PRE ALGEBRA 2 - PA CORE 8 – COURSE 3
STUDENT WORKBOOK
UNIT 5 – STATISTICS AND PROBABILITY

Before		

After		

Unit 5	Statistics and Probability	PURPLE	GREEN	RED
9.1	Scatter Plots	8.5	B-7	
9.2	Lines of Best Fit			
9.3	Two Way Tables			
9.4	Descriptive Statistics			
9.5	Measures of Variation			16.3
9.6	Analyze Data Distributions			16.4

STUDY ISLAND TOPICS

Scatter Plots
Best-Fit Linear Models
Two Way Tables

Name: _____ Period _____

Lesson 1 Skills Practice

Scatter Plots

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

1.
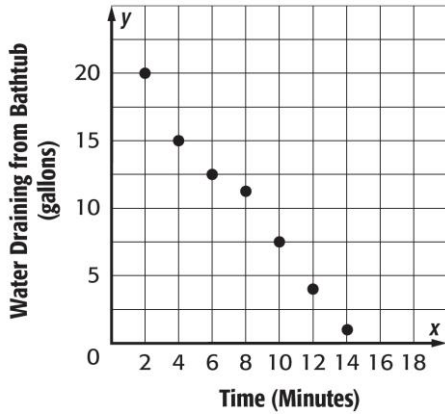
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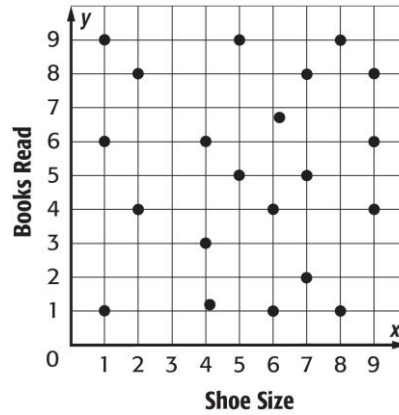
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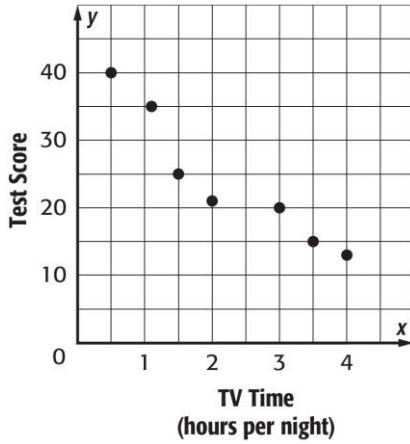
4.
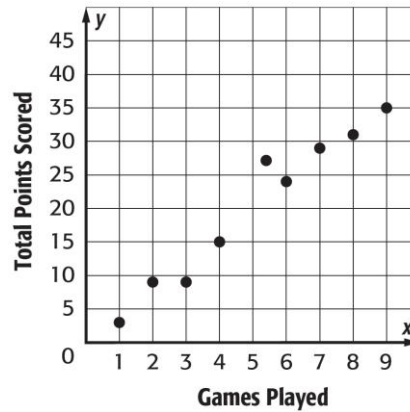
5. E-MAIL Construct a scatter plot of the number of E-mails Vincent received over the past six days. Interpret the scatter plot.

Day	1	2	3	4	5	6
E-mails	16	21	3	11	19	5

Lesson 1 Problem-Solving Practice

Scatter Plots

WAGES For Exercises 1 and 2, use the table below.

Years Since 2002	Average Hourly Wage
1	$12.25
2	$12.75
3	$13.50
4	$14.00
5	$14.75
6	$15.25

BRICKS For Exercises 3 and 4, use the table below.

Time (minutes)	Bricks Remaining
0	600
10	565
20	530
30	495
40	460
50	425

1. Construct a scatter plot of the data.

3. Construct a scatter plot of the data.

2.

a. Does the scatter plot show a *positive*, *negative*, or *no* association? Explain.

b. If an association exists, make a conjecture about the hourly wages in 2009.

4.

a. Does the scatter plot show a *positive*, *negative*, or *no* association? Explain.

b. If an association exists, make a conjecture about the number of bricks remaining to be loaded after 1 hour and 10 minutes has passed.

Name_____

Scatter Plots

Date_____ Period____

State if there appears to be a positive correlation, negative correlation, or no correlation. When there is a correlation, identify the relationship as linear or nonlinear.

1)

2)

3)

4)

5)

6)

4
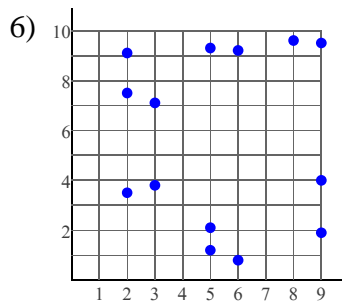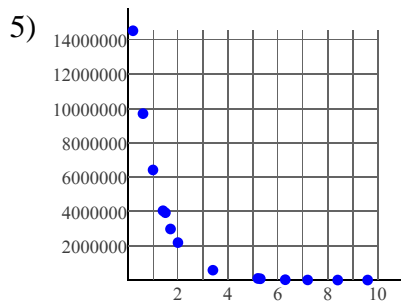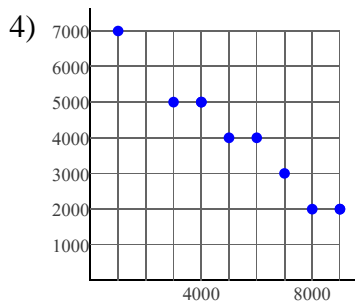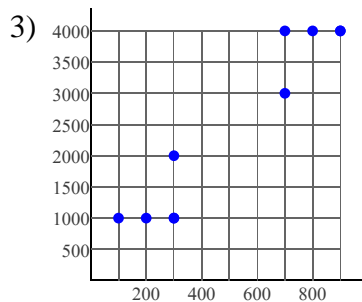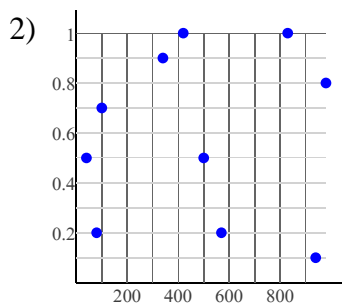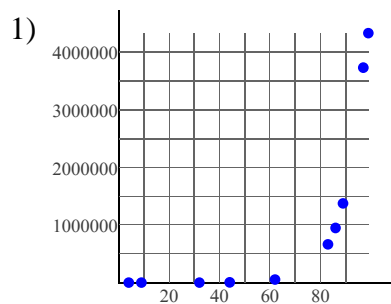
Construct a scatter plot.

7)

X	Y
300	1
800	1
1,100	2
1,600	2
1,700	2

X	Y
1,800	3
3,400	3
4,700	4
6,000	4
8,500	6

8)

X	Y
0.1	7.5
0.1	7.6
0.3	4.5
0.4	3.2

X	Y
0.4	3.3
0.6	1.4
0.6	1.7

X	Y
0.6	1.8
0.9	1.5
1	1.7

Construct a scatter plot. Find the slope-intercept form of the equation of the line that best fits the data.

9)

X	Y
10	700
10	800
30	400
30	500

X	Y
40	300
60	200
70	100

X	Y
70	100
80	100
100	200

10)

X	Y
1	20
2	40
3	50
4	60

X	Y
5	70
6	80
7	80

X	Y
7	80
9	80
10	80

5

Name_____

Scatter Plots

Date_____ Period____

State if there appears to be a positive correlation, negative correlation, or no correlation. When there is a correlation, identify the relationship as linear, quadratic, or exponential.
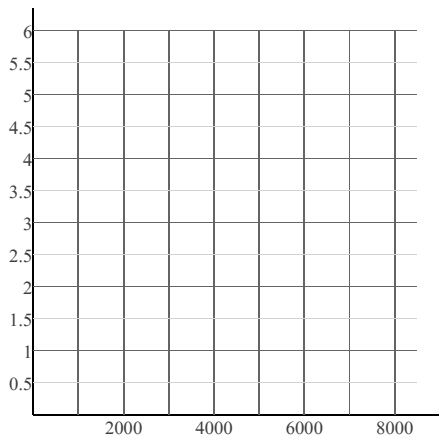
1)

2)

3)

4)

Construct a scatter plot. State if there appears to be a positive correlation, negative correlation, or no correlation. When there is a correlation, identify the relationship as linear, quadratic, or exponential.

5)

X	Y	X	Y
1,000	1,300	5,000	2,500
2,000	1,500	7,000	3,600
3,000	2,000	7,000	3,700
3,000	2,000	9,000	4,200
4,000	2,400	10,000	5,200

6)

X	Y	X	Y
140	500	280	900
150	1,000	450	500
170	300	450	500
180	100	770	400
270	200	910	600

6
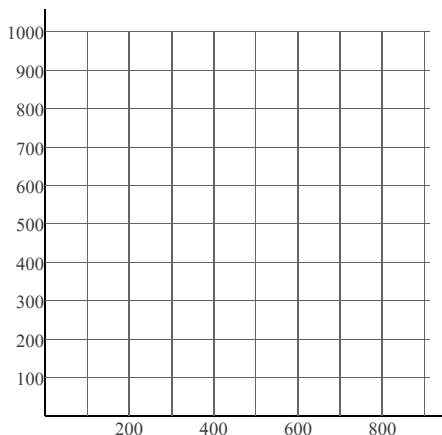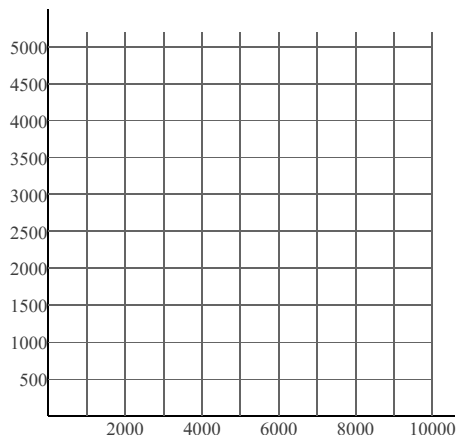
Find the slope-intercept form of the equation of the line that best fits the data.

7)

X	Y
2	150
11	280
27	490
27	500
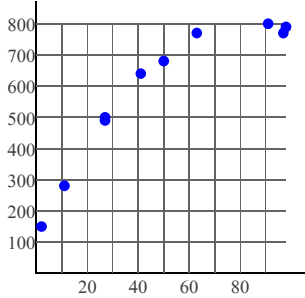
X	Y
41	640
50	680
63	770

X	Y
91	800
97	770
98	790

Construct a scatter plot. Find the slope-intercept form of the equation of the line that best fits the data and its r² value.

8)

X	Y
0.1	2,000
0.1	2,000
2.6	3,000
3.7	4,000
3.8	4,000

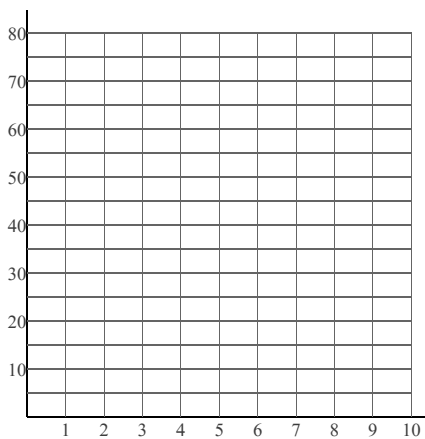| X	Y
5	5,000
6.7	6,000
7.9	7,000
8.5	8,000
9.4	8,000
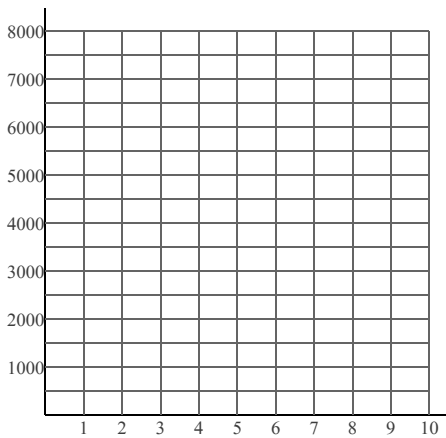
Lesson 2 Skills Practice

Lines of Best Fit

1. **BOATING** Rehan's yacht holds 70 passengers. Each hour he stops at the marina to let some passengers off and on. The table shows how many passengers are on board during each hour of boating.

Hour	1	2	3	4	5
Passengers	30	40	32	40	55

   a. Construct a scatter plot of the data. Then draw and assess a line that seems to best represent the data.

   b. Use the line of best fit to make a conjecture about the number of passengers on the boat during hour 8.
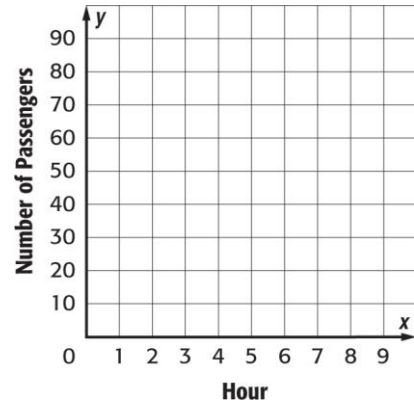
2. **RESALE VALUE** The table shows the resale value of six SUVs plotted against the age of the vehicle.

Age (yr)	1	2	3	4	5	6
Value ($1,000)	24	22	19	17	16	13

   a. Construct a scatter plot of the data. Then draw and assess a line that seems to best represent the data.

   b. Use the line of best fit to estimate the resale value of a 7-year-old SUV.
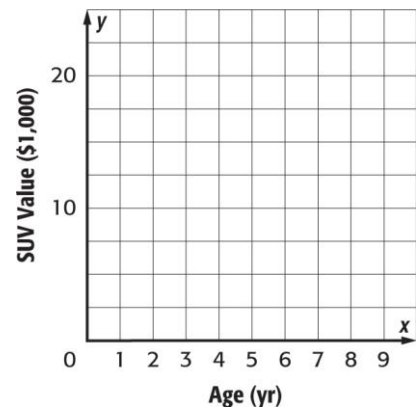
3. **BIRD WATCHING** Sage belongs to a bird-watching club. Every two days, she goes out and counts the number of Black-hooded Parakeets she sees. The scatter plot shows the number of parakeets she saw in the past 12 days.

   a. Write an equation in slope-intercept form for the line that is drawn.

   b. Use the equation to make a conjecture about the number of parakeets she saw on the eighteenth day.

8
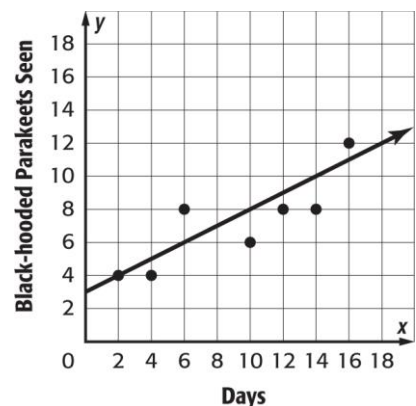
Lesson 2 Problem-Solving Practice

Lines of Best Fit

FALL Haley has a leaf-raking company to help offset school costs. The table shows how many bags of leaves Haley was able to fill each hour. Use the information in the table to answer Exercises 1 and 2.

Hour	1	2	3	4	5
Bags Filled	3	4	5	8	14

1. Construct a scatter plot of the data. Then draw and assess a line that represents the data.
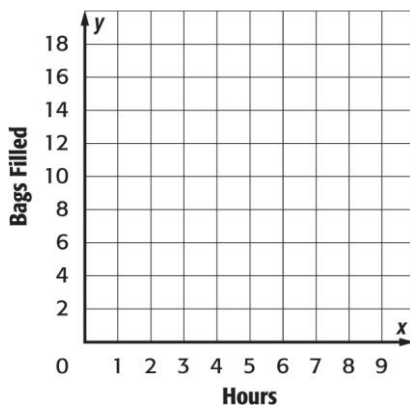
2. Use the line of best fit to make a conjecture as to how many bags of leaves Haley will have filled at the end of 7 hours of raking.

BABY POOL Cleo's baby pool has a leak. The scatter plot shows the amount of water left in the pool at the end of each 5-minute segment. Use the information in the scatter plot to answer Exercises 3 and 4.
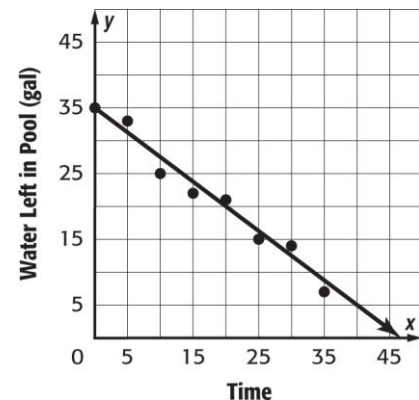
3. Write an equation in slope-intercept form for the line that is drawn.

4. Use the equation to make a conjecture about the amount of water left in the pool after 40 minutes.

9

Name_____

Using Statistical Models

1) The height and weight of adults can be related by the equation $y = 49.2x - 134$ where x is height in feet and y is weight in pounds.
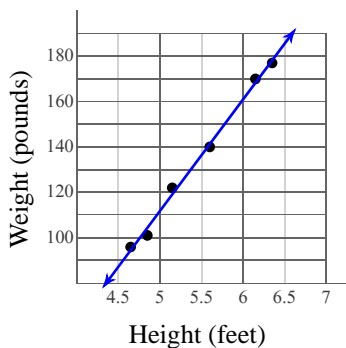
a) What does the slope of the line represent?

b) What does the y-intercept of this function represent?

2) The average amount of electricty consumed by a household in a day is strongly correlated to the average daily temperature for that day. This relationship is given by $y = 0.46x + 6.17$ where x is the temperature in °F and y is the amount of electricity consumed in kilowatt-hours (kWh).
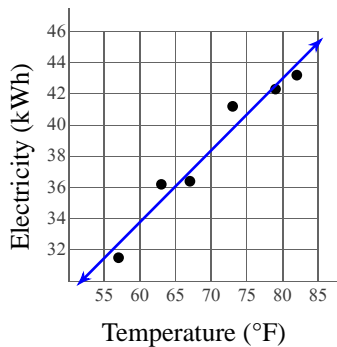
a) What does the slope of the line represent?

b) What does the y-intercept of this function represent?

3) The number of marriage licenses issued by Clark County Nevada, the county where Las Vegas is located, has been decreasing since the year 2000:

Year	Marriage Licenses
2001	141,000
2006	127,000
2007	121,000
2010	111,000
2011	109,000
2012	104,000

This can be modeled by the equation $y = -3358.1x + 6861400$ where x is the year and y is the number of marriage licenses issued.
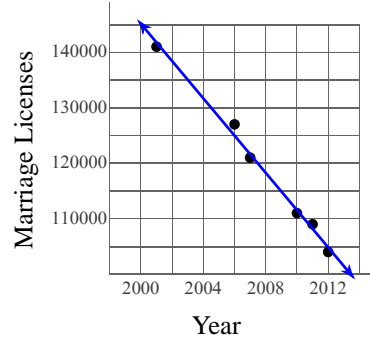
a) According to the model, how many marriage licenses were issued in 2004? Round your answer to the nearest hundred.

b) Using this model, how many marriages licenses would you expect to be issued in 2023? Round your answer to the nearest hundred.

c) According to the model, in what year did Clark County issue 140,000 marriage licenses? Disregard years before 1990. Round your answer to the nearest year.

4) With the help of scientists, farmers in Cameroon have been able to produce more and more grain per hectare each year. Here are the crop yields for several years:

Year	Yield (kg/hectare)
1962	656
1969	728
1974	846
1980	1,100
2000	1,480
2004	1,540

The crop yield can be described by the equation $y = 22.3x - 43100$ where x is the year and y is the grain yield in kilograms per hectare (kg/ha).
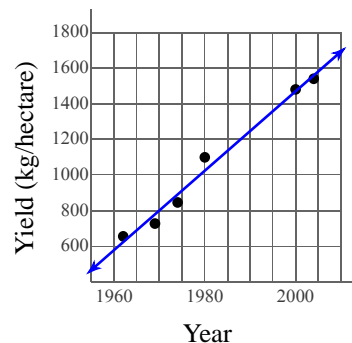
a) According to the model, what was the crop yield in 1988? Round your answer to the nearest whole number.

b) Assuming that this trend continues, what crop yield is predicted for the year 2022 by the model? Round your answer to the nearest whole number.

c) The model indicates that a crop yield of 1300 kg/hectare was achieved in what year? Round your answer to the nearest year.

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Name_____

Using Statistical Models

Date_____ Period_____

1) The oyster population of the Chesapeake Bay has been in decline for over 100 years. This can be expressed by the equation $y = 41.6 \cdot 0.969^x$ where x is the number of years since 1900 and y is the amount of oysters harvested in metric tons.

Years since 1900
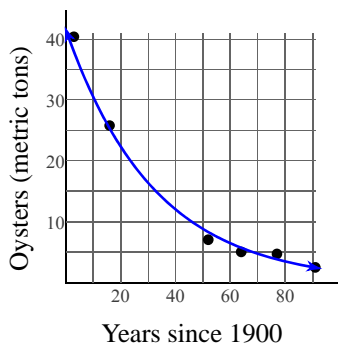
What does the y-intercept of this function represent?

2) The Hurricane Hunters took the following measurements from a hurricane over several days as it developed:

Air Pressure (kPa)	Wind Speed (knots)
924	126
946	104
956	93.5
967	84.9
991	44.4
1,003	30.6

They found that the air pressure and wind speed are related in the following way: $y = -1.24x + 1270$ where x is the air pressure in millibars (kPa) and y is the maximum sustained wind speed in knots (nautical miles per hour).
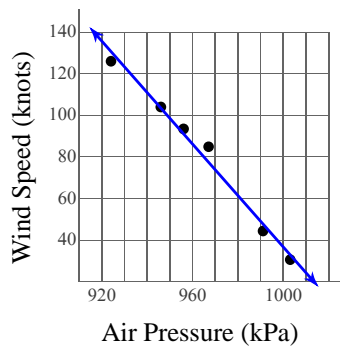
Air Pressure (kPa)

a) Using the model, what would be the wind speed of a hurricane with an air pressure of 980 kPa? Round your answer to the nearest knot.

b) According to the model, a hurricane with an air pressure of 891 kPa would have what wind speed? Round your answer to the nearest knot.

c) The model indicates that a wind speed of 110 knots is associated with what air pressure? Round your answer to the nearest millibar.

3) The time for the fastest runner for their age in the Marine Corps Marathon is given for several ages:

Age	Time (minutes)
17	196
30	149
35	149
47	174
50	173
55	182

This can be modeled by the equation $y = 0.111x^2 - 8.1x + 299$ where x is the age and y is the number of minutes taken.
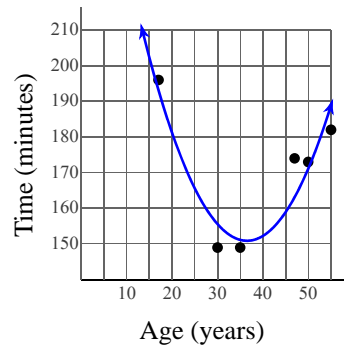
a) Using this model, what would be the time for the fastest 41-year-old? Round your answer to the nearest hundredth.

b) According to the model, what would be the time for the fastest 83-year-old? Round your answer to the nearest hundredth.

c) What age(s) correspond to a time of 171 minutes? Round your answer(s) to the nearest tenth.

4) Economists have found that the amount of corruption in a country is correlated to the productivity of that country. Productivity is measured by gross domestic product (GDP) per capita. Corruption is measured on a scale from 0 to 100 with 0 being highly corrupt and 100 being least corrupt:

Corruption Score	GDP Per Capita ($)
18	2,850
24	4,050
33	3,740
45	10,100
60	25,000
65	25,000

This can be modeled by the equation $y = 525x - 9640$ where x is the corruption score and y is GDP per capita in dollars.
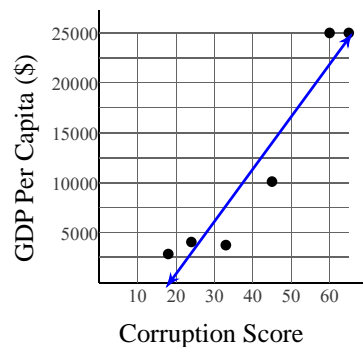
a) According to the model, what would be the GDP per capita of a country with a corruption score of 38? Round your answer to the nearest dollar.

b) Using this model, a country with a corruption score of 75 would have what GDP per capita? Round your answer to the nearest dollar.

c) A GDP per capita of $17,000 corresponds to what corruption score, according to the model? Round your answer to the nearest whole number.

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Lesson 3 Skills Practice

Two-Way Tables

For Exercises 1 and 2, construct a two-way table summarizing each set of data.

1. There are 195 male and 126 female students at McGuffey Junior High. A survey showed that 110 males and 84 females ride the bus.

	Bus	Not Bus	Total
Males			
Females			
Total			

2. The two-way table shows the enrollment in language classes at Carson Middle School. Find and interpret the relative frequencies of students in the survey by row. Round to the nearest hundredth if necessary.

	Spanish	Not Spanish	Total
Chinese	30	65	95
Not Chinese	20	5	25

3. Refer to the table in Exercise 2. Find and interpret the relative frequencies of students in the survey by column. Round to the nearest hundredth if necessary.

	Spanish	Not Spanish
Chinese	30	65
Not Chinese	20	5
Total	50	70

Lesson 3 Problem-Solving Practice

Two-Way Tables

Solve.

1. Ricardo surveyed 110 eighth grade students to find out if they have a part time job. There are 60 students who have a part-time job, including 48 honor roll students. Half of the students who do not have a job are on the Honor Roll. Construct a two-way table summarizing the data.

	On Honor Roll	Not on Honor Roll	Total
Job			
No Job			
Total			

Customers entering a store were asked what electronic technology they own. The results of the survey are shown at the right. For Exercises 2 and 3, round relative frequencies to the nearest hundredth if necessary.

	E-Reader	No E-Reader	Total
Laptop	20	8	28
No Laptop	45	22	67
Total	65	30	95

2. Find and interpret the relative frequencies by row.	3. Find and interpret the relative frequencies by column.

Lesson 4 Skills Practice

Descriptive Statistics

For Exercises 1−3, find the mean, median, mode, and range of each data set.

1. The points scored by a football team: 21, 24, 14, 14, 0, 16, 21, 28, 6, 20

2. Weekly earnings in dollars: 245, 250, 205, 240, 250, 275, 260, 295, 255, 225, 250

3. Science quiz scores: 61, 96, 97, 87, 84, 91, 98, and 86

4. Find the five-number summary of the data in Exercise 2. Draw a box plot of the data.
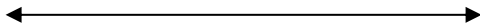
5. Find the five-number summary of the data in Exercise 3. Draw a box plot of the data.

Lesson 4 Problem-Solving Practice

Descriptive Statistics

1. The daily visitors to a carnival for one week in May are 125, 134, 132, 120, 145, 170, and 150. What is the mean number of visitors? Round to the nearest whole number.

2. Carlos read a novel for language arts class. The minutes he read each night are 40, 45, 35, 50, 25, 35, 60, 55, 40, and 30. What is the median number of minutes Carlos read?

3. The ages, in years, of children at a birthday party are 10, 12, 9, 7, 10, 12, 14, 14, 10, and 16. What are the mean, median, mode, and range of ages? Round to the nearest tenth.

4. Latoya is saving to buy a digital camera. Her savings, in dollars, for the last eight weeks are 27, 35, 35, 32, 26, 34, 36, 27, and 38. Which is greater: Latoya's median weekly savings or Latoya's mean weekly savings? Explain.

5. Find the five-number summary of the data in Exercise 3. Draw a box plot to represent the data.

6. What is a conclusion that can be drawn from the box plot in Exercise 5?

Name_____

Center and Spread of Data

Date_____ Period_____

Find the mode, median, mean, range, lower quartile, upper quartile, interquartile range, and mean absolute deviation for each data set.

1)   Shoe Size

6.5	7	7.5	8	8	8	9
10	10.5					

2)   Hits in a Round of Hacky Sack

2	3	3	3	4	4	6	7
12	18	19					

3)   Academy Awards

Movie	# Awards
The Greatest Show on Earth	2
Gentleman's Agreement	3
The Great Ziegfeld	3
The King's Speech	4

Movie	# Awards
No Country for Old Men	4
Unforgiven	4
It Happened One Night	5
Forrest Gump	6

Movie	# Awards
Mrs. Miniver	6
Lawrence of Arabia	7
On the Waterfront	8

4)   Average Time to Maturity

Plant	Days
Bok Choi	45
Okra	55

Plant	Days
Swiss Chard	60
Bell Pepper	75

Plant	Days
Sugar Baby Watermelon	75
Cantaloupe	80

Plant	Days
Honeydew	80
Beefsteak Tomato	80

Plant	Days
Rutabaga	90
Tomatillo	100

5) European Spacecraft Launches
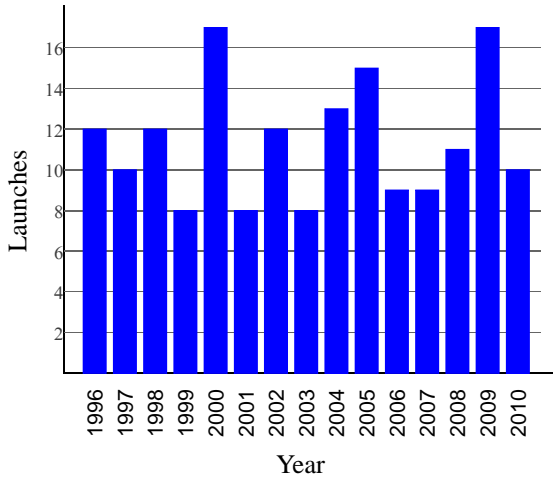
6) Federal Income Tax
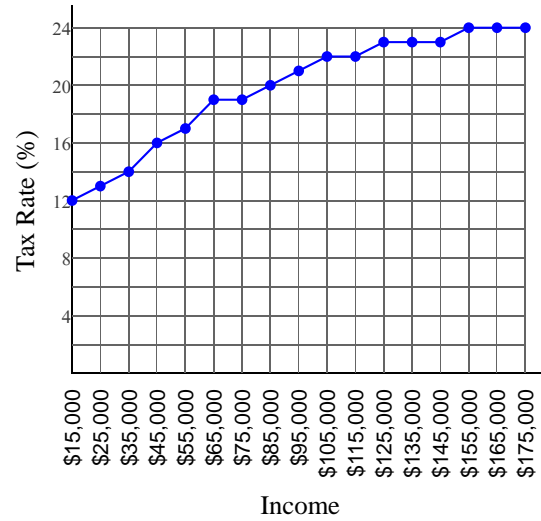
7) Goals in a Hockey Game

Goals	Frequency
2	1
4	1
5	4
7	4
8	2
9	3

8) Mountain Heights (ft)

Stem	Leaf
23	6 7 8 8 9
24	2 2 2 2 3 4 6 7 8 8
25	
26	3 7

Key: 24|2 = 24,200

9) US Senators When Assuming Office

Name_____

Center and Spread of Data

Date_____ Period____
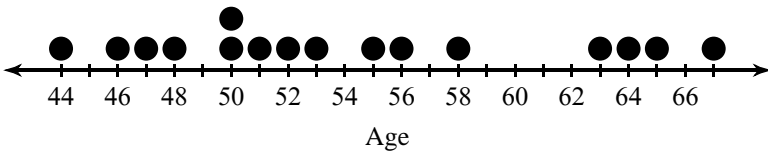
Find the mode, median, mean, lower quartile, upper quartile, interquartile range, and population standard deviation for each data set.

1)   Test Scores

37	42	48	51	52	53	54
54	55					

2)   Mens Heights (Inches)

62	64	69	70	70	71	72
73	74	75	77			

3)   Age Assumed Office

Senator	Age	Senator	Age	Senator	Age	Senator	Age	Senator	Age
Patrick Leahy	34	Carl Levin	44	Tammy Baldwin	50	John Barrasso	54	Mike Johanns	58
Mark Pryor	39	Rand Paul	47	Barbara Boxer	52	Kay Hagan	55	John Boozman	60
Brian Schatz	40	John Cornyn	50	Claire McCaskill	53	Jerry Moran	56	Jim Risch	65
John Thune	43								

4)   Sales Tax

State	Percent	State	Percent	State	Percent	State	Percent
Colorado	2.9	New Mexico	5.125	Maryland	6	Washington	6.5
Louisiana	4	Maine	5.5	South Carolina	6	Indiana	7
Wyoming	4	Florida	6	Kansas	6.15	New Jersey	7
Oklahoma	4.5	Idaho	6	Massachusetts	6.25	Rhode Island	7
North Dakota	5						

5) Birth Rate by Country

Births/woman
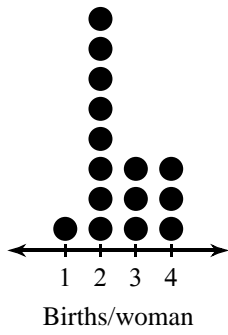
6) Length of Book Titles

# Words	Frequency
2	6
3	3
4	3
5	2
6	2

7) Goals in a Hockey Game
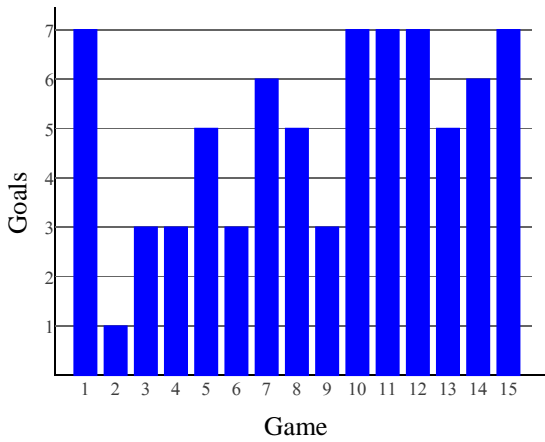
8) Boiling Point (°C)

Stem	Leaf
0	1 2 3 3 3 8 9
1	8
2	2 4 9 9
3	2 3 8
4	8

Key: 1|8 = 1,800

9) Cost of Electricity, per kWh
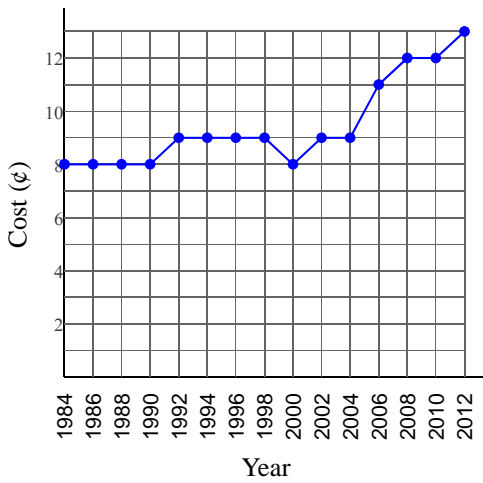
10) European Spacecraft Launches

21
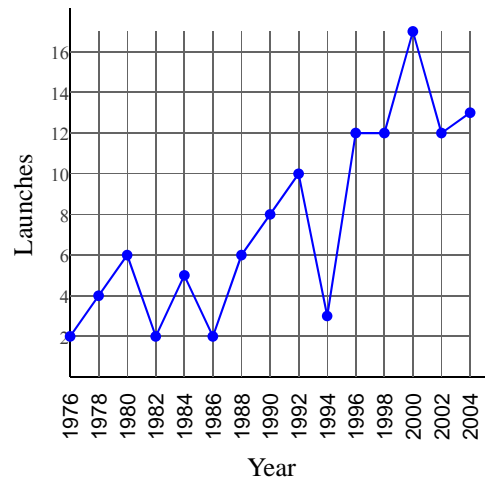
Lesson 5 Skills Practice

Measures of Variation

For Exercises 1−4, find the mean absolute deviation of each set of data. Round to the nearest tenth if necessary. Describe what the mean absolute deviation represents.

1.

Basketball Scores				
41	37	50	38	46
54	42	56	49	47

2.

Books Read				
15	12	10	24	32
18	23	19	30	27

3.

Miles Traveled		
110	85	90
115	115	80
125	85	95

4.

Bagels Sold			
65	74	91	99
104	93	62	92
75	119	116	54

5. Refer to the table in Exercise 1. The standard deviation is about 6.5 points. Describe the data values that are within one standard deviation of the mean.

6. Refer to the table in Exercise 2. The standard deviation is about 7.5 books. Describe the data values that are within one standard deviation of the mean.

Lesson 5 Problem-Solving Practice

Measures of Variation

The table shows the number of seventh and eighth graders on the Honor Roll each grading period.

	Grading Period 1	Grading Period 2	Grading Period 3	Grading Period 4	Grading Period 5	Grading Period 6
Seventh Graders	58	77	80	65	81	65
Eighth Graders	70	78	74	83	79	72

1. Find the mean absolute deviation of the number of seventh graders on the Honor Roll. Round to the nearest tenth. Describe what the mean absolute deviation means.

2. Find the mean absolute deviation of the number of eighth graders on the Honor Roll. Describe what the mean absolute deviation means.

3. Which students had less variation? Justify your answer.

4. The standard deviation of seventh graders on the Honor Roll is about 9.6. The standard deviation of eighth graders on the Honor Roll is about 4.9. Describe how this information supports your answer to Exercise 3.

Lesson 6 Skills Practice

Analyze Data Distributions

1. **AGES** The graph shows the ages of people in a play.

   a. Describe the shape of the distribution. Identify   any clusters, gaps, peaks, or outliers.

Ages of People in a Play (years)

   b. Describe the center and spread of the   distribution. Justify your response based on the   shape of the distribution.
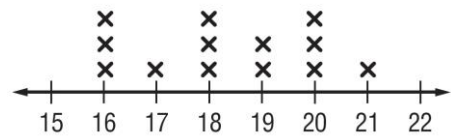
2. **SCIENCE** The graph shows the lengths of tadpoles in a small puddle.

   a. Describe the shape of the distribution. Identify   any clusters, gaps, peaks, or outliers.

Lengths of Tadpoles (cm)

   b. Describe the center and spread of the   distribution. Justify your response based on the   shape of the distribution.
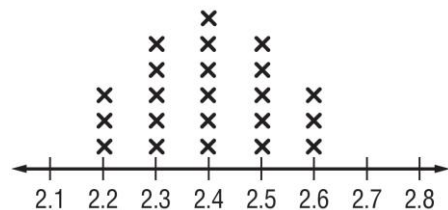
Lesson 6 Problem-Solving Practice

Analyze Data Distributions

FALL The line plot shows the number of restaurants people went to in the past month. Use the information in the line plot to answer Exercises 1 and 2.

Number of Restaurants

1. Describe the shape of the distribution shown. Identify any clusters, gaps, peaks, or outliers.	**2.** Describe the center and spread of the distribution. Justify your response based on the shape of the distribution.

SPEED The graph shows the speeds of several vehicles traveling down a highway. Use the information in the graph to answer Exercises 3 and 4.

1. Describe the shape of the distribution shown. Identify any clusters, gaps, peaks, or outliers.	**2.** Describe the center and spread of the distribution. Justify your response based on the shape of the distribution.

Name_____

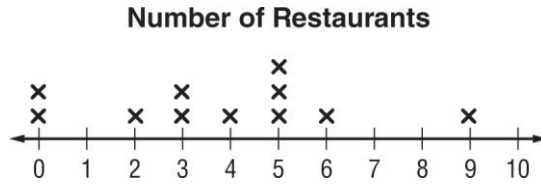# Visualizing Data

Draw a dot plot for each data set.

1)   Games per World Series

4	4	4	4	5	5	5	6
6	7	7	7	7	7	7	7
7							

2)   Age Assumed Office

Senator	Age	Senator	Age	Senator	Age	Senator	Age	Senator	Age
Mary Landrieu	41	Jon Tester	50	Mike Enzi	52	Barbara Boxer	52	Lamar Alexander	62
Mike Crapo	47	Tim Johnson	50	Dick Durbin	52	Sherrod Brown	54	Richard Blumenthal	64
John Cornyn	50	Jeff Sessions	50	Bob Menendez	52	John Barrasso	54	Angus King	68

Draw a stem-and-leaf plot for each data set.

3)   Annual Precipitation (Inches)

9.2	15.6	15.8	22.4	26.4
34	34.4	34.8	38.8	39.6
45.2	50.4	51.6	55.6	55.6
56.6	69.2			

4)

Per Capita Income

Country	US $	Country	US $	Country	US $	Country	US $
Central African Rep.	604	Uzbekistan	5,167	Maldives	11,654	Chile	21,911
Djibouti	2,998	Rep. of Congo	5,867	South Africa	12,504	Japan	36,315
Yemen	3,958	Mongolia	9,433	Botswana	15,675	Belgium	40,338
Laos	4,812	Grenada	11,498	Gabon	19,260	United Arab Emirates	58,042

Draw a box-and-whisker plot for each data set.

5)   Test Scores

37	38	39	44	44	45	46
47	47	47	47	48	51	52
52	53	54				

6)   Life Expectancy

State	Years	State	Years
Arkansas	74.2	Wisconsin	79.8
New Mexico	77.7	Washington	80.3
Alabama	78.1	Colorado	80.9
Louisiana	78.2	Indiana	81.3
Wyoming	78.4	Nevada	81.3
Kansas	78.6	Pennsylvania	81.6
Maine	79.1	Florida	81.7
Hawaii	79.7	Massachusetts	83.8

Name_____

Visualizing Data

Date_____ Period____

Draw a dot plot for each data set.

1) Hits in a Round of Hacky Sack

2	3	4	5	5	5	5	6
6	7	7	7	7	8	13	

2) Hours Slept

7	4	6	7	9	7	6	7
6	8	7	7	6	7	6	5

Draw a stem-and-leaf plot for each data set.

3)   Nobel Laureates

Name	Age	Name	Age	Name	Age
Rudolf Ludwig Mössbauer	32	Stanley Ben Prusiner	55	Robert Merton Solow	63
Wolfgang Ketterle	44	Torsten Nils Wiesel	57	Stanley Cohen	64
Joseph Leonard Goldstein	45	Richard Axel	58	Peter Mansfield	70
Aung San Suu Kyi	46	Robert Coleman Richards	59	Vernon Lomax Smith	75
Kenneth Joseph Arrow	51	James Alexander Mirrlees	60	Richard Fred Heck	79
Barry James Marshall	54				

4)   Large US Cities

City	Population	City	Population	City	Population	City	Population
Boston	617,594	Seattle	608,660	Irving	216,290	Washington DC	601,723
Gilbert	208,453	Richmond	204,214	Santa Ana	324,528	Columbus	787,033
Stockton	291,707	Scottsdale	217,385	Fort Worth	741,206	Aurora	325,078
Austin	790,390	Portland	583,776	San Francisco	805,235		

Draw a box-and-whisker plot for each data set.

5) Minutes to Run 5km

26	26.1	27.2	27.6	28.9
30.2	30.6	31.1	31.5	32.1
33.4	34	34	34	36.7
45				

6) Age At Inauguration

President	Age	President	Age	President	Age	President	Age
Calvin Coolidge	51	James Madison	57	Barack Obama	47	William McKinley	54
Lyndon B Johnson	55	Millard Fillmore	50	Chester A Arthur	51	James A Garfield	49
Gerald Ford	61	Zachary Taylor	64	Grover Cleveland	55	William Howard Taft	51
Theodore Roosevelt	42	James K Polk	49	Harry S Truman	60	Abraham Lincoln	52
Martin Van Buren	54						

Draw a histogram for each data set.

7) Average Time to Maturity

Plant	Days	Plant	Days	Plant	Days	Plant	Days	Plant	Days
Mesclun	40	Turnip	55	Romano Pole Bean	60	Sweet Potato	90	Tomatillo	100
Spinach	44	Swiss Chard	60	Yukon Gold Potato	65	Brussel Sprouts	90	Gooseneck Gourd	120
Endive	47	Kale	60	Cantaloupe	80	Celery	95	Pumpkin	120

8) Average Lifespan

Animal	Years	Animal	Years
Lion	35	Chinchilla	20
Cottontail	10	Bee (Queen)	5
Teal	20	Congo Eel	27
Macaw	50	Pheasant	18
Painted Turtle	11	Prarie Dog	10
Asian elephant	40	Nutria	15
Grouse	10	Flying Squirrel	14
Rhinoceros	40	Pionus Parrot	15