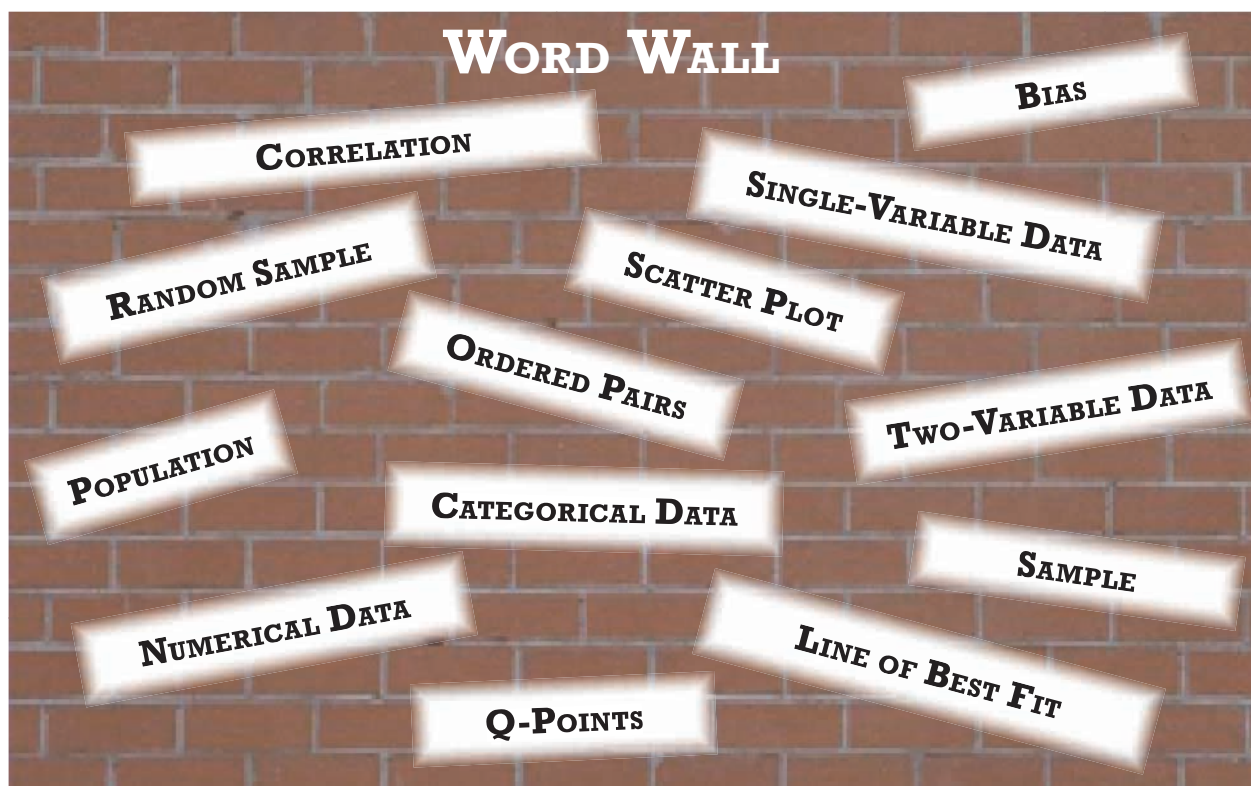


BLOCK 4 ~ DATA ANALYSIS

TWO - VARIABLE DATA

LESSON 20	SCATTER PLOTS AND CORRELATION -----	130
LESSON 21	PREDICTING WITH LINES OF BEST FIT -----	134
	Explore! Finding a Good Fit	
LESSON 22	Q-POINTS AND LINES OF BEST FIT -----	139
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BLOCK 4 ~ TWO - VARIABLE DATA

TIC - TAC - TOE

PREDICTION TUTORIAL

Make a brochure to teach a new student how to use scatter plots or lines of best fit to make predictions.



See page 138 for details.

TEST A THEORY

Make conjectures about the relationship between two variables. Collect data to see if the theories are correct.



See page 163 for details.

A MISLEADING GRAPH?

Analyze two graphs of the same data set. Determine which is truthful and which is misleading.



See page 158 for details.

CONDUCT A SURVEY

Create a short survey to give to classmates. Graph and analyze the results.



See page 152 for details.

GLOSSARY FLASHCARDS

Create flashcards of all vocabulary terms in this book.



See page 163 for details.

PATTERNS IN SPORTS

Explore the correlations and variables in a sport. Describe how the results could help a coach make team decisions.



See page 138 for details.

CORRELATIONS IN THE REAL WORLD

Find examples of positive and negative correlations in newspapers or magazines.



See page 152 for details.

Q-POINTS POSTER

Create a poster that summarizes the process of finding a line of best fit by Q-points.



See page 144 for details.

GOOD SURVEY/BAD SURVEY

Create a survey with good questions. Change the questions to make the same survey a bad survey.



See page 157 for details.

SCATTER PLOTS AND CORRELATION

LESSON 20



Read, create and describe the correlations in scatter plots.

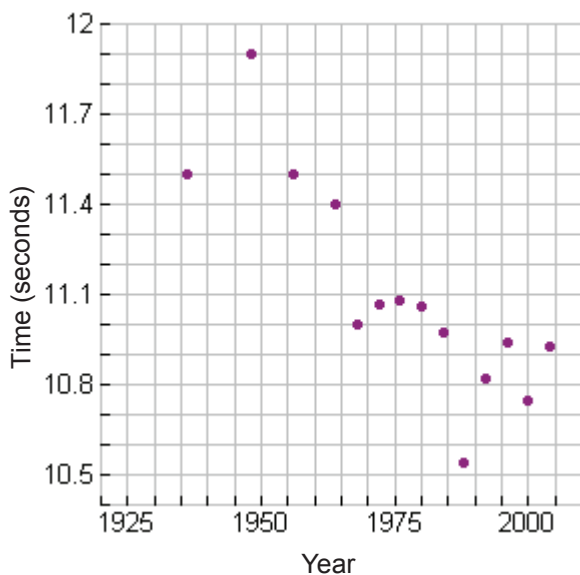
Is there a relationship between people's education level and their salaries? Is there a relationship between the number of missing assignments that students have and their grades? In **Blocks 2 and 3** of this book, you have focused on **single-variable data**. These data sets only showed one type of data, perhaps the weights of frogs or the heights of buildings. In this block, the focus will shift to **two-variable data**, where two types of data will be considered at the same time.

It is often helpful to plot two-variable data sets as **ordered pairs**. The first number in an ordered pair corresponds to the number on the x -axis. The second number in an ordered pair corresponds to the number on the y -axis. Ordered pairs are always written as (x, y) . Plotting the points from a two-variable data set can help you to see if there is a relationship between the two variables. This set of points is called a **scatter plot**.

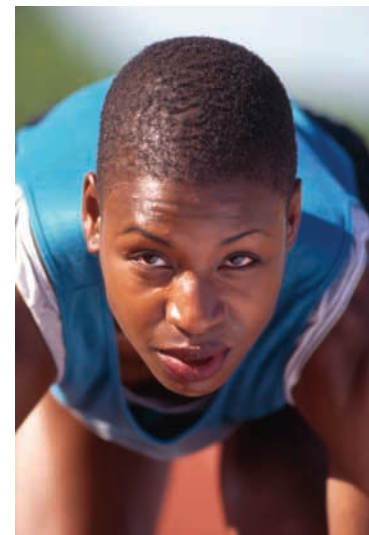
The data at right shows the times from the Women's 100-Meter Dash from the last several Summer Olympic Games. The x -values vary from 1936 to 2004. The y -values vary from 10.54 to 11.9 seconds. The axes have been scaled to include these values. Each point has been plotted where (x, y) represents (Year, Time in Seconds).

Year	Time (seconds)
1956	11.5
1972	11.07
2004	10.93
1976	11.08
1996	10.94
1988	10.54
1936	11.5
1980	11.06
1948	11.9
2000	10.75
1964	11.4
1984	10.97
1992	10.82
1968	11.0

Source: Time Almanac



The relationship between the variables can be shown by plotting the points. The graph shows a downward pattern. The pattern shows that, in general, as the years increase, the women's times decrease. Women's Olympic runners are getting faster over time.



EXAMPLE 1

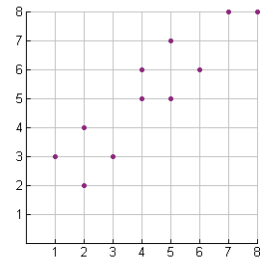
Make a scatter plot of this data set. Describe the pattern of the data.

x	1	3	5	2	8	4	5	4	2	6	7
y	3	3	7	2	8	5	5	6	4	6	8

SOLUTION

The x -values go from 1 to 8. The y -values go from 2 to 8. an appropriate scale that includes all ordered pairs goes from 0-8 on the x - and y -axes.

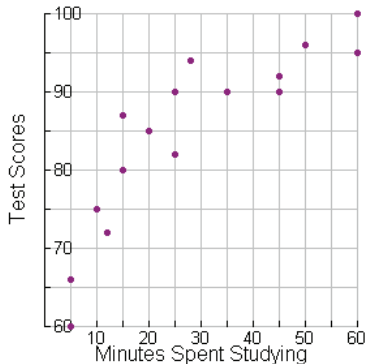
Plot the points. In general, as the x -values increase, the y -values also increase.



A scatter plot can be very helpful in determining if there is a relationship between a pair of variables in a data set. A **correlation** describes the relationship between the two variables in a scatter plot. There are three types of correlations.

Positive Correlation

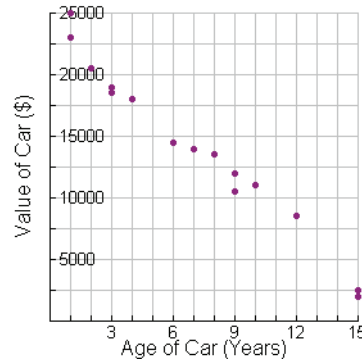
Studying and Test Scores



as x increases, y increases

Negative Correlation

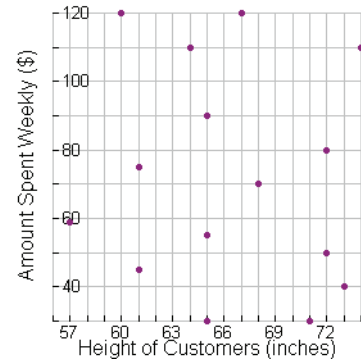
Car's Value Over Time



as x increases, y decreases

No Correlation

Weekly Grocery Expenses by Height



x and y are not related

Notice that correlations are not always perfect patterns. A correlation shows the general pattern or trend of the data. When there is no correlation, the ordered pairs in the graph do not show any recognizable pattern or trend.

EXAMPLE 2

Predict whether the following sets of data would show a positive, negative or no correlation. Explain.

- a student's grade level and the amount of recess time
- a student's height and their score on the last science test
- a student's height and their shoe size

SOLUTIONS

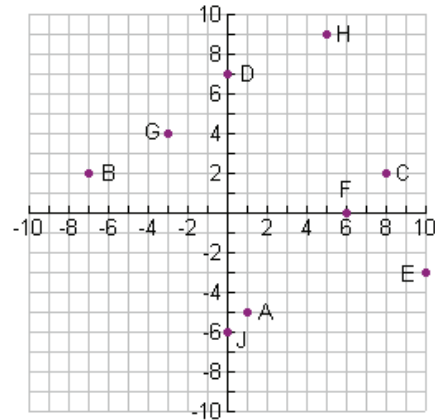
- As students get older, the amount of time they get for recess typically decreases. This would likely show a negative correlation.
- The height of a student should have no effect on how they performed on the last science test. There is likely no correlation.
- Taller students are more likely to have larger feet and shorter students are more likely to have smaller feet. This is a positive correlation.

EXERCISES

- How are scatter plots related to ordered pairs?
- How is a scatter plot used to determine if two-variable data shows no correlation?
- Draw a coordinate plane and label the x - and y -axes. Plot the following ordered pairs and label.

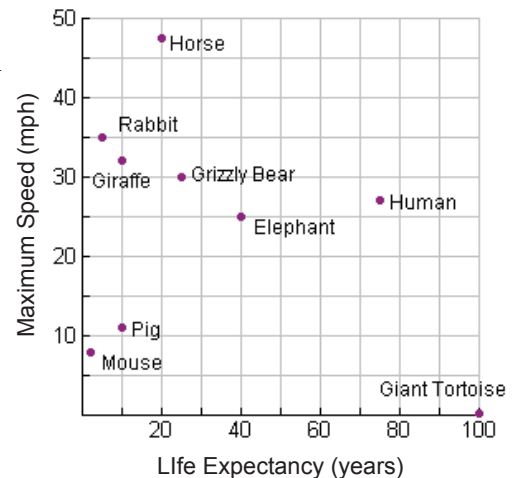
A (6, 1)	B (0, -5)	C (-3, 7)	D (2, 8)
E (3, 0)	F (1, -8)	G (-4, -1)	H (7, -2)

- Write the ordered pair for each point in the scatter plot at right.



- The scatter plot at right shows the life expectancy and maximum speed of several animals. Use the plot to answer the following questions.
 - Which animal has the fastest maximum speed?
 - Which animal has the greatest life expectancy?
 - Which animal has the lowest life expectancy?
 - How do an elephant and a grizzly bear compare in terms of their life expectancy and maximum speed?
 - Does there appear to be a correlation between life expectancy and maximum speed of animals? Explain.

Life Expectancy and Maximum Speed



Source: *pubquizhelp.com* and *Natural History Magazine*

Predict whether each set of data would show positive, negative or no correlation. Explain each answer.

- a toad's weight and its jumping distance
- price a gas station charges per gallon and the number of customers they have per day
- time spent studying and the score received on a test
- time spent brushing teeth and the number of cavities

10. Hayden wondered if there was a relationship between the minutes students spent exercising each day and the minutes they spent doing homework. He asked several of his classmates to keep track of each for one day. He recorded the data in the table at right.

- Make a scatter plot of the data. Let x represent the minutes spent exercising. Let y represent the number of minutes spent on homework.
- Which two points seem out of place on the scatter plot? Explain.
- Aside from these two points, describe the correlation.
- Hayden was surprised by the correlation he found. Why might the time spent exercising actually lead to more time spent on homework?

Minutes Spent Exercising	Minutes Spent on Homework
25	30
45	70
40	50
5	80
15	40
30	50
15	15
60	20
35	40
40	60
50	60
20	40

Bridge Name	Year Completed	Length (feet)
Astoria	1966	1232
Croton Reservoir	1970	1052
Raven's Wood	1981	902
Central	1995	850
Braga Memorial	1965	840
Kingston-Rhinecliff	1957	800
Mark Clark Expressway	1992	800
Oshima	1976	1066
Tenmon	1966	984
Kuronoseto	1974	984
Graf Spee	1936	839

Source: Time Almanac

11. Oregon boasts having the largest continuous truss bridge in the world. The bridge spans the Columbia River from Astoria, Oregon to Washington. The table at left gives the length of the longest truss bridges around the world.

- Make a scatter plot of the data in the table to show the year completed (x) and the length in feet (y).
- Is there a correlation between the year the bridge was completed and its length? Explain.

REVIEW

12. Find the mean, median and mode of the following data set:

18, 2, 25, 16, 14, 2, 14

13. The data set below has a mean of 22 and a range of 15. Find the missing numbers of the ordered data set.

___, 18, 20, ___, 23, 32

14. Create a histogram of the following data set. Use interval widths of 5.

33, 38, 48, 36, 29, 42, 40, 41, 23, 45,
24, 24, 28, 35, 45, 44, 49, 20, 47, 22

15. The top 10 countries in internet usage are listed in the table. Use the data to answer each question.

- Find the five-number summary of the data set.
- Create a box-and-whisker plot of the data set.
- Is the United States an outlier? Use the IQR Method to justify your answer.

Country	Percentage of World-Wide Internet Users
United States	18.3%
China	11.1%
Japan	8.0%
India	4.7%
Germany	4.3%
United Kingdom	3.3%
South Korea	3.1%
Italy	2.7%
France	2.7%
Brazil	2.4%

Source: Computer Industry Almanac Inc.

PREDICTING WITH LINES OF BEST FIT

LESSON 21



Draw a line of best fit for a set of data.
Use a line of best fit to make predictions.

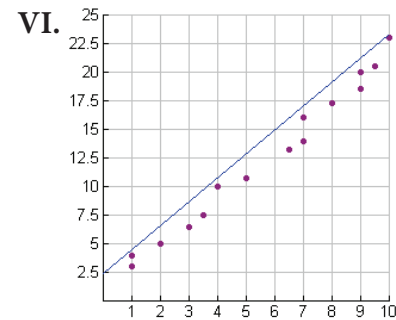
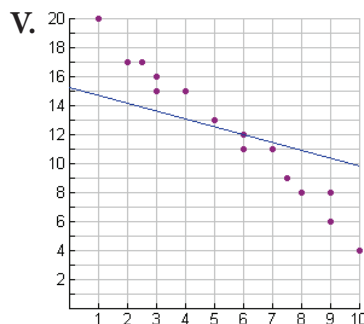
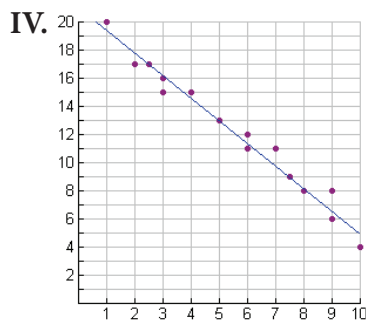
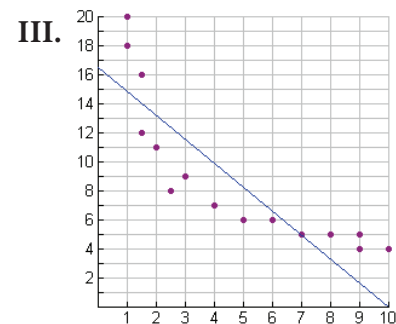
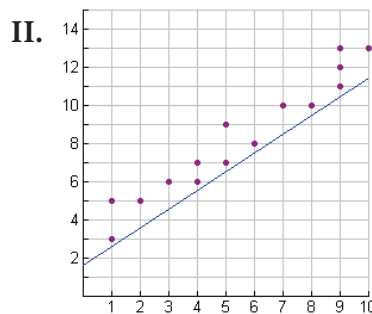
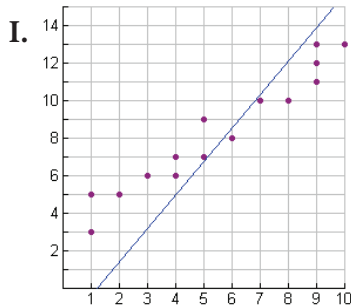
In Lesson 20, you learned how to create and interpret scatter plots. A scatter plot often reveals a recognizable pattern in a data set. For example, sometimes positively or negatively correlated scatter plots form a linear pattern. When this occurs, it can be helpful to determine a **line of best fit** for the data. A line of best fit approximates the pattern of the data. It is useful for making predictions about the data set.



There are two criteria for a good line of best fit. First, the line must follow the direction of the linear data well. Also, the line should have about half the points above the line and half the points below the line.

EXPLORE!

Refer to the scatter plots below:



Step 1: Which scatter plots show a positive correlation? Which show a negative correlation?

Step 2: Which scatter plots follow a linear pattern?

Step 3: Which scatter plot has a good line of best fit?

Step 4: Which scatter plots do not have a good line of best fit? Explain what is wrong with each.

LINE OF BEST FIT

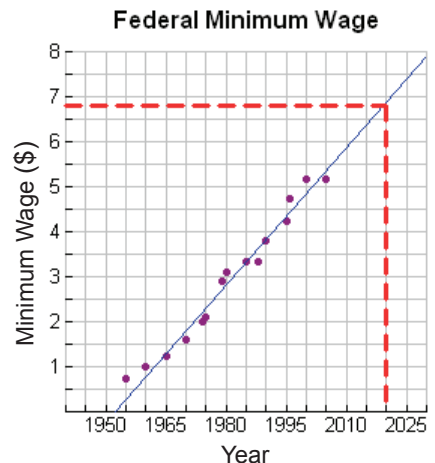
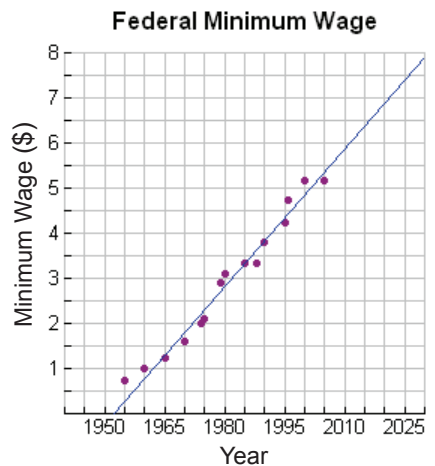
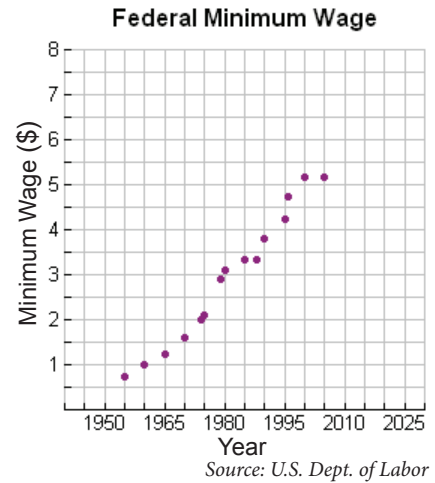
A good line of best fit:

- ◆ follows the direction of a linear pattern, and
- ◆ has approximately half the points above and half the points below the line.

EXAMPLE 1

Use the scatter plot of Federal Minimum Wage by Year to complete the following.

- a. Draw a line of best fit for the scatter plot. Justify why the line of fit is a good one.
- b. Use the line of best fit to predict what the federal minimum wage will be in the year 2020.



SOLUTIONS

- a. A good line of best fit will follow the pattern of the data and will have about half the points above and below the line. This line is a good approximation.

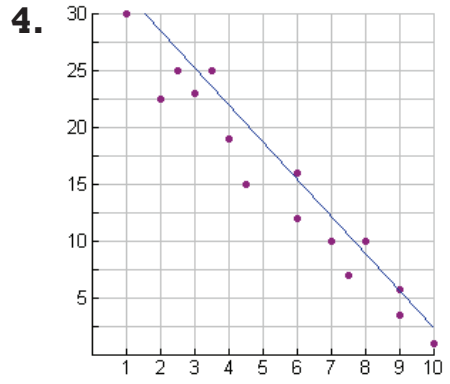
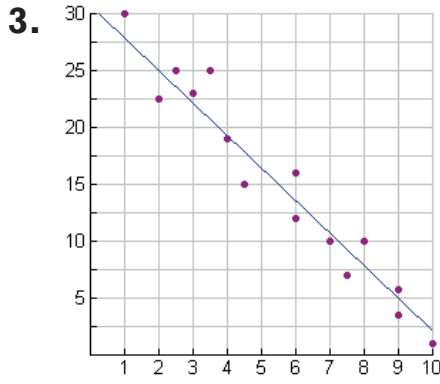
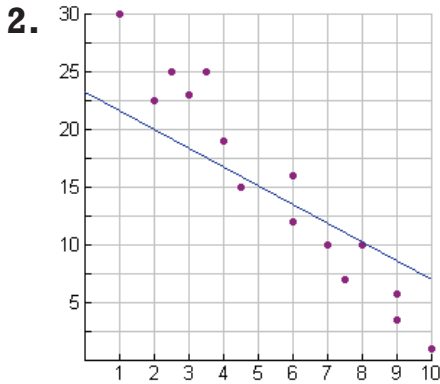
- b. Extend the line of best fit as well as the x - and y -axes. Find the year 2020 on the x -axis (Years) and follow it up to where it meets the line of best fit. Now follow that point to the y -axis (Minimum Wage in Dollars).

Locate the y -value that matches with the year 2020 on the line. This represents the approximate minimum wage. It appears that the minimum wage will be about \$6.75 in 2020.

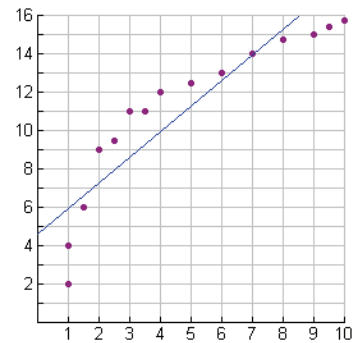
EXERCISES

1. What are the characteristics of a good line of best fit?

Identify whether each graph has a good line of best fit. If the line is not a good fit, explain why.



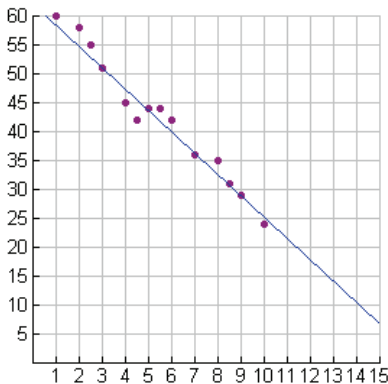
5. Dave drew a line of best fit for the scatter plot at right.
- How many points are above Dave's line of best fit?
 - How many points are below Dave's line of best fit?
 - Scott said Dave's line does not fit the pattern of the data very well. Do you agree or disagree?
 - Should the data in the scatter plot be represented by a line of best fit? Why or why not?



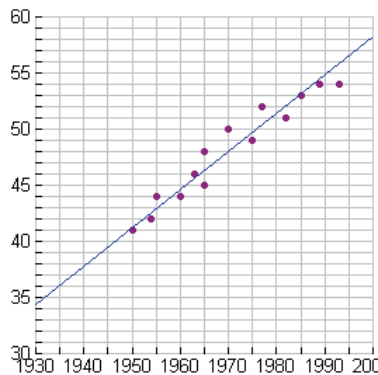
6. Inessa plotted her age and height from birth to when she turned 13 on a scatter plot. She noticed that as she got older, she also got taller. She wants to draw a line of best fit through the data to predict how tall she will be when she is 30. Explain why her line of best fit will not work in this situation.

Use the scatter plot and line of best fit to approximate each missing value.

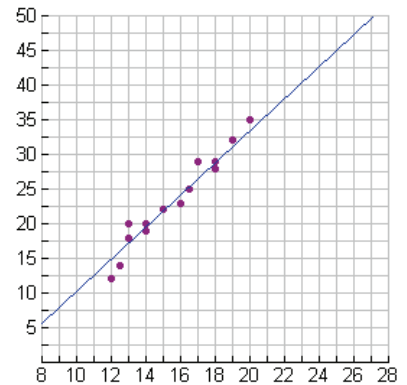
7. When $x = 14$, $y =$ _____



8. When $y = 38$, $x =$ _____



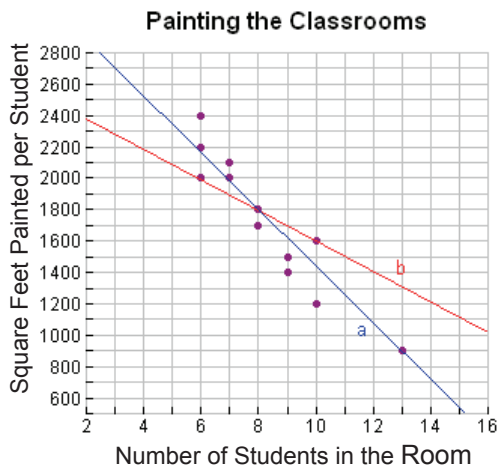
9. When $x = 26$, $y =$ _____



10. Morgan wanted to see if there was a correlation between a person's age and the number of hours they watch television each week. He surveyed several people and then put the information into the following table.

- Create a scatter plot of the data. Scale the x -axis from 0 to 60 years old and the y -axis from 10 to 45 hours.
- Describe the correlation of the data. Does the data appear to be linear?
- Draw a line of best fit for the data. Extend your line all the way through the graph. Based on Morgan's data, how many hours of television would you expect a 50 year old person to watch?
- If a person watched 40 hours of television each week, approximately how old would you expect them to be?

Person's Age (x)	Hours Watching TV per Week (y)
13	24
5	23
35	32
25	31
7	18
2	18
14	22
19	24
40	32
26	29
9	20
16	24
22	27
38	34
30	30



11. All the classrooms in a school are to be painted. Several students chose to volunteer for the painting project. The graph at left shows the number of students who painted in each room and the area (in square feet) each student painted.

- Describe the correlation between the number of students painting in each room and the area each one painted.
- Which line of best fit (a or b) on the graph represents the correlation best?
- Use the line of best fit you chose in **part b**. How many square feet would you expect each student to paint if they were in a room of 4 students?
- If each student painted 1,400 square feet, about how many students were in the room?

REVIEW

12. Sketch an example of a scatter plot with a negative correlation.

Predict whether the following sets of data would show a positive, negative or no correlation.

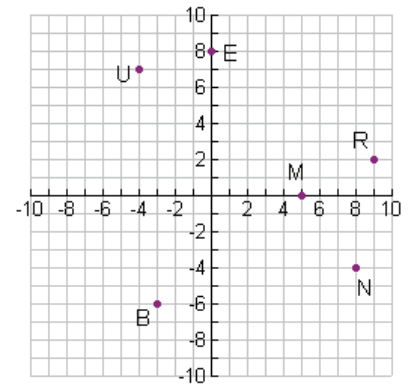
- the size of a person's car and the speed they drive
- number of traffic tickets a person has received and the cost of their car insurance
- number of cars on the highway and the average speed of drivers

16. Write the ordered pair for each point in the scatter plot at the right.

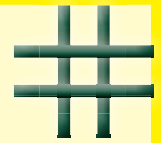
17. The ages of the people at the Monday Matinee at the local theater are listed below.

Ages: 32, 24, 41, 3, 4, 2, 12, 29, 6, 3, 28, 29, 62

- Create a stem-and-leaf plot to display the ages.
- Use the graph to make a statement about what age groups come to the Monday Matinee.

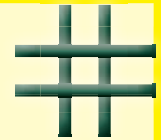


TIC-TAC-TOE ~ PREDICTION TUTORIAL



A new student has just joined class. Create a brochure to teach the student how to make predictions using a scatter plot or an equation for a line of best fit. The brochure should explain both processes and give two examples for each. Include some practice problems and their solutions for the new student to try on their own.

TIC-TAC-TOE ~ PATTERNS IN SPORTS



Are there correlations in sports? Choose one sport and collect data on the relationships among four pairs of variables. For example, for football you could find the relationship between the number of rushing yards per game and the number of wins for various teams as one pair of variables.

Each data set should consist of at least 12 ordered pairs. Create a scatter plot for each of the four pairs of variables. Describe the correlations in each scatter plot.

Were the relationships surprising? How could the manager or coach of the team use the scatter plots to help the team? Print or cut out the data used to create the graphs for a visual presentation of the information.

Q - POINTS AND LINES OF BEST FIT

LESSON 22



Write equations for a line of best fit based on Q-points.

Lines of best fit approximate the pattern of a data set. They are helpful for making predictions. A common problem with lines of best fit is that two students may draw their lines differently. This could greatly affect predictions made from those lines.

To eliminate this problem, statisticians have developed ways to determine a line of best fit. One method for finding a line of best fit is to find the **Q-points** of the data set. The Q-points (quartile points) of a data set are the points created by the intersection of the quartiles for the x - and y -values. Follow the steps below to find the line of best fit for a given data set.

USING Q-POINTS TO FIND A LINE OF BEST FIT

1. Draw a scatter plot of the data set.
2. Find the five-number summary for the x -values. Draw vertical lines on the scatter plot at the Q1 and Q3 values.
3. Find the five-number summary for the y -values. Draw horizontal line on the scatter plot at the Q1 and Q3 values.
4. Find the four intersection points created by the lines in **parts 2 and 3**. Write the ordered pairs of the two Q-points that follow the pattern of the data.
5. Write a slope-intercept form equation for the line that goes through the two Q-points.

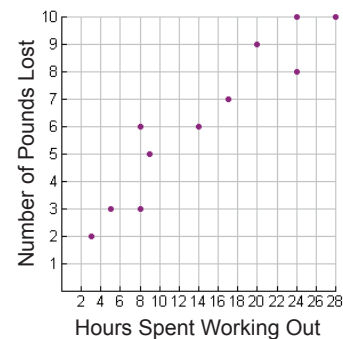
EXAMPLE 1

Mrs. Harvey's PE class collected data about the effect of workout time on weight loss. Each student recorded how many hours they spent working out for a month. They also recorded how much weight they lost. Use the Q-points of the data to find a line of best fit.

Hours Spent Working Out	3	5	8	8	9	14	17	20	24	24	28
Number of Pounds Lost	2	3	3	6	5	6	7	9	8	10	10

SOLUTION

Draw a scatter plot of the data.



EXAMPLE 1**SOLUTION****(CONTINUED)**Find the five-number summary of the hours spent working out (x -values).

3, 5, 8, 8, 9, 14, 17, 20, 24, 24, 28

3 ~ 8 ~ 14 ~ 24 ~ 28

Draw vertical lines at $Q1 = 8$ and $Q3 = 24$.Find the five-number summary of the y -values.Be sure to list the y -coordinates in order.

2, 3, 3, 5, 6, 6, 7, 8, 9, 10, 10

2 ~ 3 ~ 6 ~ 9 ~ 10

Draw horizontal lines at $Q1 = 3$ and $Q3 = 9$.

From the four intersection points created by the lines, the points (8, 3) and (24, 9) follow the pattern of the data the best. These are the two Q-points that lie on the line of best fit.

Use the two points. Find the slope-intercept form equation for the line: $y = mx + b$.

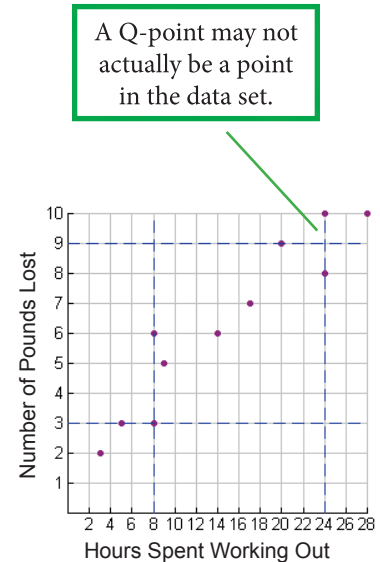
$$m = \text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{9 - 3}{24 - 8} = \frac{6}{16} = \frac{3}{8} \rightarrow y = \frac{3}{8}x + b$$

Substitute one of the points (8, 3) into the equation to find the y -intercept (b):

$$3 = \frac{3}{8}(8) + b$$

$$3 = 3 + b$$

$$0 = b$$

The equation for the line of best fit based on Q-points is $y = \frac{3}{8}x + 0$ or $y = \frac{3}{8}x$.

The process of finding a line by Q-points has several steps. Be sure to carefully go through the process to arrive at an accurate equation.

EXPLORE!**THE WAVE**

Your team has just scored the winning touchdown in the football game. The crowd goes wild and starts to do 'the wave' to celebrate the victory. How long will it take them to wave to one end of the stadium and back?

Step 1: Have four students in the class line up to do the wave. A student at one end of the line throws his or her hands over their head and brings them back down. When the first student's hands are above their head, the next student does the same, creating a 'wave' down the line. When the 'wave' reaches the end of the line, it should reverse back to the start of the line. Record the time it took to complete the wave to the nearest second.

Step 2: Copy the table below. Continue to collect data for various numbers of students in the wave line. Each trial should have a different number of students. Collect 11 trials.

Number of Students in Wave	4										
Time (seconds)											

Step 3: Let x represent the number of students in the wave. Let y represent the time in seconds. Plot the ordered pairs from the table on graph paper.

Step 4: Find the five-number summary for the x -values and the y -values. Be sure each set of values is written in order before finding the five-number summary.

Step 5: Draw vertical lines on the graph from **Step 4** at the quartiles (Q1 and Q3) for the x -values. Draw horizontal lines on the graph at the quartiles for the y -values.

Step 6: Write the ordered pairs for the four Q-points created by the intersecting lines. Circle the two ordered pairs that best follow the pattern of the data.

Step 7: Find the slope between the two points chosen in **Step 6**. Show how to calculate the slope.

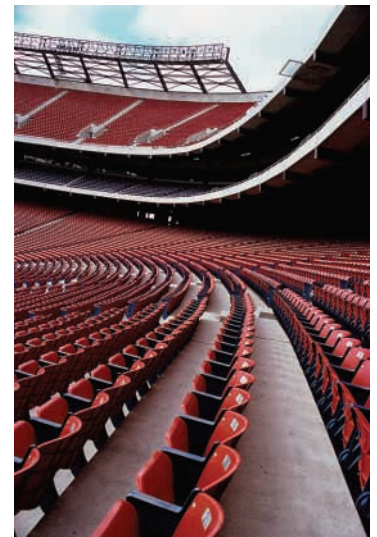
Step 8: Substitute the slope and the coordinates of one of the two Q-points in the appropriate places in the slope-intercept equation: $y = mx + b$. Solve the equation for the y -intercept, b .

Step 9: Write the final slope-intercept equation. Check with a classmate. Do you have the same equation? If not, help each other out to determine where the error is.

Finally, use the equation to make a prediction...

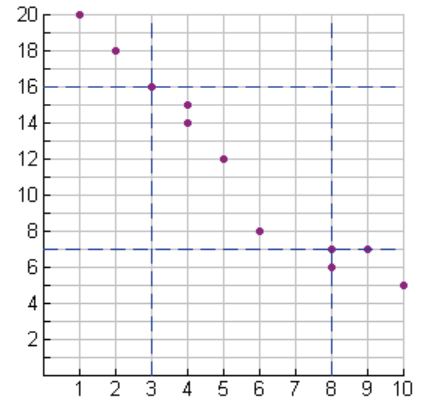
Step 10: A stadium has 6 sections that stretch across one side. Each section has 30 seats per row. How many people could be seated in each row across the whole side of the stadium?

Step 11: Substitute the answer from **Step 10** into the **Step 9** equation. Since this number represents the number of people in the 'wave', substitute it for x . Evaluate the expression to find the time, in seconds, to complete the 'wave' with this number of people. Is this the exact answer? Explain.



EXAMPLE 2

Use the scatter plot to answer the questions. The vertical and horizontal lines based on the quartiles have already been drawn.



- Write the ordered pairs for the four Q-points created by the intersecting lines.
- Does the graph show a positive or negative correlation? Which two Q-points follow the direction of the data best?
- What is the slope of the line between those Q-points?
- Write an equation in slope-intercept form for the equation of the line through the Q-points.

SOLUTIONS

- The ordered pairs are (8, 16), (8, 7), (3, 7) and (3, 16).
- Because the y -values decrease as x increases, this scatter plot shows a negative correlation. The two Q-points that follow the data best are (3, 16) and (8, 7).
- The slope of the line through these Q-points is:

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - 16}{8 - 3} = \frac{-9}{5} = -1.8$$

- Slope-Intercept form:

Substitute the slope from **part c**.

Substitute one of the points, (8, 7).

Solve for b .

Write the final equation.

$$y = mx + b$$

$$y = -1.8x + b$$

$$7 = -1.8(8) + b$$

$$7 = -14.4 + b$$

$$21.4 = b$$

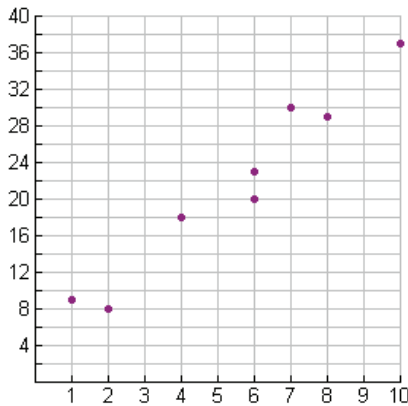
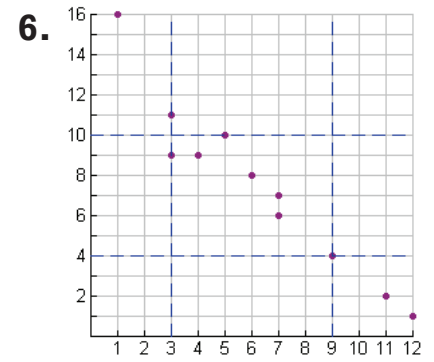
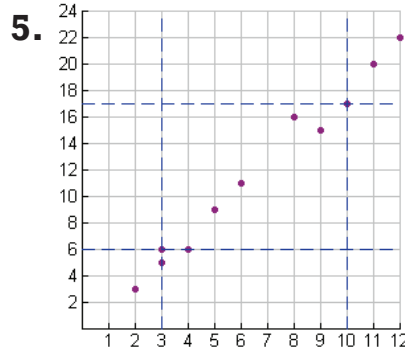
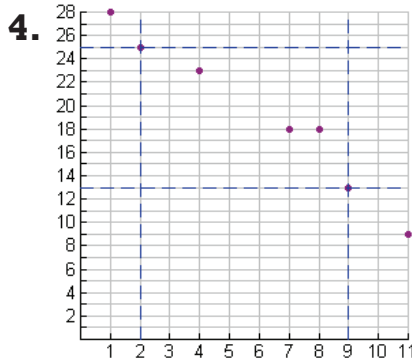
$$y = -1.8x + 21.4$$

EXERCISES

- Why do you think mathematicians developed the Q-points method for finding lines of best fit? What is the problem with just finding a line using the method learned in **Lesson 21**?
- What does the “Q” in Q-points represent?
- Susan drew a scatter plot of a data set. She drew vertical and horizontal lines at Q1 and Q3 of the x - and y -values. How should she decide which of the points to use for her two Q-points?



Write the ordered pairs for the four Q-points for each graph. Mark the two ordered pairs which best follow the data.



7. Use the scatter plot at left.

- Write the ordered pairs for the points that are shown in the scatter plot.
- Find the five-number summary of the x -coordinates.
- Find the five-number summary of the y -coordinates.
- Copy the scatter plot and draw the horizontal and vertical lines from the quartiles in **parts b and c**.
- Write the ordered pairs for the two Q-points that follow the data best.
- Were these points in the list of ordered pairs from **part a**? Explain.

Given the following Q-points, write a slope-intercept form equation for the line through these points.

8. $(5, 21)$ and $(11, 3)$

9. $(4, 8)$ and $(12, 20)$

10. The following table shows the cost of U.S. postage stamps since 1975. Follow the steps below to write an equation for the line of best fit based on Q-points.

Year	1975	1978	1981	1985	1988	1991	1995	1999	2001	2002	2006
Cost (cents)	13	15	18	22	25	29	32	33	34	37	39

Source: Time Almanac

- Let x represent the years and let y represent the cost of a stamp in cents. Draw a scatter plot of the data.
- Find the five-number summary for the x - and y -values.
- Draw the horizontal and vertical lines from your quartiles into the scatter plot.
- Write the ordered pairs for the two Q-points that follow the data best.
- Write a slope-intercept equation for the line through the Q-points from **part d**. Round numbers to the nearest tenth.



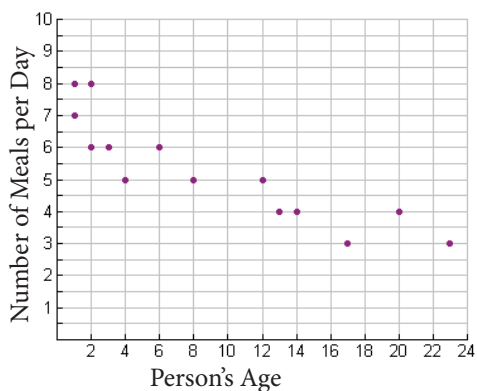
11. Find the equation of the line of best fit based on Q-points for the scatter plot shown in **Exercise 6**.

12. The following table shows the number of missing assignments students had in English class and their overall grade as a percent. Use the data to find the equation for the line of best fit based on Q-points.

Number of Missing Assignments (x)	0	0	0	1	1	2	3	3	4	5	6	6	7	9	10
Overall Percent (y)	98	82	95	95	90	92	78	88	82	85	80	68	75	65	50

REVIEW

13. Louise was doing a study to see if there is a relationship between a person's age and the number of times they eat per day. She collected data from fourteen people and made the following scatter plot.



- a. Does there appear to be a relationship between a person's age and the number of times they eat per day? Describe the correlation of the data.
- b. Louise only collected data for people 23 years old or younger. Do you think this scatter plot could be used to predict how many meals per day a 50-year-old person would eat? Explain.



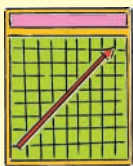
14. Draw a scatter plot for the following set of data and describe the correlation.

Average SAT Scores (Verbal Section)

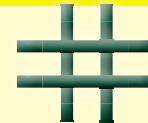
Year (x)	1988	1998	1980	2005	2002	1990	1976	2000	1992	1984	1994	1996	2004
Average Score (y)	505	505	502	508	504	500	509	505	500	504	499	505	508

Source: College Entrance Examination Board

TIC-TAC-TOE ~ Q-POINTS POSTER



Make a poster that models the process for finding a line of best fit based on Q-points. Use an example to show all the steps involved and include helpful teaching tips. On a separate sheet of paper, create at least two example data sets (with different amounts of points) that students could use to practice. Include a key for these problems.



PREDICTING WITH BEST FIT EQUATIONS

LESSON 23



Use equations based on data to make predictions and judge the reasonableness of predictions.

Marlon sells ice cream cones in the park during the summer. He collected information about the high temperature on different days and the number of ice cream cones he sold on each day. He used this information to create a scatter plot and found the equation for a line of best fit. He determined that the number of ice cream cones he sells (N) is related to the high temperature in degrees Fahrenheit (t) using the equation:

$$N = 50 + 0.8t$$

The equation for his line of best fit can be used to make predictions about future events. One summer day the temperature is 95° F. How many ice cream cones could Marlon expect to sell?



Substitute 95 for t in the equation.
Multiply, then add.

$$\begin{aligned} N &= 50 + 0.8t \\ N &= 50 + 0.8(95) \\ N &= 50 + 76 = 126 \end{aligned}$$

Marlon can expect to sell approximately 126 ice cream cones when the high temperature is 95° F.

EXAMPLE 1

Use the equation and given value of one variable to solve for the other variable.

a. $y = 2x - 8$
 $x = 11, y = \underline{\hspace{2cm}}$

b. $T = 40 + 1.6d$
 $T = 65, d = \underline{\hspace{2cm}}$

SOLUTIONS

a. Write the original equation.
Substitute 11 for x in the equation.
Multiply, then subtract.

$$\begin{aligned} y &= 2x - 8 \\ y &= 2(11) - 8 \\ y &= 22 - 8 \\ y &= 14 \end{aligned}$$

b. Write the original equation.
Substitute 65 for T in the equation.
Subtract 40 from both sides of the equation.
Divide by 1.6 on both sides.

$$\begin{aligned} T &= 40 + 1.6d \\ 65 &= 40 + 1.6d \\ -40 \quad -40 & \\ \hline 25 &= 1.6d \\ 1.6 & \quad 1.6 \\ \hline 15.625 &= d \end{aligned}$$

EXAMPLE 2

A grocery store manager tracked the cost of a gallon of milk for the last several months of 2009. The line of best fit models the price, P , based on the number of months (m) since December 2009: $P = 3.60 + 0.04m$.

- What value of m would represent January 2011?
- Use the equation $P = 3.60 + 0.04m$ to predict the price of a gallon of milk at this store in January 2011.
- How many months after December 2009 will a gallon of milk first cost more than \$5.00 at this store?

SOLUTIONS

a. January 2011 is a full year (12 months) plus a month after December 2009, so $m = 13$.

b. January 2011 means $m = 13$.

Substitute 13 into the equation for m .

$$P = 3.60 + 0.04m$$

$$P = 3.60 + 0.04(13)$$

Evaluate the equation.

$$P = 3.60 + 0.52$$

$$P = 4.12$$

A gallon of milk will cost \$4.12 in January 2011.

c. The price of milk is \$5.00. $P = 3.60 + 0.04m$

Substitute 5.00 for P and solve for m .

$$5.00 = 3.60 + 0.04m$$

Subtract 3.60 from both sides.

$$\begin{array}{r} 5.00 = 3.60 + 0.04m \\ -3.60 \quad -3.60 \\ \hline 1.40 = 0.04m \end{array}$$

Divide both sides by 0.04.

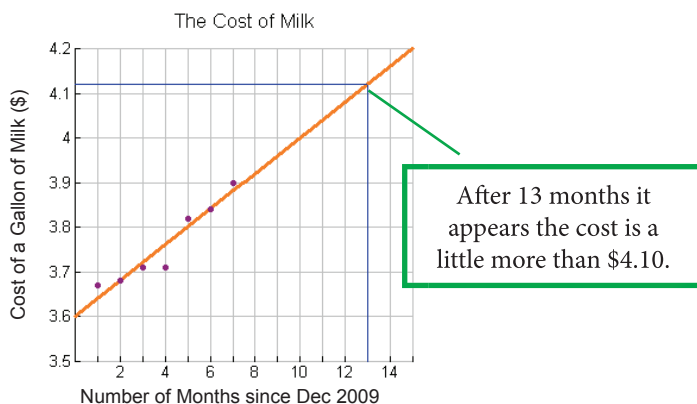
$$\frac{1.40}{0.04} = \frac{0.04m}{0.04}$$

$$35 = m$$

After 35 months, milk will cost \$5.00 at this grocery store.

Now you have two methods for using two-variable data to make predictions.

Extend the Line of Best Fit



Use the Equation for a Line of Best Fit

$$P = 3.60 + 0.04m$$

$$P = 3.60 + 0.04(13)$$

$$P = 3.60 + 0.52$$

$$P = 4.12$$



EXAMPLE 3

Cybil works in the maternity section of the hospital as a nurse. She determined that a baby's weight in pounds (P) can be modeled by $P = 7.2 + 0.6w$, where w is the baby's age in weeks. Does this model seem reasonable for a one-year old baby?

SOLUTION

A one-year old baby is 52 weeks old.
Evaluate the equation for $w = 52$.

$$\begin{aligned} P &= 7.2 + 0.6w \\ P &= 7.2 + 0.6(52) \\ P &= 7.2 + 31.2 \\ P &= 38.4 \text{ pounds} \end{aligned}$$

A weight of 38.4 pounds is far too heavy for a 1-year old baby. This model may only be reasonable for the first few months after a baby's birth.

EXERCISES

Use the equation and given value of one variable to solve for the other variable.

1. $y = 3x + 10$; $x = 12$, $y = \underline{\hspace{2cm}}$

2. $y = -4x + 42$; $y = 10$, $x = \underline{\hspace{2cm}}$

3. $P = 24 + 0.8n$; $P = 37.60$, $n = \underline{\hspace{2cm}}$

4. $T = 40 - 1.6d$; $d = 15$, $T = \underline{\hspace{2cm}}$

5. Mrs. Gonzalez noticed that class sizes at her school have been slowly declining over the years. When she started teaching in 1980, there was an average of 29 students in her classes. Now she only has an average of 24 students per class. Using a line of best fit, she found that the number of students per class (y) can be modeled by $y = 29 - 0.2x$, where x represents the number of years since 1980.

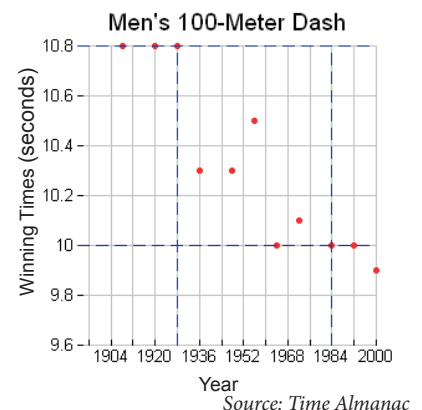
- What value of x would represent the year 2020?
- Use the equation to predict the number of students per class in the year 2020.
- In what year will the student population reach 18 students per class?
- Does this equation accurately predict the class sizes at this school in the year 2050? Explain.

6. Mike and Aurora organize whitewater rafting trips with their friends. The more people they can get to join them on a trip, the less it costs per person. They determine that the cost per person (C) can be modeled by $C = 35 - 0.75p$, where p represents the number of people rafting.

- If 15 people go on the rafting trip, how much will it cost per person?
- How many people need to go on the rafting trip for the cost to decrease to \$20 per person?
- If 50 people go on the rafting trip, how much will it cost? Is it reasonable to use this equation for a 50-person rafting trip? Explain.

7. The graph at right shows the winning times (rounded to the nearest tenth) for the Men's 100-Meter Dash in the Summer Olympics. The horizontal and vertical lines representing the quartiles have already been drawn in.

- Describe the correlation of the data.
- Name the two Q-points that follow the direction of the data.
- The equation of the line of best fit is approximately $y = -0.01x + 29.84$. Use the equation to predict the winning 100-Meter Dash time in the year 2020.
- Use the equation to predict when the winning time will decrease to 7 seconds? Is this reasonable? Explain.



8. Ali hikes on the weekends. She started with small hikes and has gradually increased her distance. The first hike she went on was 1.2 miles. The second was 1.5 miles. Use the information in the table to complete the following problems.

Number of Hikes	1	2	3	4	5	6	7	8	9
Distance of Hike (miles)	1.2	1.5	1.6	1.9	2.3	2.3	2.7	2.8	3

- Let x represent the number of hikes Ali has been on. Let y represent the distance of her hike. Make a scatter plot of the data.
- Find the five-number summary of the x -values. Draw vertical lines on the graph for the quartile values.
- Find the five-number summary of the y -values. Draw horizontal lines on the graph for the quartile values.
- What are the coordinates of the two Q-points that follow the direction of the data?
- Write an equation for the line through these points.
- Use the equation to predict how far Ali will travel on her twentieth hike.
- Predict how many hikes it will take for Ali to reach a 10-mile hike.
- Will this equation apply for Ali's one-hundredth hike? Explain.



REVIEW

9. Use the following ordered pairs to do the following:

x	2	4	4	7	8	10	12
y	20	17	16	11	12	9	4

- Draw a scatter plot of the data set.
- Find the four Q-points of the data set. Circle the two Q-points that best follow the pattern of the data.

Match each plot below with the correct name.

10. Histogram

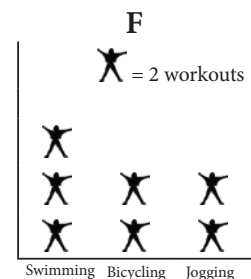
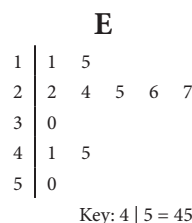
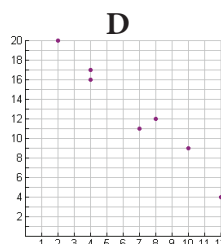
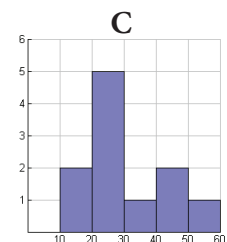
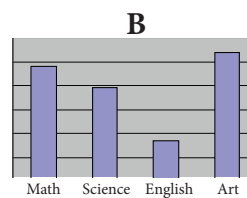
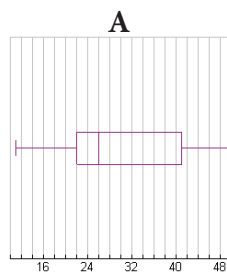
11. Scatter Plot

12. Stem-and-Leaf Plot

13. Bar Graph

14. Box-and-Whisker Plot

15. Pictograph



CHOOSING APPROPRIATE DATA DISPLAYS

LESSON 24

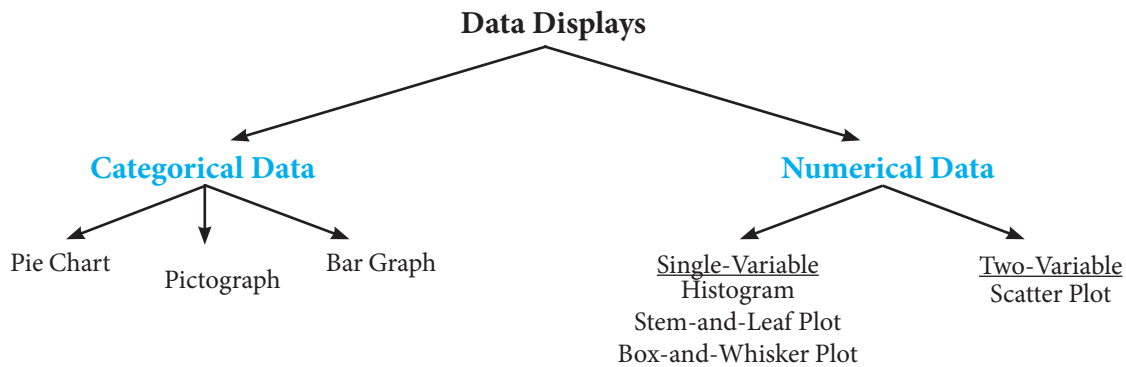


Choose an appropriate display for a set of data.

Data is displayed for many reasons. A newspaper may display data to inform their readers. A business might display data to show growth of the company or areas of weakness. A data display may show the differences between two communities or two products. A teacher might show the distribution of scores on the latest test in the form of a graph.



Data can be divided into **categorical data** and **numerical data**. Categorical data is data collected in the form of words. For example, if you collected data on your friends' favorite color, they would respond with specific words (red, green, orange, etc). Numerical data is data that is collected in the form of numbers. For example, if you asked your friends how many CDs they owned, they would respond with a number (5, 32, etc.). The type of data to display determines the type of graph needed.



EXAMPLE 1

State which type of graph could be used to display each type of data. Explain.

- your classmates' favorite types of music
- number of hours worked and the pay of employees
- the number of flowers on assorted rose bushes

SOLUTIONS

- Students will respond with answers such as rock, country or R&B. This data would be considered categorical. A bar graph, pictograph or pie chart would be a good choice.
- The data includes numbers for the hours and the pay. This data is numerical. Because there are two numbers collected (hours and pay), this is two-variable data. A scatter plot would be the best choice to display the data.
- This data is also numerical. Depending on how many rose bushes are used for the data collection, a stem-and-leaf plot, histogram or box-and-whisker plot could be used.

Of the single-variable numerical data, histograms work well with larger data sets (at least ten numbers) since enough data is available to have bars of some height. Stem-and-leaf plots often work better with smaller data sets (less than twenty numbers) since all the leaves need to be listed. Box-and-whisker plots work well with any numerical single-variable data set.

When making a data display, a helpful question to ask is, “What do I want this data to show?” Is the purpose convincing someone that the data is skewed? Sometimes a data set may appear different when using different types of graphs. Try a variety of graphs and then decide which displays the data best.

EXAMPLE 2

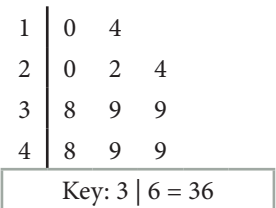
An innkeeper at a ski lodge kept track of the average nightly occupancy for the past eleven months.

Month	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Average Occupancy	38	22	39	49	49	39	48	24	20	10	14

- Use the data to make a stem-and-leaf plot.
- Use the data to make a box-and-whisker plot.
- The innkeeper wants to show the owner that the lodge is getting a lot of visitors. Which graph would be most convincing? Explain.

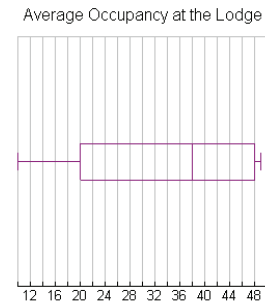
SOLUTIONS

- The numbers vary from 10 to 49. Use 1-4 as the stems. Place the ones digits in the plot as leaves.



- Find the five-number summary of the data.
 10, 14, 20, 22, 24, 38, 39, 39, 48, 49, 49
 10 ~ 20 ~ 38 ~ 48 ~ 49

Put these values on a number line to create the box-and-whisker plot.



- The stem-and-leaf plot is pretty evenly distributed. The box-and-whisker plot shows that there are more larger values (skewed left). The box-and-whisker plot would probably be most convincing to the owner that the lodge has had a lot of visitors.



EXERCISES

- Which types of graphs can be used to display numerical data?
- Which types of graphs can be used to display categorical data?

Classify each data set as either categorical or numerical. State which type of graph could be used to display the following types of data. Justify each answer.

- the heights of students in your class
- the favorite food of students in your class
- the shoe sizes of twelve players on the basketball team
- distance of students' homes from school and the time it takes them to get to school
- the maximum speeds of the top 20 roller coasters in the United States
- number of flowers of each type sold at the local florist
- The following data shows the high temperatures in ten different Oregon cities on a day in November.
20, 25, 38, 38, 44, 44, 50, 50, 60, 69
 - Use the data to construct a box-and-whisker plot.
 - Start at 20 and use an interval width of ten. Construct a histogram of the data.
 - Describe the distribution of the histogram. Is the histogram skewed?
 - Which graph would convince someone that the temperatures in Oregon during November are usually between 38 and 50 degrees?



Make an appropriate graph for each set of data. Use each type of graph below only once.

Histogram Box-and-Whisker Plot Scatter Plot Pie Chart Stem-and-Leaf Plot Bar Graph

10. When Do Students Prefer to do Homework?

After School	In the Evening	In the Morning
14	12	3

11. Costs of Concert Tickets in Dollars

25, 28, 29, 30, 32, 35, 39, 40, 40, 42, 42, 45, 45, 45, 48, 48, 52, 54, 56, 57, 72, 72, 75, 89, 95

12.

Age	10	11	11	12	13	13	14
Height (inches)	48	51	52	52	54	60	59

13. Costs of Boxes of Cereal in Dollars

2.99, 3.25, 3.25, 3.55, 3.65, 3.79, 3.79, 3.88, 3.99, 4.15, 4.15, 4.25, 4.29, 4.35

14. Speed of Drivers on I-5 in Miles per Hour

58, 59, 61, 64, 65, 65, 67, 68, 69, 72, 74

15. How Time is Spent on the Internet

Finances	Research	Entertainment	Shopping
15%	25%	50%	10%

REVIEW

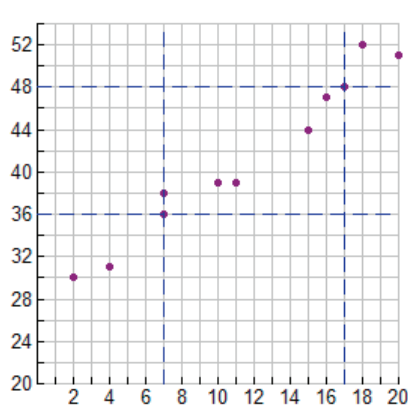
Use the equation and given value of one variable to solve for the other variable.

16. $y = 58 - 5x$
 $x = 7, y = \underline{\hspace{2cm}}$

17. $y = 9x + 5$
 $y = 68, x = \underline{\hspace{2cm}}$

18. $y = 21 - 3x$
 $y = 45, x = \underline{\hspace{2cm}}$

19. Margaret analyzed her employees' pay using a line of best fit. She found that the hourly salary, S , of her employees can be modeled by $S = 8.15 + 0.45n$, where n represents the number of years in the company.
- What is the approximate hourly salary of an employee who has been with the company for 8 years?
 - About how many years will someone need to work for the company in order to make \$14 per hour?

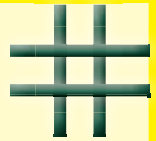


20. Use the scatter plot at left to complete the following. The horizontal and vertical lines representing the quartiles have been drawn in.
- Describe the correlation of the data.
 - Name the two Q-points that follow the direction of the data.
 - Write a slope-intercept equation for the line through the Q-points.

TIC-TAC-TOE ~ CONDUCT A SURVEY



Create a survey with 3 questions. One question should request categorical data and two questions should request numerical data. Survey at least 20 students, asking each student all three questions. Record the data. Choose an appropriate graph to display the results from each question.

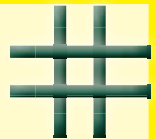


Write a one-page summary of the results from your survey. What do the graphs show about the data? Were the results surprising? Was there any bias in the questions? Did the survey contain a random sample of students? If the survey is done again, would anything change about the data-collection process?

TIC-TAC-TOE ~ CORRELATIONS IN THE REAL WORLD



Find three examples of data sets with correlations in a magazine or newspaper. The three data sets should include at least one example of a positive correlation and one example of a negative correlation. Cut out or make a copy of each data set. Create a scatter plot, draw a line of best fit and describe the correlation of each data set. Explain why you think each data set has the given correlation.



USING DATA AND GRAPHS TO PERSUADE

LESSON 25



Recognize and eliminate bias in surveys and data displays.

Data can be extremely powerful in making decisions and predictions. However, it is important to know that data can also be used to persuade and that sometimes data displays can be misleading. Oftentimes it is consumers who are the targets of misleading data.



A common way of collecting data is using a written or verbal survey. The survey is used to collect information about a specific **population**, the group of people or objects being studied. Instead of studying the entire population, a **sample** might be used. A sample is a part of the population that is used to make conclusions about the entire population. For example, if you wanted information about all the students in your school, you might survey students in a specific class. The class would be a sample of the larger school population. For the results of a survey to be accurate, a **random sample** of the population should be used. A random sample is representative of the population being studied, with each person or object having an equal chance of being in the sample.

EXAMPLE 1

For each situation, which option gives the best random sample? Explain.

a. What is teenagers' favorite food?

Option 1: Ask all your friends to name their favorite food.

Option 2: Ask students in the hallway during passing time.

b. How many books do students typically read per year?

Option 1: Ask students in the cafeteria during lunch time.

Option 2: Ask students in the library during lunch time.

SOLUTIONS

a. Option 2. Asking only friends does not give other teenagers the opportunity to be in the sample. Asking students in the hallway would give the best random sample.

b. Option 1. Students in the library at lunch time are more likely to read a lot of books. This does not give a very random sample. Surveying students in the cafeteria is more likely to give a random sample of students' reading habits.



When conducting a survey or analyzing the results of another survey it is important to keep these questions in mind:

WHO?

WHAT?

WHEN?

WHERE?

HOW?

Who conducts the survey or data collection can make a big difference in how people respond. Are people going to feel comfortable being truthful to the surveyor?

What questions are asked can greatly affect the results of a survey. Are the questions asked going to lead people to a certain answer?

When a survey is conducted can affect the randomness of the sample. Is each person in the studied population given an equal chance to be included?

Where the survey is given also affects the randomness of the sample. Is the chosen location likely to make certain groups of people more or less likely to be represented?

How the survey is given should be considered. Is it a verbal or written survey? Is responding optional? Optional surveys tend to get responses from people with strong opinions.

EXPLORE!

ELIMINATING BIAS

Each survey situation has some sort of **bias**. Bias is a systematic error that contributes to the inaccuracy of a sample.

- A. A restaurant owner asks customers to rate their dining experience on a scale of 1-10 as they leave the restaurant.
- B. A worker surveys people outside the monkey exhibit: "What is your favorite animal at the zoo?"
- C. A pollster questions customers as they leave a local grocery store on a Saturday: "How much do you spend weekly on groceries?"
- D. An ice cream company surveys customers, asking: "What is your favorite type of ice cream: Chocolate, Vanilla or Caramel Fudge Swirl?"
- E. A restaurant leaves a comment card at each table where customers can choose to rate their dining experience on a scale of 1-10.



WHO? WHAT? WHEN? WHERE? HOW?

Step 1: Identify which type of bias (who, what, when, where, how) each situation could create. Explain.

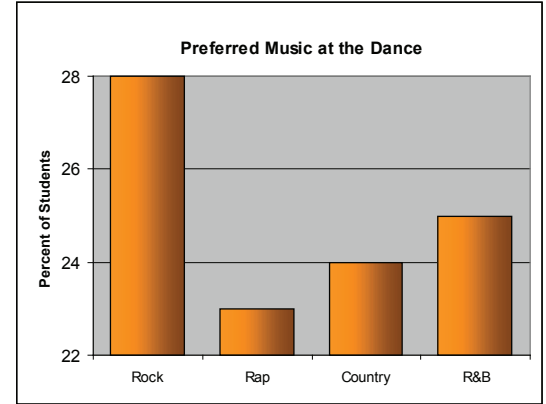
Step 2: Describe how each survey situation could be improved to eliminate the bias.

Another way data can be misleading is in how it is displayed. Choosing certain types of graphs over others as well as changing the scale of axes can create very different impressions of a data set.

EXAMPLE 2

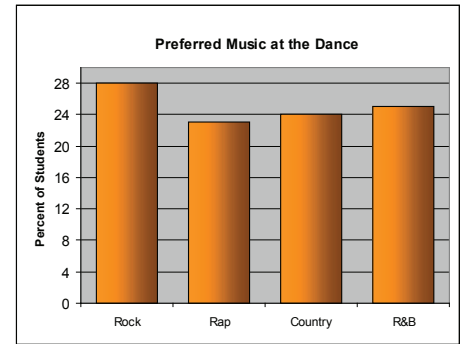
Students at Humphrey Middle School collected data on the type of music students would prefer for the next school dance. The bar graph at right shows the results.

- What is misleading about the graph?
- Draw a new bar graph which represents the data better.
- Why might someone use the original graph to represent the data?



SOLUTIONS

- The graph does not start at 0%. This makes it appear that Rock had a large majority of the votes. There is really only five percent difference between Rock and Rap.
- Starting the graph at 0% would better represent how close the vote was.
- If someone really wanted to convince people that Rock was a far more popular choice among students, they might use the original graph.



EXERCISES

- What is the difference between a population and a sample?
- Why is it important to have a random sample when doing a statistical study?
- Brad writes for the school newspaper. He surveyed a group of his friends using the survey questions at the right. He called them late the night before his article was due to the newspaper. Some of his friends did not answer the phone. He drew the following conclusions for his article:

Students at Happy Rock Middle School

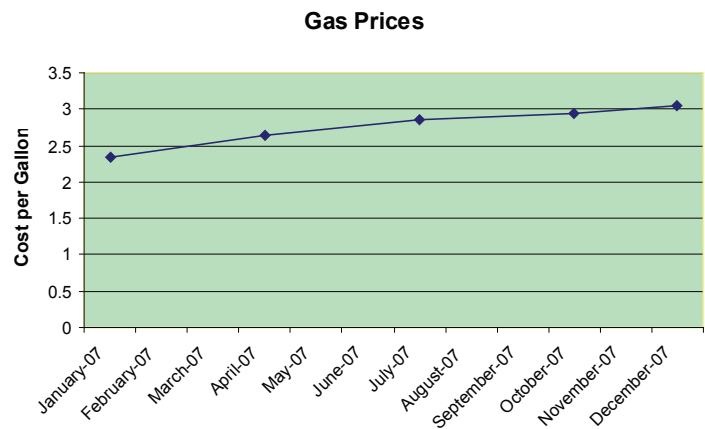
- What is your favorite class? (Choose one)
Science ___ Math ___ Music ___
- How many classes do you have an A in?
- How late do you stay up on school nights?

- ◆ Students at Happy Rock Middle School say math as their favorite class.
 - ◆ They have an average of 5 As in their classes.
 - ◆ Students typically stay up until about 11 pm.
- Who did Brad survey to get his data? How might this create bias?
 - What is wrong with the conclusion Brad made from question #1 on his survey?
 - Is Brad's data about the number of As that students are earning accurate? What bias might have been created when Brad asked his friends this question?
 - Brad made his phone calls late at night. How might this have affected the results of his survey?
 - If Brad did his survey again, what recommendations would improve the accuracy of the results?

Describe the possible bias in each survey situation. Explain how to modify each situation to eliminate the bias.

4. An employee asks customers entering a pizza restaurant about their “favorite type of food”.
5. The president of a company asks employees if they are “happy with their salary”.
6. Respondents answer a telephone survey about whether they plan to vote Republican or Democrat for the next Presidential election.
7. A girl asks her friends how much allowance they receive per month to determine a typical allowance amount.
8. A hair salon placed a “1-800” number on its receipts so customers can call and give feedback on their haircuts.
9. A teacher asks the first one hundred students who arrive at school on Monday what their GPA is in order to determine the typical GPA of students at her school.
10. The line plot at right shows the gas prices at one gas station five different times in 2007.

- a. Draw a new line plot which exaggerates the increase in gas prices throughout the year 2007.
- b. Which graph (the original or the graph from part a) would the station owner use to bring in customers? Explain.
- c. Which graph would a car dealer use to convince customers to buy a hybrid vehicle? Explain.



REVIEW

State which type of graph you would use to display each type of data. Justify your answers.

11. the number of push-ups that 15 students can do in five minutes
12. the number of your classmates that own dogs, cats, birds and reptiles
13. heights of students in your class and the time it takes them to run a mile

14. Pete researched the cost of flying a group of people from Portland to San Francisco for a baseball game. He found that as more people were included in the group, the cost per person went down. The data he collected is in the following table.

Number of People in Group	1	3	5	6	8	9	10	11	12	13	15
Cost per Person (dollars)	350	325	300	295	265	260	255	250	240	230	215

- Make a scatter plot of the data. Let x represent the number of people in the group and y represent the cost per person.
 - Find the quartiles of the x - and y -values. Draw in horizontal and vertical lines on your graph at those values.
 - Write the ordered pairs for the two Q-points which the data follows.
15. The table compares hamburger calories at two different fast food restaurants.



Burgertopia		Burger Shack	
Burger Name	Calories	Burger Name	Calories
Single with Cheese	450	Basic Burger	240
Deluxe	590	Double Burger with Cheese	610
Deluxe with Cheese	690	SupraBurger with Cheese	700
MegaBurger	825	Monster Burger	840

- Find the mean, median and mode for the number of calories in hamburgers at each restaurant.
- Burger Shack boasts that their burgers average less than 600 calories. What is misleading about that claim?

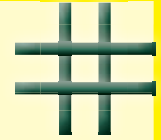
TIC-TAC-TOE ~ GOOD SURVEY/BAD SURVEY



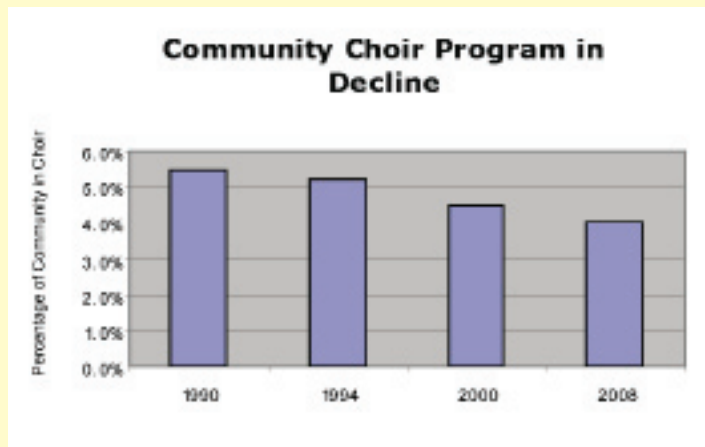
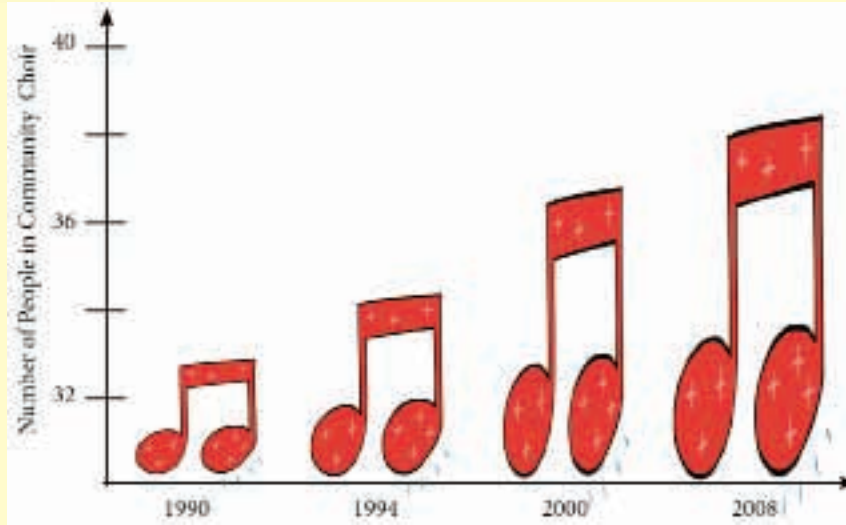
Lesson 25 explained random samples and bias. Use that information to create a good survey. The survey should include at least five questions that are worded appropriately to eliminate bias. Explain how to conduct the survey (the “who”, “what”, “when”, “where”, “how” from **Lesson 25**). The survey does not have to actually be conducted. Just explain how it should be done and the questions to ask.

Next, take the good survey and turn it into a bad survey. The content of the questions should stay the same. Change how the questions are worded. Also, explain how to conduct this survey. The bad survey should show an understanding of the various forms of bias and a lack of random sampling. You do not actually have to conduct the survey; just explain how it should be done.

Tic-Tac-Toe ~ A MISLEADING GRAPH?



The two graphs below give information about the number of people who participated in the community choir over the years. The choir director used the first graph to argue that more resources and money need to be given to the community choir program. The second graph is used by a community member to argue that the choir program does not need more money and resources. Which is true?



Use the graphs above to answer each question.

1. Which position do you favor in this argument and how do the graphs support your reasoning?
2. Is one of the graphs misleading? If so, explain how it is misleading.
3. Is there any other information the City Council should want to know before deciding how much money should be given to the choir program?

Find another graph in a newspaper or magazine that seems to be misleading. Attach the graph to a separate sheet of paper. Explain why the graph is misleading. Describe how the graph should be changed so that it is not misleading.



Vocabulary



bias
categorical data
correlation
line of best fit

numerical data
ordered pairs
population
Q-points
random sample

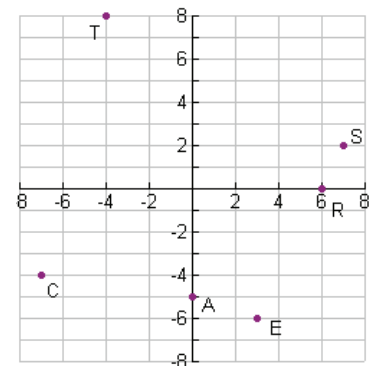
sample
scatter plot
single-variable data
two-variable data



- Read, create and describe the correlations in scatter plots.
- Draw a line of best fit for a set of data.
- Use a line of best fit to make predictions.
- Write equations for a line of best fit based on Q-points.
- Use equations based on data to make predictions and judge the reasonableness of predictions.
- Choose an appropriate display for a set of data.
- Recognize and eliminate bias in surveys and data displays.

Lesson 20 ~ Scatter Plots and Correlation

1. Write the ordered pair for each point in the scatter plot at right.



Explain whether each set of data shows positive, negative or no correlation.

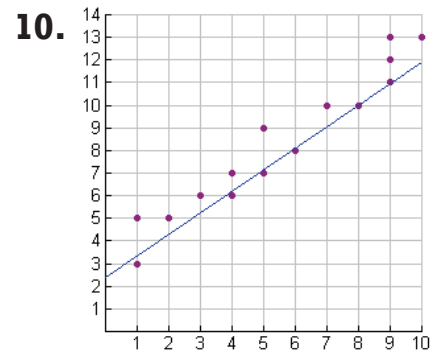
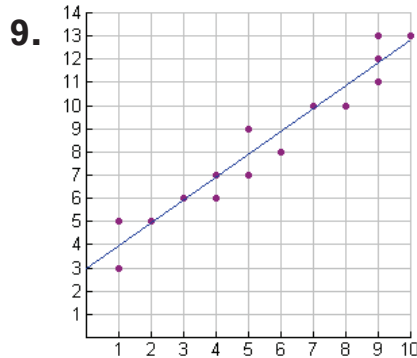
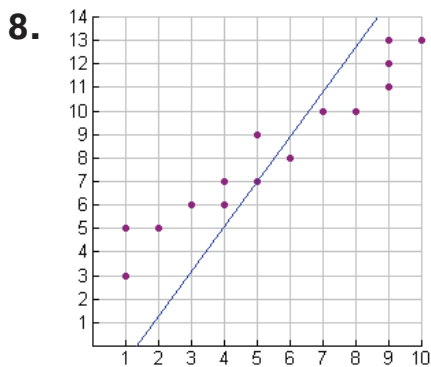
2. a person's income and the size of their house
3. the cost of jeans and the number of pairs sold
4. hours spent exercising and the number of calories burned
5. a person's height and the hours they spend exercising
6. Kelby sells hot dogs in the park during the summer. He collected data to show the relationship between the outside temperature and the number of hot dogs he sold.
 - a. Make a scatter plot of the data. Use the outside temperatures as the x -variable and the number of hot dogs sold as the y -variable.
 - b. Describe the correlation.

Outside Temperature (Fahrenheit)	Number of Hot Dogs Sold
83°	29
80°	30
95°	13
72°	38
76°	32
88°	24
97°	9
92°	12

Lesson 21 ~ Predicting with Lines of Best Fit

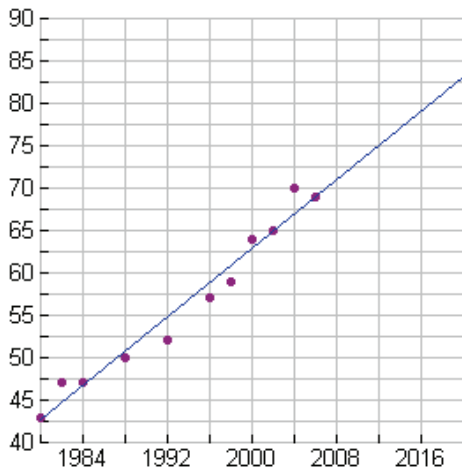
7. What are the characteristics of a good line of best fit?

Identify whether each graph has a good line of best fit. If the line is not a good fit, explain why.

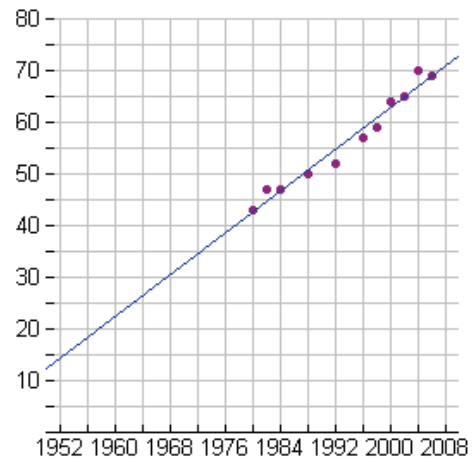


Use the scatter plot and line of best fit to approximate each missing value.

11. When $x = 2020$, $y =$ _____

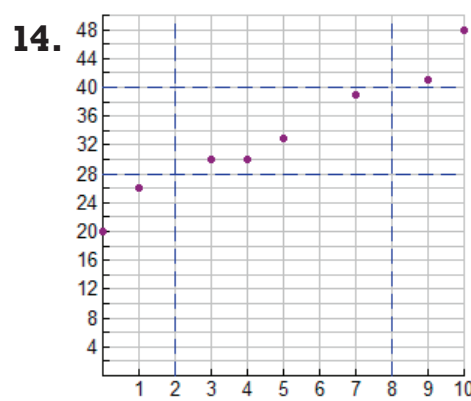
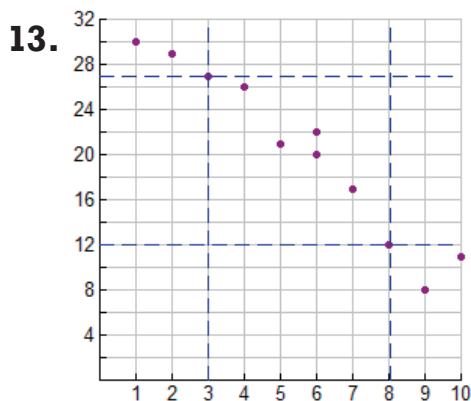


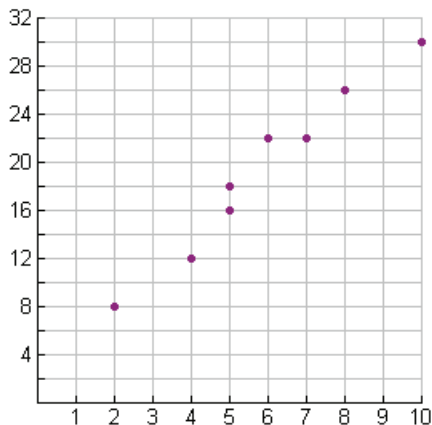
12. When $y = 30$, $x =$ _____



Lesson 22 ~ Q-Points and Lines of Best Fit

Write the ordered pairs for the two Q-points that follow the pattern of the data best. Find the slope-intercept equation for the line through those points.





- 15.** Use the scatter plot at left.
- Write the ordered pairs for the points that are shown in the scatter plot.
 - Find the five-number summary of the x -coordinates.
 - Find the five-number summary of the y -coordinates.
 - Copy the scatter plot and draw in the horizontal and vertical lines from the quartiles in **parts b and c**.
 - Write the ordered pairs for the two Q-points that follow the data best.

- 16.** Nolan works at Mt. Bachelor. He noticed there was a correlation between the number of inches of new snow that day and the number of skiers per hour on a particular ski-run. Use the data to find the equation of a line of best fit based on Q-points.

Number of Inches of New Snow (x)	1	4	5	5	6	7	7	8	9	10	10
Number of Skiers per Hour (y)	25	30	32	35	34	38	40	45	51	53	56

Lesson 23 ~ Predicting with Best Fit Equations

Use the equation and given value of one variable to solve for the other variable.

17. $y = 48 - 3x$
 $x = 9, y = \underline{\hspace{2cm}}$

18. $y = 7x + 25$
 $y = 67, x = \underline{\hspace{2cm}}$

- 19.** Jessica makes and sells jewelry. She determines her profit, P , from selling the jewelry using the equation $P = 14j - 42$, where j represents the number of pieces of jewelry sold.
- Jessica makes and sells 10 pieces of jewelry in one month. How much profit will she make?
 - How many pieces of jewelry will Jessica need to sell in order to make \$1,000?

- 20.** Tanner worked to improve his maximum bench-press lift. Using a scatter plot, he determined that the weight he can lift, L , can be modeled by $L = 185 + 2.4w$, where w represents the number of weeks he has been lifting.
- Tanner lifts weights for 8 weeks. How much will he be able to bench-press?
 - How many weeks will Tanner need to lift to be able to bench-press 221 pounds?
 - If Tanner lifts weights for 100 weeks, how much will he be able to bench-press according to this model? Is this realistic? Explain.



Lesson 24 ~ Choosing Appropriate Data Displays

21. What is the difference between numerical and categorical data? Give examples of each.

State which type of graph (histogram, pie chart, scatter plot) could be used to display each type of data. Justify your answer.

22. the allowance of all 8th graders in your school

23. amount of water given to plants and their heights

24. type of vegetable most recently eaten by students in your class



Make an appropriate graph for each set of data. Use each type of graph only once.

Box-and-Whisker Plot	Histogram	Bar Graph
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25.

Favorite Item to Shop For	Number of Students
Clothes	2
Electronics	5
Books	5
Video Games	3
Movies	12

26. Cost of a 1-topping pizza from various pizza parlors: \$12.50, \$8.50, \$9.99, \$11.99, \$7.99, \$10.50, \$10.99, \$9.99, \$15.49, \$10.99, \$10.49, \$10.00

27. Age of cats in years at a veterinary clinic on a given day: 3, 10, 12, 1, 17, 10, 13, 5, 1, 19, 15, 12, 9, 16, 13, 18

Lesson 25 ~ Using Data and Graphs to Persuade

Describe how there could be bias for each survey situation. Explain how each could be changed to eliminate the bias.

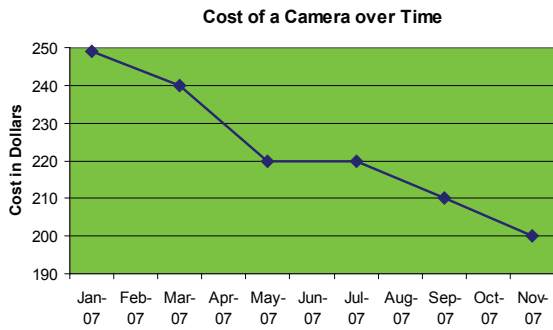
28. You ask 20 of your friends what their favorite movie is in order to collect data on students' favorite movies.

29. An employee surveys customers outside of an ice cream shop to determine how many times per month people eat ice cream.

30. A movie critic hands out mail-in questionnaires to people leaving the theater to determine whether people liked the movie they just saw.

31. A student asks other students at school to choose their favorite fruit from bananas, apples and strawberries.

32. The president of a company asks employees if they are "happy with their job" after the employee received a pay raise.



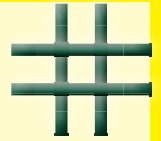
- 33.** The graph at left shows the change in the cost of a digital camera throughout the year. What is misleading about the graph? Draw a new graph that is not misleading.



TIC-TAC-TOE ~ GLOSSARY FLASHCARDS



Create flashcards for all vocabulary terms in this book. Write the term on one side of the flashcard. The other side of the flashcard should have a definition, a picture, a formula and/or an example.



Quiz yourself on the various vocabulary terms. Create three stacks of flashcards. The first stack should include terms that you know well. The second stack should include terms that you know fairly well, but still need to study. The third stack should include terms that you do not remember very well. Write a short reflection about what terms you still need to study. Turn in the flashcards and reflection.

TIC-TAC-TOE ~ TEST A THEORY



A conjecture is a statement thought to be true but not proven. Think of two conjectures about students in school that states a relationship of two variables. For example, “As students get older, the amount of homework they are assigned increases.”



Conduct a survey of at least 30 students at school. Collect the data necessary to test the conjectures. Make a scatter plot of each set of data and analyze the results. Describe the correlations of the data sets. Were the conjectures correct? Was there anything surprising about the results of the survey?

CAREER FOCUS

BOB
ACTUARY
PORTLAND, OREGON



I am an actuary. An actuary places a value on things that could be lost, broken or destroyed. For instance, suppose it took you a year to save up enough money to purchase an MP3 player. When you buy the MP3 player, the clerk tells you that if it breaks in the first six months the store will replace it. The clerk also tells you that for a few more dollars, the store will replace it if anything goes wrong for two years. The person who calculates how much needs to be paid to guarantee that your MP3 player will be fixed is called an actuary. Actuaries determine how much should be paid for different kinds of insurance to guarantee there will be enough money to replace or fix whatever is wrong.

As an actuary, I use math every day. I use probabilities to calculate things like how many MP3 players will quit working in the first two years. I use division to decide how much each person who wants insurance on their MP3 player should pay for that insurance.

In order to become an actuary, I got a Bachelor's degree in Mathematics. I also got a Masters in Actuarial Science. I had to take 10 exams to achieve the highest actuarial designation offered by the Society of Actuaries. That designation is the Fellow of the Society of Actuaries.

Most actuaries start out making between \$44,000 - \$61,000 per year. After passing a few of the exams and working for a few years, many actuaries can make over \$100,000 per year.

I enjoy my job. I like to provide assurance for people that their valuable items are protected from loss and damage. Insurance helps protect people when unfortunate events occur. As an actuary, I am able to help insurance companies know how much to charge.