Scatter Plots

> **MINI Lab**

Measure a partner's height in inches. Then ask your partner to stand with his or her arms extended parallel to the floor. Measure the distance from the end of the longest finger on one hand to the longest finger on the other hand. Write these measures as the ordered pair (height, arm span) on the board.

1. Graph each of the ordered pairs listed on the board.

2. Examine the graph. Do you think there is a relationship between height and arm span? Explain.

A **scatter plot** is a graph that shows the relationship, if any relationship exists, between two sets of data. In this type of graph, two sets of data are graphed as ordered pairs on a coordinate plane. Scatter plots often show a pattern, trend, or relationship between the variables.
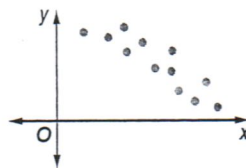
Types of Relationships   **Concept Summary**
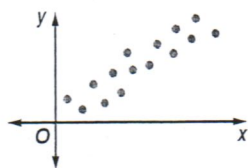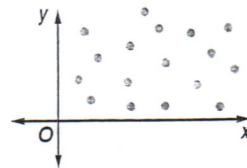
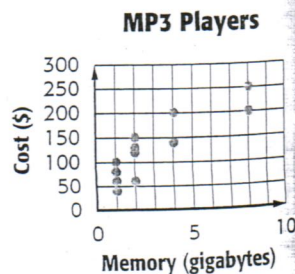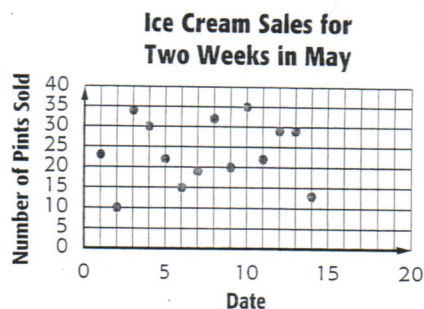| Positive Relationship	Negative Relationship	No Relationship
As x increases, y increases.	As x increases, y decreases.	No obvious pattern

EXAMPLES Identify a Relationship

1. Explain whether the scatter plot of the data for the amount of memory in an MP3 player and the cost shows a *positive*, *negative*, or *no* relationship.

As the amount of memory increases, the cost increases. Therefore, the scatter plot shows a positive relationship.

MP3 Players

② Explain whether the scatter plot of the date in May and the number of pints of ice cream sold show a *positive*, *negative*, or *no* relationship.

Ice Cream Sales for Two Weeks in May

Ice cream sales do not depend on the date. Therefore, the scatter plot shows no relationship.

✓ **CHECK Your Progress**

a. Explain whether the scatter plot of the data for time and temperature shows a *positive*, *negative*, or *no* relationship.
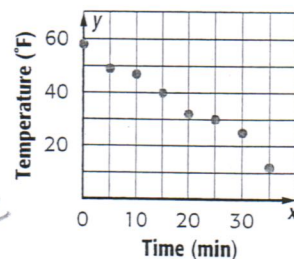
ans → it has neg slope so negative correlation

why → as time increases temperature decreases

A **line of fit** is a line that is very close to most of the data points.

CITY MPG **34**   HIGHWAY MPG **39**
Fuel Economy Information

EXAMPLES Line of Fit

CARS The MPG ratings for a certain car company are given.

Engine Size	1.8	2	2.2	2.4	2.4	2.4	3.4	3.4	3.5	3.6	3.8	3.9	5.3
MPG	29	22	24	20	24	23	19	19	20	20	19	17	18

③ Make a scatter plot using the data. Then draw a line that best seems to represent the data.

Graph each of the data points. Draw a line that fits the data.

Fuel Economy Values, 2007
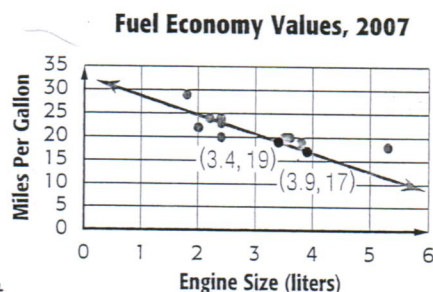
④ Write an equation for this line of fit.

The line passes through points at (3.9, 17) and (3.4, 19). Use these points to find the slope, or rate of change, of the line.

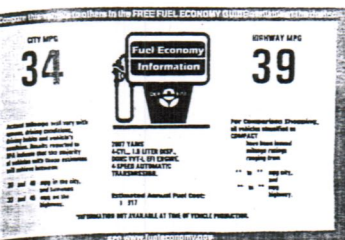$$m = \frac{y_2 - y_1}{x_2 - x_1}$$ Definition of slope

$$m = \frac{19 - 17}{3.4 - 3.9}$$ $(x_1, y_1) = (3.9, 17)$, $(x_2, y_2) = (3.4, 19)$

$$m = \frac{2}{-0.5} \text{ or } -4$$ The slope is -4, and the y-intercept is 35.

The y-intercept is 35 because the line of fit crosses the y-axis at about the point (0, 35).

$y = mx + b$ Slope-intercept form

$y = -4x + 35$ The equation for the line of fit is $y = -4x + 35$.

⑤ Use the equation to predict the MPG for a 5.5-liter engine.

$y = -4x + 35$ Equation for the line of fit

$y = -4(5.5) + 35$ or 13   The MPG will be about 13.

✓ CHECK Your Progress

EDUCATION The approximate numbers of high school graduates in Texas over a 10-year period are shown in the table.

Graduating Class	Number of Graduates	Graduating Class	Number of Graduates
1994	163,000	1999	203,000
1995	169,000	2000	213,000
1996	172,000	2001	215,000
1997	182,000	2002	225,000
1998	197,000	2003	238,000

Source: Texas Education Agency
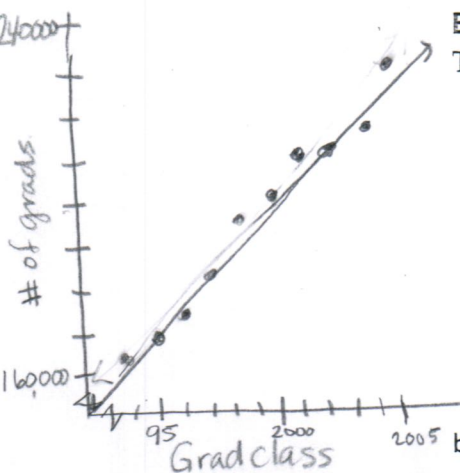
b. Make a scatter plot of the data. Then draw a line that represents the data.

c. Write an equation for a line of fit. *(my years are from (1990 (is my zero figure))*

d. Use the equation to predict the number of graduates for the graduating class of 2015.

[Handwritten work:]

(5, 169000) (11, 215000)

$m = \dfrac{215000 - 169000}{11 - 5} = \dfrac{46000}{8}$

$m = 5750$

$169000 = 5750(5) + b$

$140,250 = b$

$y = 5750x + 140500$
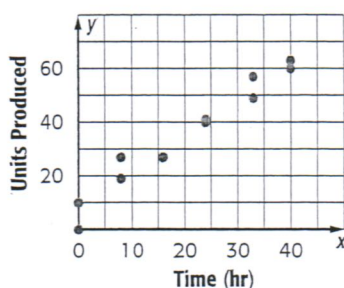
$y = 5750(25) + 140500$

$y = 284,500$

✓ CHECK Your Understanding

Examples 1, 2
(pp. 510–511)

Explain whether the scatter plot of the data for each of the following shows a *positive*, *negative*, or *no* relationship.

1.

2.
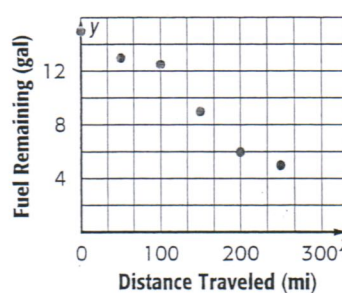
Examples 3–5
(pp. 511–512)

NUTRITION For Exercises 3–5, use the table.

Fast Food Nutritional Information												
Sandwich	A	B	C	D	E	F	G	H	I	J	K	L
Fat (grams)	21	10	14	21	30	34	32	37	27	26	18	7
Calories	490	280	330	430	530	590	540	590	550	470	450	340

3. Draw a scatter plot for the data and draw a line of fit.

4. Write an equation for the line of fit.

5. Estimate the number of grams of fat in a sandwich with 350 calories.
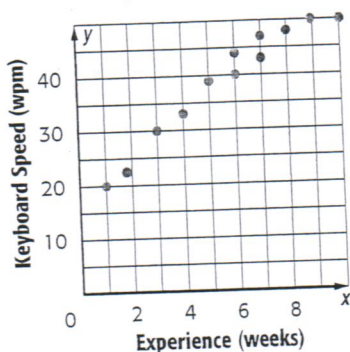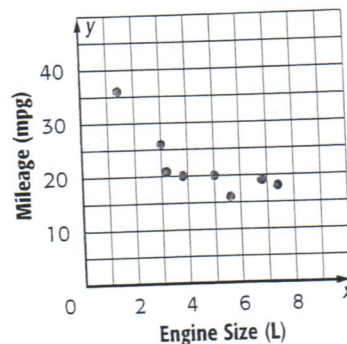
Explain whether the scatter plot of the data for each of the following shows a *positive*, *negative*, or *no* relationship.
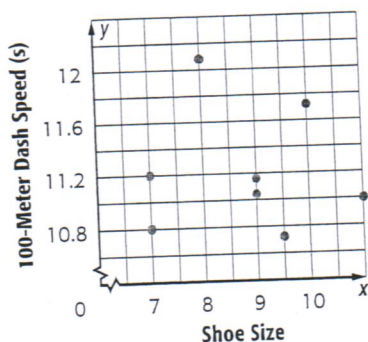
6.
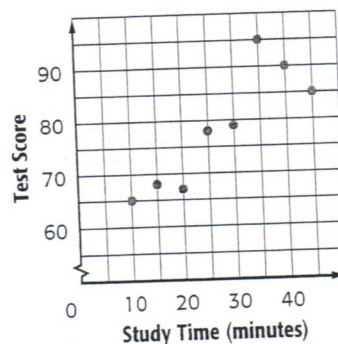

7.

8.

9.

BUSINESS For Exercises 10–12, use the following information. The results of a survey about women's shoe sizes and heights are shown.

10. Draw a scatter plot for the data. Then draw a line of fit.

11. Write an equation for the line of fit.

12. Use your equation to estimate the height of a female who wears a size 5 shoe.

Height (inches) and Shoe Size

Shoe Size	8	8	$7\frac{1}{2}$	7	7	10	7	9	9	9
Height	66	65	65	62	61	70	62	65	65	68
Shoe Size	$6\frac{1}{2}$	9	$6\frac{1}{2}$	7	$5\frac{1}{2}$	5	9	6	$7\frac{1}{2}$	$9\frac{1}{2}$
Height	65	68	62	64	62	60	67	59	63	66

LIFE EXPECTANCY For Exercises 13–15, use the following table.

Year Born	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	1999	2000
Life Expectancy	47.3	50.0	54.1	59.7	62.9	68.2	69.7	70.8	73.7	75.4	76.7	77.1

Source: U.S. Census Bureau

13. Draw a scatter plot for the data. Then draw a line that seems to best fit the data.

14. Write an equation for your line of fit.

15. Use the equation to predict the life expectancy for a person born in 2020.

Explain whether a scatter plot of the data for each of the following would show a *positive*, *negative*, or *no* relationship.

16. length of a side of a square and perimeter of the square

17. grade in school and number of pets

18. length of time for a shower and amount of water used

19. outside temperature and amount of heating bill

BASEBALL For Exercises 20–22, use the table at the right.

20. Make a scatter plot of the data to show the relationship between home runs and runs batted in.

21. Explain whether you can draw a line of fit to approximate the data.

22. Could you predict the number of runs batted in for a player if you are given the number of home runs hit by that player? Explain.

Player	Home Runs	Runs Batted In
A. Jones	51	128
A. Rodriguez	48	130
D. Ortiz	47	148
D. Lee	46	107
M. Ramirez	45	144
M. Teixeira	43	144
A. Pujols	41	117
A. Dunn	40	101
P. Konerko	40	100
R. Sexton	39	121

Source: Major League Baseball

23. **SCHOOL** Determine the relationship a scatter plot of the data might show. Explain.

Week	1	2	3	4	5	6	7	8	9
Quiz Score	91	91	84	85	90	87	86	97	97

24. **FIND THE DATA** Refer to the Data File on pages 16–19. Choose some data and make a scatter plot with a line of fit. Use your graph to make predictions about unlisted data.

H.O.T. Problems

25. **OPEN ENDED** Give an example of data that could be represented by the scatter plot at the right. Explain the outlying value.
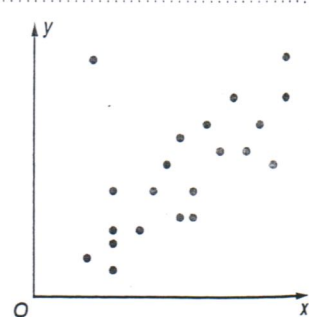
26. **NUMBER SENSE** Suppose a scatter plot shows that as the values of x decrease, the values of y decrease. Does the scatter plot show a *positive*, *negative*, or *no* relationship?

27. **CHALLENGE** Determine whether the following statement is *always*, *sometimes*, or *never* true. Justify your answer.

> A scatter plot that shows a positive relationship suggests that the relationship is proportional.

28. **WRITING IN MATH** Explain why a scatter plot of skateboard sales and swimsuit sales for each month of the year might show a positive relationship. Does this mean that one factor caused the other? Explain.
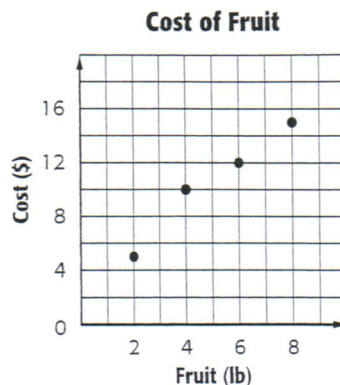
29. A car owner tracked the value of a car using a scatter plot.

Lifetime Value of Car
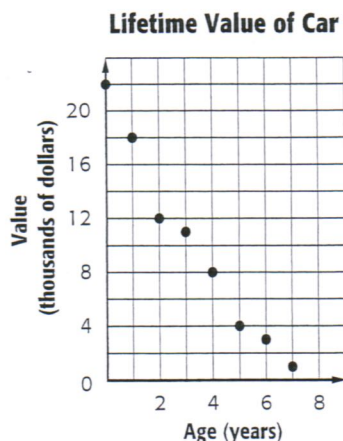
Which description best represents the relationship of the car's value?

A negative trend

B no trend

C positive trend

D cannot be determined

30. The scatter plot shows the cost of fruit Franco bought from a produce stand in relation to the weight of the fruit.

Cost of Fruit

Based on the information in the graph, which statement is a valid conclusion?

F As Franco bought more pieces of fruit, the cost of the fruit increased.

G As Franco bought fewer pieces of fruit, the cost of the fruit decreased.

H As Franco bought fewer pounds of fruit, the number of pieces of fruit decreased.

J As Franco bought more pounds of fruit, the cost of the fruit increased.

Spiral Review

CITIES For Exercises 31–33, use the table. (Lesson 9-8)

31. Make a graph of the data.

32. Describe how the population of Detroit, Michigan, changed from 1950 to 2000.

33. Which city had the greatest percent increase from 1950 to 2000?

34. SPORTS There are a total of 36 baseballs and softballs in a bin. There are 5 more softballs than baseballs. Write a system of equations that represents the situation. (Lesson 9-7)

Largest U.S. Cities		
City	2000	1950
New York, NY	8,010,000	7,890,000
Los Angeles, CA	3,690,000	1,970,000
Chicago, IL	2,900,000	3,620,000
Houston, TX	1,950,000	600,000
Philadelphia, PA	1,520,000	2,070,000
Phoenix, AZ	1,320,000	110,000
San Diego, CA	1,220,000	330,000
Dallas, TX	1,190,000	430,000
San Antonio, TX	1,150,000	410,000
Detroit, MI	950,000	1,850,000

Source: U.S. Census Bureau

Solve each equation. Check your solution. (Lesson 8-5)

35. $2x + 16 = 6x$

36. $4a - 9 = 7a + 6$

37. $5y - 1 = 3y + 11$

38. $n + 0.8 = -n + 1$