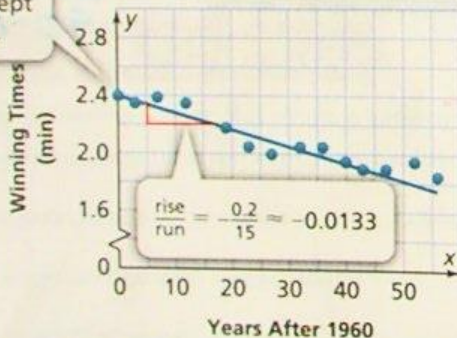
Make Sense and Persevere

What relationship might there be between the two measurements? **MP.1**



STEP 1 Write an equation for the trend line.

The y-intercept is about 2.4.



The equation of the trend line is $y = -0.0133x + 2.4$.

STEP 2 Use the equation of the trend line to predict what might be the winning time in 2026.

$$\begin{aligned} y &= -0.0133x + 2.4 \\ &= -0.0133(66) + 2.4 \\ &= -0.8778 + 2.4 \\ &= 1.5222 \end{aligned}$$

If the trend in faster times continues at the same rate, Michaela should target about 1.5222 minutes, or 1 minute 30 seconds.

Try It! $m: \frac{15-18}{0-10} = \frac{-3}{-10} = 0.3$

Assuming the trend shown in the graph continues, use the equation of the trend line to predict average fuel consumption in miles per gallon in 2025.

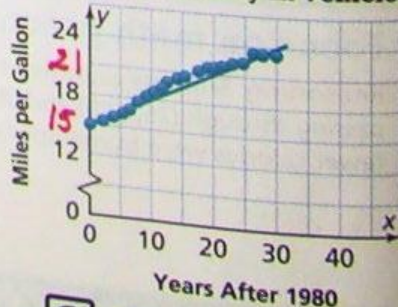
The equation of the trend line is $y = 0.3x + 15$. In 2025,

the average fuel consumption is predicted to be about **28.5** mpg.

Convince Me! Why can you use a linear model to predict the y-value for a given x-value?

$x = 45, y = 0.3(45) + 15$
 $y = 28.5$

Fuel Economy in Vehicles



EXAMPLE 2



Use a Scatter Plot to Make a Prediction

The scatter plot shows the relationship between the number of people at a water park and the temperature. About how many people should the owners of the park expect at the water park when the outside temperature is 90°F?

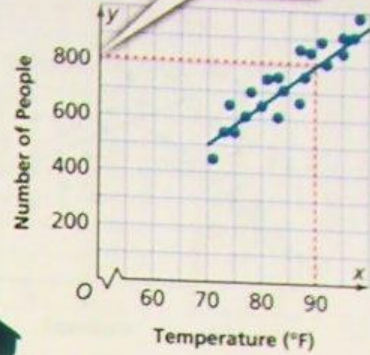
Find the y-value for an x-value of 90.

The park owners should expect about 800 people at the water park when the outside temperature is 90°F.



(Use the graph)

You can approximate the y-value since this is an estimated value.



EXAMPLE 3



Interpret the Slope and y-intercept

The scatter plot at the right suggests a linear relationship between the temperature and the number of smoothies purchased, in thousands.

A. What does the rate of change, or slope, represent in this situation?

The rate of change, or slope, describes the number of smoothies purchased for each 1 degree of temperature increase.

B. What does the y-intercept of the line represent in this situation?

The y-intercept represents the number of smoothies sold when the temperature is 0°F.

C. What equation relates the temperature, x , and the number of people who buy a smoothie, y ?

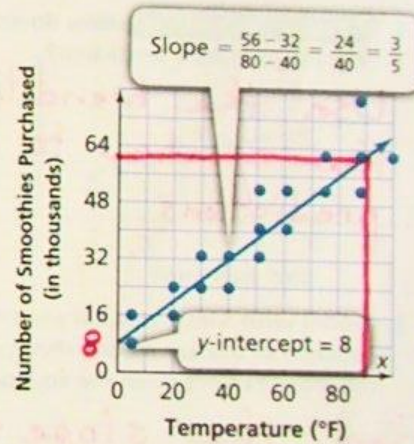
Find the slope. Two points on the graph of the trend line are (40, 32) and (80, 56).

$$y = \frac{3}{5}x + 8$$

$$y = 0.6x + 8$$

$$y = 0.6(90) + 8$$

$$y = 62 \text{ so } \boxed{62000}$$



Try It!

A smoothie café has the ingredients needed to make 50,000 smoothies on a day when the high temperature is expected to reach 90°F. Should the café employees expect to have enough ingredients for the day's smoothie sales? Explain.

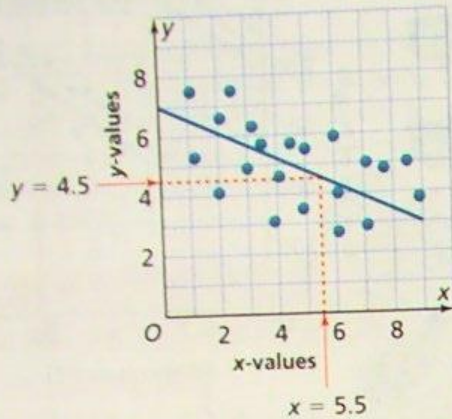
They'd run out of ingredients



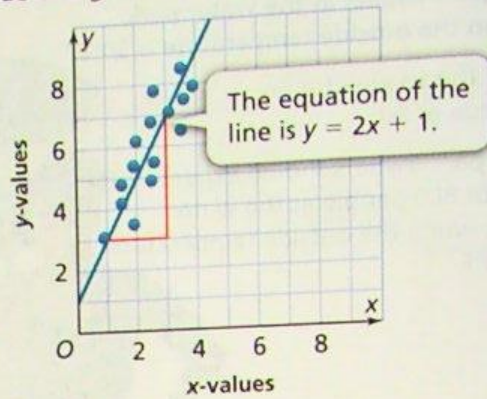


Scatter plots can be used to make predictions about current or future trends.

Look for the corresponding y-value for a given x-value.



Find the equation of the trend line and find the y-value of a given x-value.



Do You Understand?

- Essential Question** How do linear models help you to make a prediction?

Use the trend line and/or the equation to make predictions

- Model with Math** How do you find the equation of a linear model when you are given the graph but not given the equation? **MP.4**

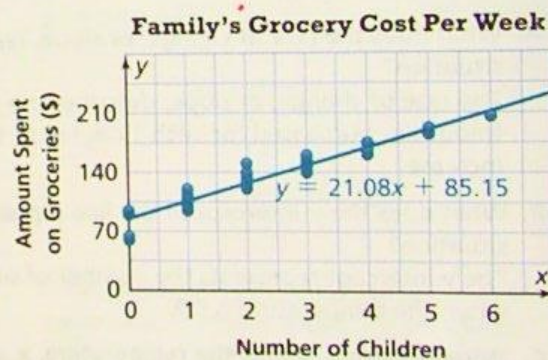
Find the slope & y-int. and use $y = mx + b$.

- Reasoning** Can the linear model for a set of data that is presented in a scatter plot always be used to make a prediction about any x-value? Explain. **MP.2**

Sometimes the x-values don't make sense. IE: Negative time or outside temp being 200°F

Do You Know How?

- The graph shows a family's grocery expenses based on the number of children in the family.



- Using the slope, predict the difference in the amount spent on groceries between a family with five children and a family with two children.

x = 2, Find y

x = 5, Find y

- How many children can you predict a family has if the amount spent on groceries per week is \$169.47?

y = 169.47, Find x



Practice & Problem Solving



5. Leveled Practice The scatter plot shows the number of people at a fair based on the outside temperature. How many fewer people would be predicted to be at the fair on a 100°F day than on a 75°F day?

(50, 14)
(100, 6)

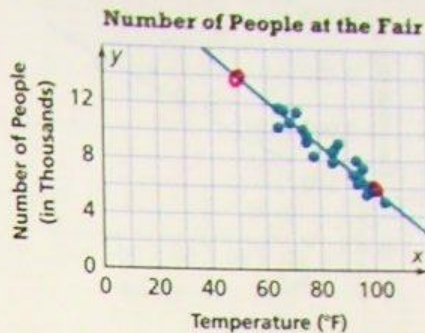
The slope is

For each degree that the outside temperature increases, the fair attendance decreases by thousand people.

The difference between 75°F and 100°F is °F.

$-0.16 \cdot \text{} = \text{}$

About thousand fewer people are predicted to be at the fair on a 100°F day than on a 75°F day.



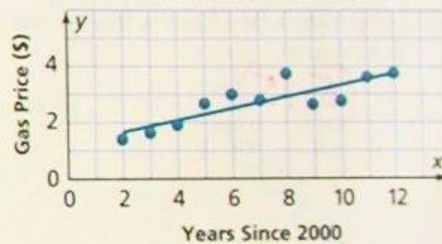
6. Make Sense and Persevere If x represents the number of years since 2000 and y represents the gas price, predict what the difference between the gas prices in 2013 and 2001 is?

~~Round to the nearest hundredth.~~ © MP.1

Use the graph.
(like example 2)



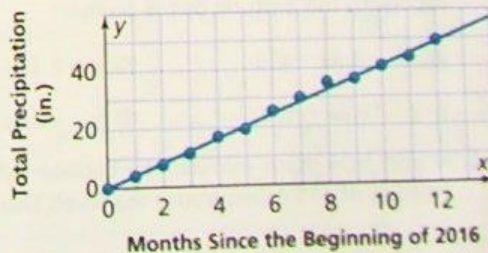
Massachusetts' Gas Price



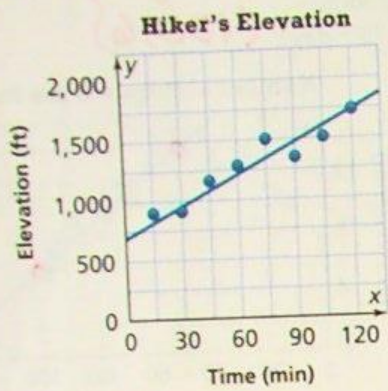
7. Make Sense and Persevere If x represents the number of months since the beginning of 2016, and y represents the total precipitation to date, predict the amount of precipitation received between the end of March and the end of June. © MP.1

Use an equation
16
13

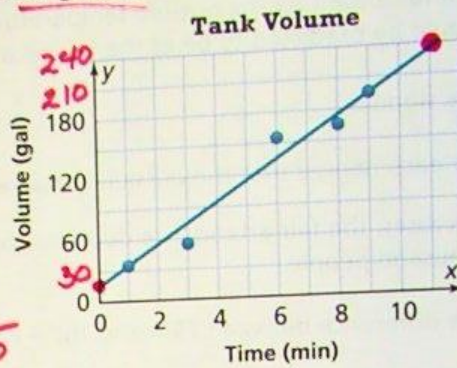
City Annual Precipitation in 2016



The scatter plot shows a hiker's elevation above sea level over time. The equation of the trend line shown is $y = 8.77x + 686$. To the nearest whole number, predict what the hiker's elevation will be after 145 minutes.



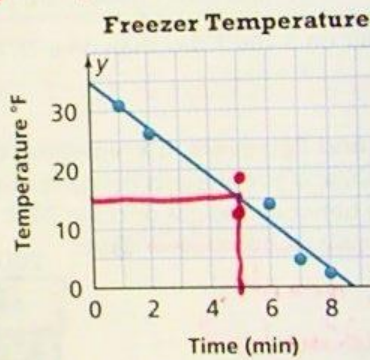
9. *Use an equation* **Make Sense and Persevere** The graph shows the number of gallons of water in a large tank as it is being filled. Based on the trend line, predict how long it will take to fill the tank with 375 gallons of water. **MP.1**



$b = 15$
 $(0, 15)$
 $(11, 240)$

10. **Higher Order Thinking** The graph shows the temperature, y , in a freezer x minutes after it was turned on. Five minutes after being turned on, the temperature was actually three degrees from what the trend line shows. What values could the actual temperature be after the freezer was on for five minutes?

$(5, 15)$



Assessment Practice

The graph shows the altitude above sea level of a weather balloon over time. The trend line passes through the points $(0, 453)$ and $(10, 359)$.

11. Which of these is a trend line for the data set shown? Use x to represent the number of minutes and y to represent the altitude of the balloon.
- Ⓐ $y = -9.4x - 453$ Ⓒ $y = 9.4x - 453$
 Ⓑ $y = 18.8x + 453$ Ⓓ $y = -9.4x + 453$
12. Predict how many minutes the balloon will take to be at an altitude of 415.4 feet above sea level. Show your work.

