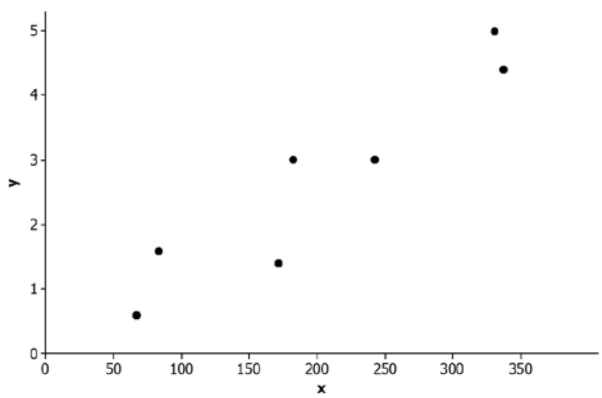
Name _____ Date_____

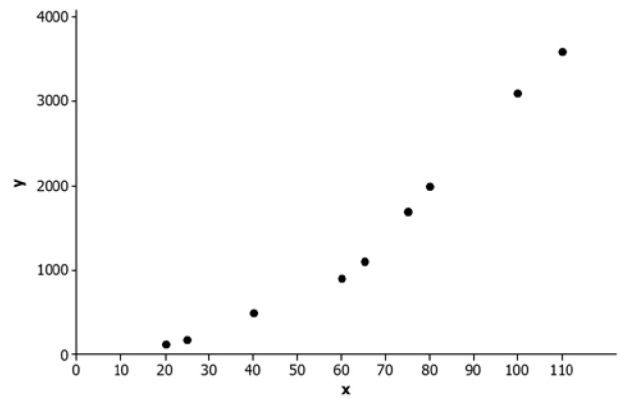
# Patterns in Scatter Plots

1. Which of the following scatter plots shows a negative linear relationship? Explain how you know.

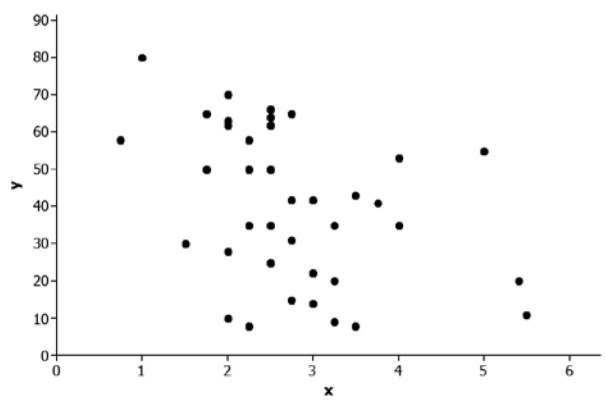
**Scatter Plot 1**



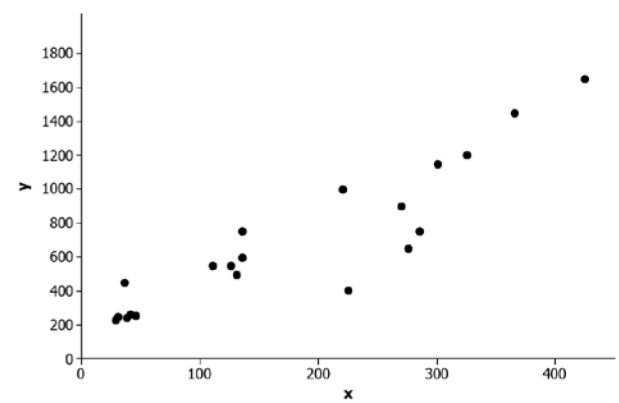

**Scatter Plot 2**



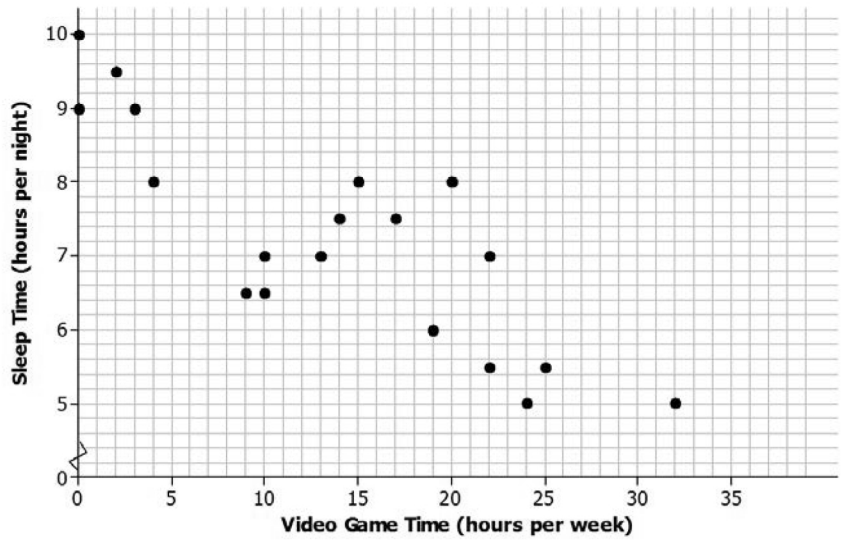

**Scatter Plot 3**




**Scatter Plot 4**

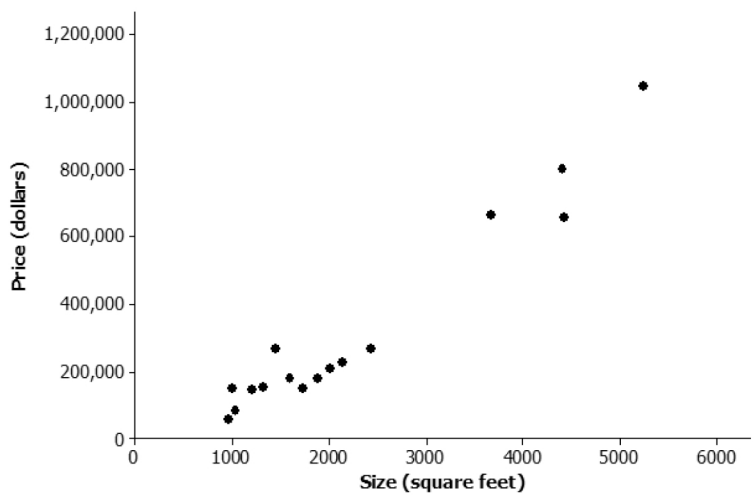


2. The scatter plot below was constructed using data from eighth-grade students on time spent in hours playing video games per week ($x$) and number of hours of sleep per night ($y$). Write a few sentences describing the relationship between sleep time and time spent playing video games for these students. Are there any noticeable clusters or outliers?

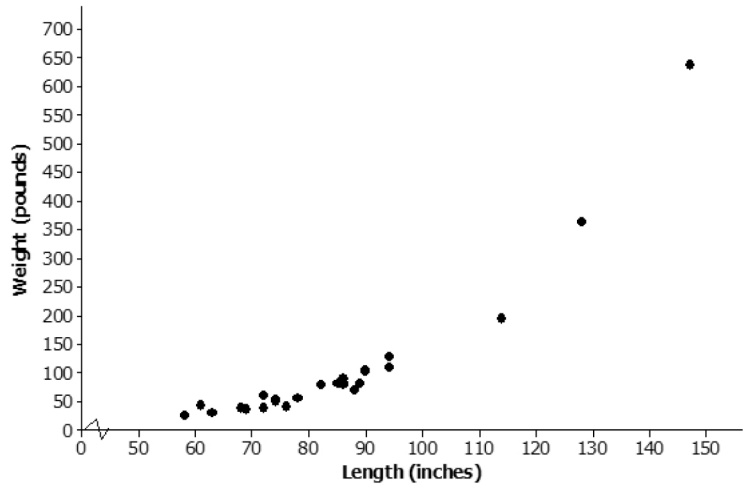



3. In a scatter plot, if the values of $y$ tend to increase as the value of $x$ increases, would you say that there is a positive relationship or a negative relationship between $x$ and $y$? Explain your answer.

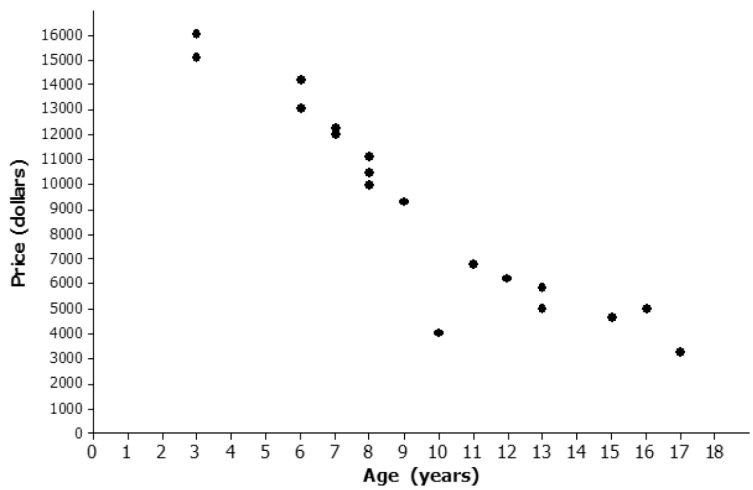
1. The scatter plot below was constructed using data size in square feet ($x$) of several houses and price in dollars ($y$). Write a few sentences describing the relationship between price and size for these houses. Are there any noticeable clusters or outliers?



2. The scatter plot below was constructed using data on length in inches ($x$) of several alligators and weight in pounds ($y$). Write a few sentences describing the relationship between weight and length for these alligators. Are there any noticeable clusters or outliers?



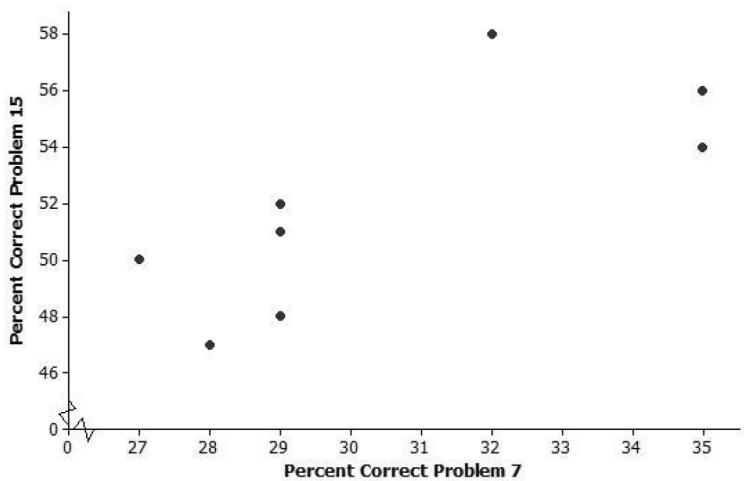

3. The scatter plot below was constructed using data on age in years ($x$) of several Honda Civics and price in dollars ($y$). Write a few sentences describing the relationship between price and age for these cars. Are there any noticeable clusters or outliers?



4. Samples of students in each of the U.S. states periodically take part in a large-scale assessment called the National Assessment of Educational Progress (NAEP). The table below shows the percent of students in the northeastern states (as defined by the U.S. Census Bureau) who answered problems 7 and 15 correctly on the 2011 eighth-grade test. The scatter plot shows the percent of eighth-grade students who got problems 7 and 15 correct on the 2011 NAEP.

| State | % Correct Problem 7 | % Correct Problem 15 |
|---|---|---|
| Connecticut | 29 | 51 |
| New York | 28 | 47 |
| Rhode Island | 29 | 52 |
| Maine | 27 | 50 |
| Pennsylvania | 29 | 48 |
| Vermont | 32 | 58 |
| New Jersey | 35 | 54 |
| New Hampshire | 29 | 52 |
| Massachusetts | 35 | 56 |

**Percent Correct for Problems 7 and 15 on 2011 Eighth-Grade NAEP**



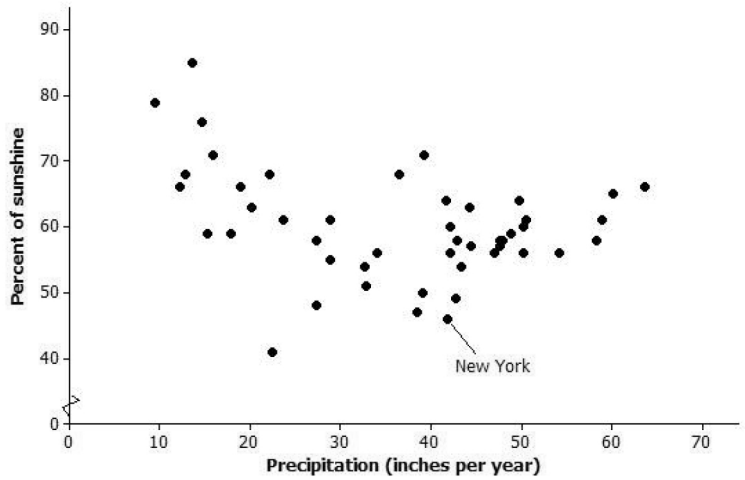

a. Why does it appear that there are only eight points in the scatter plot for nine states?

b. What is true of the states represented by the cluster of five points in the lower left corner of the graph?

c. Which state did the best on these two problems? Explain your reasoning.

d. Is there a trend in the data? Explain your thinking.

5. The plot below shows the mean percent of sunshine during the year and the mean amount of precipitation in inches per year for the states in the United States.




Data Source: www.currentresults.com/Weather/US/average-annual-state-sunshine.php
www.currentresults.com/Weather/US/average-annual-state-precipitation.php

a. Where on the graph are the states that have a large amount of precipitation and a small percent of sunshine?

b. The state of New York is the point $(46, 41.8)$. Describe how the mean amount of precipitation and percent of sunshine in New York compare to the rest of the United States.

c. Write a few sentences describing the relationship between mean amount of precipitation and percent of sunshine.

6. At a dinner party, every person shakes hands with every other person present.

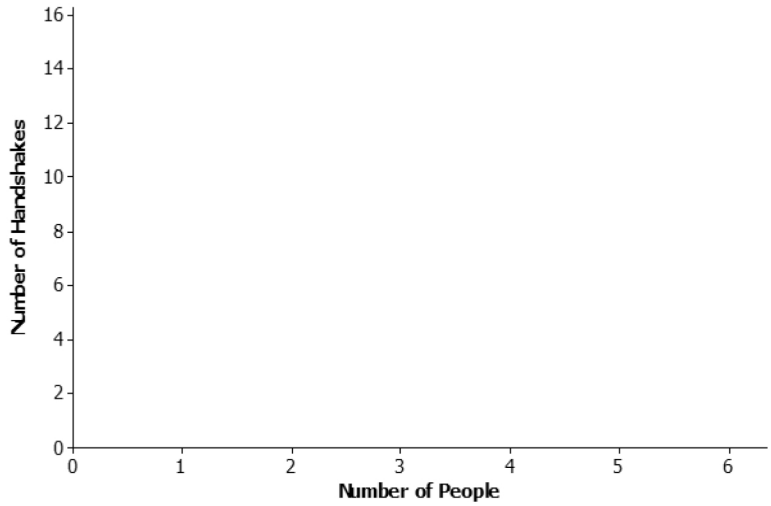
a. If three people are in a room and everyone shakes hands with everyone else, how many handshakes will there be?

b. Make a table for the number of handshakes in the room for one to six people. You may want to make a diagram or list to help you count the number of handshakes.

| Number People | Handshakes |
|---|---|
| | |
| | |
| | |

| Number People | Handshakes |
|---|---|
| | |
| | |
| | |

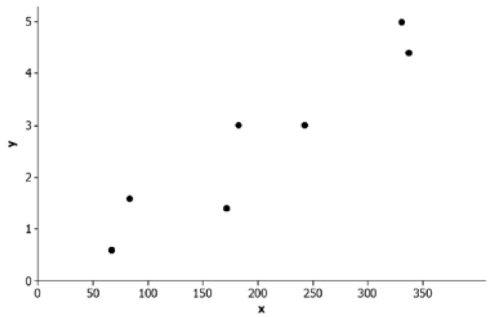
c. Make a scatter plot of number of people ($x$) and number of handshakes ($y$). Explain your thinking.



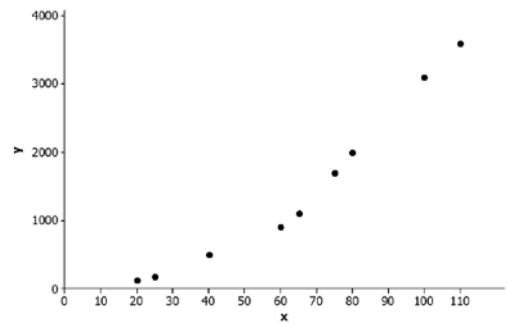

d. Does the trend seem to be linear? Why or why not?

**1. Which of the following scatter plots shows a negative linear relationship? Explain how you know.**

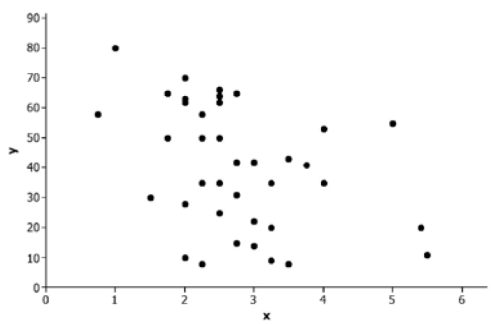
**Scatter Plot 1**



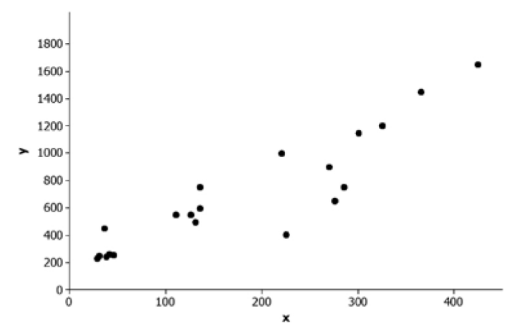

**Scatter Plot 2**




**Scatter Plot 3**

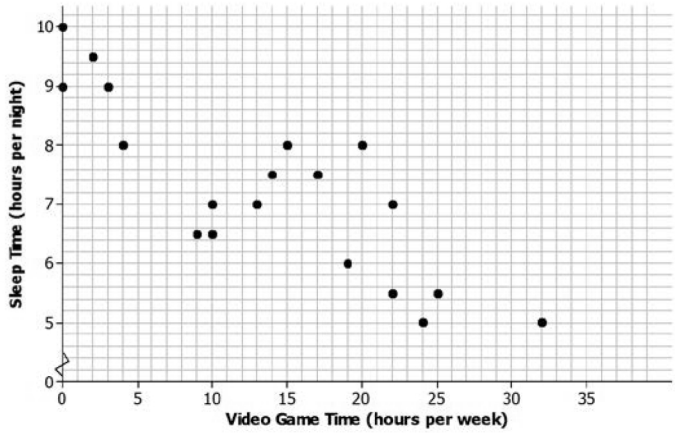



**Scatter Plot 4**




***Only Scatter plot 3 shows a negative linear relationship because the $y$-values tend to decrease as the value of $x$ increases.***

2. **The scatter plot below was constructed using data from eighth-grade students on time spent in hours playing video games per week ($x$) and number of hours of sleep per night ($y$). Write a few sentences describing the relationship between sleep time and time spent playing video games for these students. Are there any noticeable clusters or outliers?**



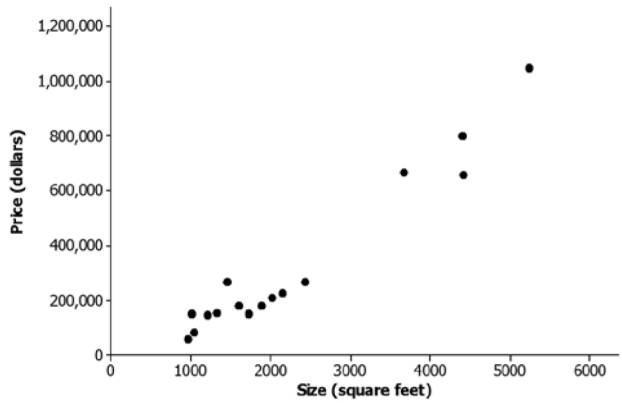

*Answers will vary. Sample response: There appears to be a negative linear relationship between the number of hours per week a student plays video games and the number of hours per night the student sleeps. As video game time increases, the number of hours of sleep tends to decrease. There is one observation that might be considered an outlier—the point corresponding to a student who plays video games $32$ hours per week. Other than the outlier, there are two clusters—one corresponding to students who spend very little time playing video games and a second corresponding to students who play video games between about $10$ and $25$ hours per week.*

3. **In a scatter plot, if the value of $y$ tends to increase as the value of $x$ increases, would you say that there is a positive relationship or a negative relationship between $x$ and $y$?**

*A positive relationship. If the value of $y$ increases as the value of $x$ increases, the points go up on the scatter plot from left to right.*

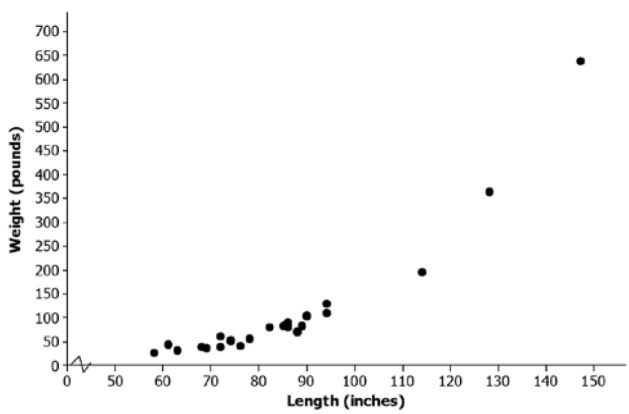
The Problem Set is intended to reinforce material from the lesson and have students think about the meaning of points in a scatter plot, clusters, positive and negative linear trends, and trends that are not linear.

1. **The scatter plot below was constructed using data size in square feet ($x$) of several houses and price in dollars ($y$). Write a few sentences describing the relationship between price and size for these houses. Are there any noticeable clusters or outliers?**



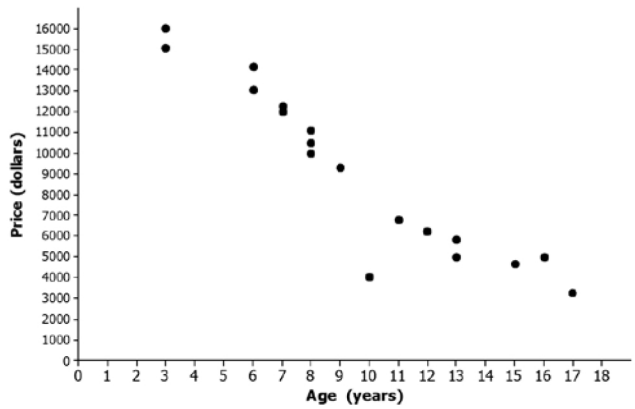

*Answers will vary. Possible response: There appears to be a positive linear relationship between size and price. Price tends to increase as size increases. There appear to be two clusters of houses—one that includes houses that are less than $3,000$ square feet in size and another that includes houses that are more than $3,000$ square feet in size.*

2. **The scatter plot below was constructed using data on length in inches ($x$) of several alligators and weight in pounds ($y$). Write a few sentences describing the relationship between weight and length for these alligators. Are there any noticeable clusters or outliers?**




*Answers will vary. Possible response: There appears to be a positive relationship between length and weight, but the relationship is not linear. Weight tends to increase as length increases. There are three observations that stand out as outliers. These correspond to alligators that are much bigger in terms of both length and weight than the other alligators in the sample. Without these three alligators, the relationship between length and weight would look linear. It might be possible to use a line to model the relationship between weight and length for alligators that have lengths of fewer than $100$ inches.*

3. **The scatter plot below was constructed using data on age in years ($x$) of several Honda Civics and price in dollars ($y$). Write a few sentences describing the relationship between price and age for these cars. Are there any noticeable clusters or outliers?**




*Answers will vary. Possible response: There appears to be a relatively strong negative linear relationship between price and age. Price tends to decrease as age increases. There is one car that looks like an outlier—the car that is 10 years old. This car has a price that is lower than expected based on the pattern of the other points in the scatter plot.*

4. **Samples of students in each of the U.S. states periodically take part in a large-scale assessment called the National Assessment of Educational Progress (NAEP). The table below shows the percent of students in the northeastern states (as defined by the U.S. Census Bureau) who answered Problems 7 and 15 correctly on the 2011 eighth-grade test. The scatter plot shows the percent of eighth-grade students who got Problems 7 and 15 correct on the 2011 NAEP.**

| State | % Correct Problem 7 | % Correct Problem 15 |
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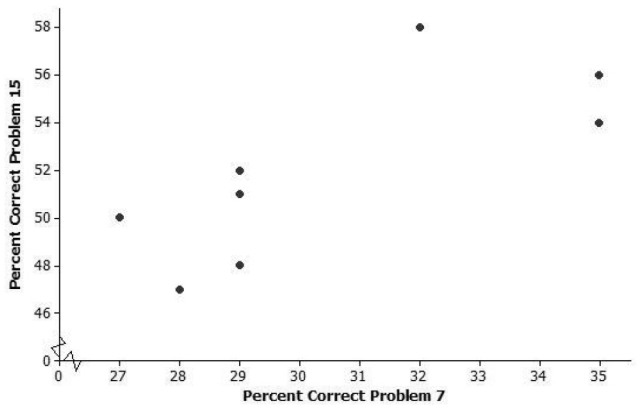
**Percent Correct for Problems 7 and 15 on 2011 Eighth-Grade NAEP**




a. **Why does it appear that there are only eight points in the scatter plot for nine states?**

*Two of the states, New Hampshire and Rhode Island, had exactly the same percent correct on each of the questions,* $(29, 52)$.

b. **What is true of the states represented by the cluster of five points in the lower left corner of the graph?**

*Answers will vary; those states had lower percentages correct than the other three states in the upper right.*

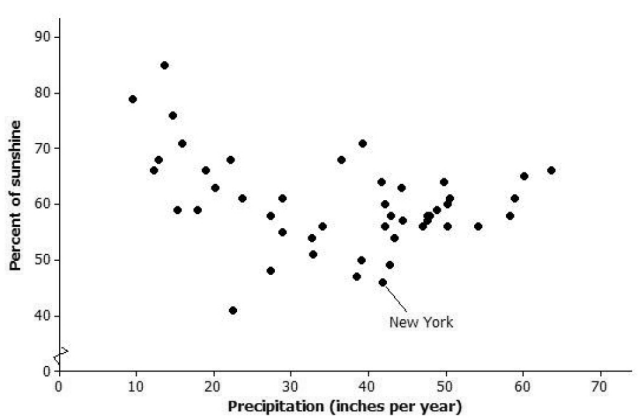
c. **Which state did the best on these two problems? Explain your reasoning.**

*Answers will vary; some students might argue that Massachusetts at* $(35, 56)$ *did the best. Even though Vermont actually did a bit better on Problem 15, it was lower on Problem 7.*

d. **Is there a trend in the data? Explain your thinking.**

*Answers will vary; there seems to be a weak positive linear trend as a large percent correct on one question suggests a large percent correct on the other, and a low percent on one suggests a low percent on the other.*

5. **The plot below shows the mean percent of sunshine during the year and the mean amount of precipitation in inches per year for the states in the United States.**




**Data Source:** www.currentresults.com/Weather/US/average-annual-state-sunshine.php
www.currentresults.com/Weather/US/average-annual-state-precipitation.php

a. **Where on the graph are the states that have a large amount of precipitation and a small percent of sunshine?**

*Those states will be in the lower right hand corner of the graph.*

b. **The state of New York is the point $(46, 41.8)$. Describe how the mean amount of precipitation and percent of sunshine in New York compare to the rest of the United States.**

*New York has a little over $40$ inches of precipitation per year and is sunny about $45\%$ of the time. It has a smaller percent of sunshine over the year than most states and is about in the middle of the states in terms of the amount of precipitation, which goes from about $10$ to $65$ inches per year.*

c. **Write a few sentences describing the relationship between mean amount of precipitation and percent of sunshine.**

*There is a weak negative relationship, or the more precipitation, the less percent of sun. If you took away the three states at the top left with a large percent of sun and very little precipitation, the trend would not be as pronounced. The relationship is not linear.*

6. **At a dinner party, every person shakes hands with every other person present.**

a. **If three people are in a room and everyone shakes hands with everyone else, how many handshakes will there be?**

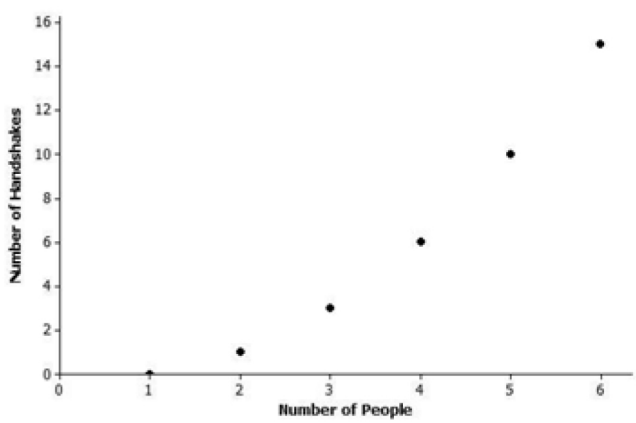
*Three handshakes*

b. **Make a table for the number of handshakes in the room for one to six people. You may want to make a diagram or list to help you count the number of handshakes.**

| Number People | Handshakes |
|---|---|
| 1 | 0 |
| 2 | 1 |
| 3 | 3 |

| Number People | Handshakes |
|---|---|
| 4 | 6 |
| 5 | 10 |
| 6 | 15 |

c. **Make a scatter plot of number of people ($x$) and number of handshakes ($y$). Explain your thinking.**




d. **Does the trend seem to be linear? Why or why not?**

*The trend is increasing, but it is not linear. As the number of people increases, the number of handshakes also increases. It does not increase at a constant rate.*