9-3 Constant Rate of Change and Slope

Find the constant rate of change between the quantities in each table.

1. 

<table>
<thead>
<tr>
<th>Items</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost ($)</td>
<td>12</td>
<td>24</td>
<td>36</td>
<td>48</td>
</tr>
</tbody>
</table>

**SOLUTION:**
The cost increases by $12 for every 5 items. Find the unit rate to determine the constant rate of change.

\[
\text{constant rate of change} = \frac{\text{change in cost}}{\text{change in number of items}} = \frac{$12}{5 \text{ items}} = $2.40 \text{ per item}
\]

The constant rate of change is $2.40 per item.

2. 

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude (ft)</td>
<td>160</td>
<td>120</td>
<td>80</td>
<td>40</td>
</tr>
</tbody>
</table>

**SOLUTION:**
The altitude decreases by 40 feet for every 2 minutes. Find the unit rate to determine the constant rate of change.

\[
\text{constant rate of change} = \frac{\text{change in altitude}}{\text{change in time}} = \frac{-40 \text{ ft}}{2 \text{ min}} = -20 \text{ ft per min}
\]

The constant rate of change is -20 feet per minute.

Find the constant rate of change for each linear function and interpret its meaning.

**Example of points for Sequence A:** (2, 7), (5, 0.5). Find the rate of change between the points.

**Example of points for Sequence B:** (2, 3), (5, 1). Find the rate of change between the points.

**SOLUTION:**
The steeper line has a higher rate of change. The rates of change are calculated as follows:

For Sequence A:

\[
\text{rate of change} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0.5 - 7}{5 - 2} = \frac{-6.5}{3} = -2.1667
\]

For Sequence B:

\[
\text{rate of change} = \frac{1 - 3}{5 - 2} = \frac{-2}{3} = -0.6667
\]

The terms from Sequence A form a steeper line.

Find the constant rate of change between the quantities in each table.

3. 

**SOLUTION:**
Find the rate of change between two points such as (2, 4) and (6, 6).

\[
\text{rate of change} = \frac{\text{change in height}}{\text{change in weeks}} = \frac{6 \text{ in.} - 4 \text{ in.}}{6 \text{ wk} - 2 \text{ wk}}
\]

\[
= \frac{2 \text{ in.}}{4 \text{ wk}} = \frac{1}{2} \text{ in./wk}
\]

The rate of change \(\frac{1}{2}\) in./wk means that the plant grows \(\frac{1}{2}\) inch per week.
Find the constant rate of change between the quantities in each table.

1. **SOLUTION:**
The cost increases by $12 per item. The unit rate to determine the constant rate of change is $2.40 per item.

2. **SOLUTION:**
New York has the greatest amount of forest land. 11,179 square miles of land are covered by forests in Ohio.

3. **SOLUTION:**
Sample answer: The constant rate of change is a proportional relationship.

4. **SOLUTION:**
Find the rate of change between two points such as (1, 2) and (2, 4).
\[
\text{rate of change} = \frac{\text{total sales}}{\text{number of pounds}} = \frac{\$4 - \$2}{2 \text{ lb} - 1 \text{ lb}} = \frac{\$2}{1 \text{ lb}} = \$2/\text{lb}
\]
The rate of change $\frac{\$2}{\text{lb}}$ means that the unit cost is $2 per pound.

5. **SOLUTION:**
Find the slope of the line in the graph.
\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - (-1)}{3 - (-1)} = \frac{8}{4} = 2
\]

6. **SOLUTION:**
Find the slope of the line that passes through the points $A(4, -5)$ and $B(9, -5)$.
\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - (-5)}{9 - 4} = \frac{0}{5} = 0
\]

7. **SOLUTION:**
The cost increases by $0.50 for every 2 photos. Find the unit rate to determine the constant rate of change.
\[
\frac{\text{change in cost}}{\text{change in number of photos}} = \frac{\$0.50}{2 \text{ photos}} = \frac{\$0.25}{1 \text{ photo}}
\]
The constant rate of change is $0.25 per photo.

8. **SOLUTION:**
The depth decreases by 192 feet for every 2 hours. Find the unit rate to determine the constant rate of change.
\[
\frac{\text{change in depth}}{\text{change in time}} = \frac{-192 \text{ ft}}{2 \text{ h}} = \frac{-96 \text{ ft}}{1 \text{ h}}
\]
The constant rate of change is $-96$ feet per hour.
9-3 Constant Rate of Change and Slope

### 9.
<table>
<thead>
<tr>
<th>Time (s)</th>
<th>7</th>
<th>9</th>
<th>11</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance (cm)</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

**SOLUTION:**
The distance decreases by 1 centimeter for every 2 seconds. Find the unit rate to determine the constant rate of change.

\[
\text{rate of change} = \frac{\text{change in distance}}{\text{change in time}} = \frac{-1 \text{ cm}}{2 \text{ s}} = -0.5 \text{ cm/s}
\]

The constant rate of change is -0.5 centimeters per second.

### 10.
<table>
<thead>
<tr>
<th>Banners</th>
<th>6</th>
<th>9</th>
<th>12</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabric (yd)</td>
<td>8</td>
<td>13</td>
<td>18</td>
<td>23</td>
</tr>
</tbody>
</table>

**SOLUTION:**
The amount of fabric increases by 5 yards for every 3 banners. Find the unit rate to determine the constant rate of change.

\[
\text{rate of change} = \frac{\text{change in amount of fabric}}{\text{change in number of banners}} = \frac{5 \text{ yd}}{3 \text{ banners}} = \frac{5/3 \text{ yd}}{1 \text{ banner}}
\]

The constant rate of change is \(\frac{5}{3}\) yards per banner.

### 11.

**SOLUTION:**
Find the rate of change between two points such as (1, 15) and (2, 30).

\[
\text{rate of change} = \frac{\text{change in distance}}{\text{change in time}} = \frac{30 \text{ mi} - 15 \text{ mi}}{2 \text{ h} - 1 \text{ h}} = \frac{15 \text{ mi}}{1 \text{ h}}
\]

The rate of change 15 mi/h means that the distance a bicyclist travels increases 15 miles for each hour of travel.
9-3 Constant Rate of Change and Slope

SOLUTION:
Find the rate of change between two points such as (10, 15) and (20, 20).
rate of change = \frac{\text{change in cost}}{\text{change in sales}}
= \frac{20 - 15}{20 - 10}
= \frac{5}{10}
= \frac{1}{2}

The cost for customized reservations increases $1 for every $2 in sales.

Find the slope of each line.

13. 

SOLUTION:
\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ m = \frac{5 - 3}{6 - 0} \]
\[ m = \frac{2}{6} = \frac{1}{3} \]

14. 

SOLUTION:
\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ m = \frac{-2 - 2}{3 - 1} \]
\[ m = \frac{-4}{2} = -2 \]

15. 

SOLUTION:
\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ m = \frac{2 - 2}{3 - (-1)} \]
\[ m = 0 \]

For each state in the table, how many square miles of land are covered by forests? Round to the nearest mile.

- Ohio: 11,179 square miles
- Michigan: 19,506 square miles
- New York: 26,487 square miles

b. New York has the greatest amount of forest land.
9-3 Constant Rate of Change and Slope

16. Find the slope of the line that passes through each pair of points.
   17. $A(3, 2), B(10, 8)$

   **SOLUTION:**
   
   \[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
   
   \[ m = \frac{8 - 2}{10 - 3} \]
   
   \[ m = \frac{6}{7} \]

   18. $R(5, 1), S(0, 4)$

   **SOLUTION:**
   
   \[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
   
   \[ m = \frac{4 - 1}{0 - 5} \]
   
   \[ m = \frac{3}{-5} \]
   
   \[ m = -\frac{3}{5} \]

   19. $L(5, -6), M(9, 6)$

   **SOLUTION:**
   
   \[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
   
   \[ m = \frac{6 - (-6)}{9 - 5} \]
   
   \[ m = \frac{12}{4} \]
   
   \[ m = 3 \]

   20. $J(-1, 3), K(-1, 7)$

   **SOLUTION:**
   
   \[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
   
   \[ m = \frac{7 - 3}{-1 - (-1)} \]
   
   \[ m = \frac{4}{0} \]

   The slope is undefined because division by zero is undefined.

   21. $C(-8, 6), D(1, 6)$

   **SOLUTION:**
   
   \[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
   
   \[ m = \frac{6 - 6}{1 - (-8)} \]
   
   \[ m = \frac{0}{9} \]
   
   \[ m = 0 \]

   22. $V(5, -7), W(-3, 9)$

   **SOLUTION:**
   
   \[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
   
   \[ m = \frac{9 - (-7)}{-3 - 5} \]
   
   \[ m = \frac{16}{-8} \]
   
   \[ m = -2 \]
9-3 Constant Rate of Change and Slope

23. Multiple Representations In this problem you will investigate ordered pairs. Use the table shown.

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>-6</td>
</tr>
<tr>
<td>0</td>
<td>-8</td>
</tr>
<tr>
<td>1</td>
<td>-10</td>
</tr>
<tr>
<td>2</td>
<td>-12</td>
</tr>
</tbody>
</table>

a. Numbers What is the slope of the line represented by the data in the table?
b. Graph Graph the points on a coordinate plane. Connect the points with a line.
c. Words What does the point (0, -8) represent?

**SOLUTION:**

a.

\[
(x_1, y_1) = (-1, -6), \\
(x_2, y_2) = (0, -8)
\]

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-8 - (-6)}{0 - (-1)} = \frac{-2}{1} = -2
\]

The slope is -2.

b. 

c. The point (0, -8) is where the line intersects the y-axis.

24. Libby is driving from St. Louis to Chicago, as shown in the graph.

a. Find the constant rate of change for the linear function and interpret its meaning.
b. Find the slope of the line.
c. How does the slope of the line compare to the rate of change you found in part a?
d. How long does it take Libby to drive from St. Louis to Chicago?

**SOLUTION:**

a. Find the rate of change between the points (1, 240) and (2, 180).

rate of change = \( \frac{\text{change in distance}}{\text{change in time}} \)

\[
= \frac{180 \text{ mi} - 240 \text{ mi}}{2 \text{ h} - 1 \text{ h}} = \frac{-60 \text{ mi}}{1 \text{ h}} = -60 \text{ mi/h}
\]

The rate of change -60 miles per hour means that the distance to Chicago decreases by 60 miles for every hour of driving.

b. 

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{180 - 240}{2 - 1} = \frac{-60}{1} = -60
\]

c. The slope of the line is equal to the rate of change.
d. The y-intercept of the graph is 300, which is the total distance from St. Louis to Chicago in miles. The distance to Chicago decreases by 60 miles for every hour, so it takes Libby 300 \( \div \) 60 or 5 hours to drive from St. Louis to Chicago.
25. The point (2, 3) lies on a line with a slope of \( \frac{1}{2} \). Name two additional points that lie on the line.

**SOLUTION:**
Sample answer:
\( (x_1, y_1) = (0, 2) \)
\( (x_2, y_2) = (2, 3) \)

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]

\[ m = \frac{3 - 2}{2 - 0} \]

\[ m = \frac{1}{2} \]

\( (x_1, y_1) = (2, 3) \)
\( (x_2, y_2) = (4, 4) \)

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]

\[ m = \frac{4 - 3}{4 - 2} \]

\[ m = \frac{1}{2} \]

26. The points (0, \( p \)) and (1, 4) lie on a line with a slope of 3. What is the value of \( p \)? Explain.

**SOLUTION:**
Sample answer: By the definition of slope,
\[ \frac{4 - p}{1 - 0} = 3 \]

So \( 4 - p = 3 \) and \( p = 1 \).

27. **Identify Structure** Graph a line that shows a 3-unit increase in \( y \) for every 1-unit increase in \( x \). State the rate of change.

**SOLUTION:**
Sample answer:

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>-3</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

The rate of change is \( \frac{3}{1} \).

28. **Identify Structure** Name two points on a line that has a slope of \( \frac{5}{8} \).

**SOLUTION:**
\( (x_1, y_1) = (2, 1) \)
\( (x_2, y_2) = (10, 6) \)

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]

\[ m = \frac{6 - 1}{10 - 2} \]

\[ m = \frac{5}{8} \]
**9-3 Constant Rate of Change and Slope**

29. **Persevere with Problems** The terms in arithmetic sequence $A$ have a common difference of 3. The terms in arithmetic sequence $B$ have a common difference of 8. In which sequence do the terms form a steeper line when graphed as points on a coordinate plane? Justify your reasoning.

**SOLUTION:**
Example of points for Sequence $A$ would be $(1, 4)$, $(2, 7)$. The slope of the line would be:

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - 4}{2 - 1} = \frac{3}{1} = 3$$

Example of points for Sequence $B$ would be $(1, 4)$, $(2, 12)$. The slope of the line would be:

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{12 - 4}{2 - 1} = \frac{8}{1} = 8$$

The terms from Sequence $B$ form a steeper line.

30. **Persevere with Problems** Refer to the graph below.

![Graph of Insects' Wings](image)

**SOLUTION:**

**a.** What is the connection between the steepness of the lines and the rates of change?

**b.** What is the connection between the unit rates and the slopes?

**SOLUTION:**

**a.** For the mosquito line, find the rate of change between the points $(0.5, 300)$ and $(1, 600)$.

rate of change = \frac{\text{change in number of beats}}{\text{change in time}}

For the honey bee line, find the rate of change between the points $(1, 200)$ and $(2, 400)$.

The steeper line has a higher rate of change. The number of times a mosquito’s wings beats increases at a faster rate than the number of times a honey bee’s wings beat.

**b.** Slope of the mosquito line:

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{300 - 0.5}{1 - 0.5} = 600$$

Slope of the honey bee line:

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{400 - 200}{2 - 1} = \frac{200}{1} = 200$$

The unit rates equal the slopes of the graphs.
31. **Model with Mathematics** A person starts walking, then runs, and then sits down to rest. Sketch a graph of the situation to represent the different rates of change. Label the x-axis *Time* and the y-axis *Distance*.

*SOLUTION*: Sample answer:

![Graph of distance vs. time](image)

32. **Building on the Essential Question** Determine whether the following statement is *always*, *sometimes*, or *never* true. Justify your reasoning. A *linear relationship that has a constant rate of change is a proportional relationship*.

*SOLUTION*: Sometimes; a linear relationship that is a direct variation is proportional. A linear relationship whose graph does not pass through the origin is not proportional.

33. Which of the following is true concerning the slope of the line below?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The slope is $-1$.</td>
</tr>
<tr>
<td>B</td>
<td>The slope is zero.</td>
</tr>
<tr>
<td>C</td>
<td>The slope is 1.</td>
</tr>
<tr>
<td>D</td>
<td>The slope is undefined.</td>
</tr>
</tbody>
</table>

*SOLUTION*: A vertical line does not have any change in the x-direction, so the run is zero. Slope is $\frac{\text{rise}}{\text{run}}$, and since division by zero is undefined, the slope of the line is undefined. Choice D is correct.

34. A horizontal line passes through the point (2, 3). What is the slope of the line?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>0</td>
</tr>
<tr>
<td>G</td>
<td>$\frac{2}{3}$</td>
</tr>
<tr>
<td>H</td>
<td>$\frac{3}{2}$</td>
</tr>
<tr>
<td>J</td>
<td>3</td>
</tr>
</tbody>
</table>

*SOLUTION*: A horizontal line always has a slope of zero. Choice F is correct.
9-3 Constant Rate of Change and Slope

35. What is the slope of the line that passes through the points (−3, 5) and (6, −1)?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>( \frac{2}{5} )</td>
</tr>
<tr>
<td>B</td>
<td>( \frac{2}{3} )</td>
</tr>
<tr>
<td>C</td>
<td>( \frac{2}{3} )</td>
</tr>
<tr>
<td>D</td>
<td>( \frac{3}{2} )</td>
</tr>
</tbody>
</table>

**SOLUTION:**

\[
m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1 - 5}{6 - (-3)} = \frac{-6}{9} = \frac{-2}{3}
\]

Choice C is correct.

36. **Short Response** Find the constant rate of change for the linear function in the graph.

**SOLUTION:**

Choose any two points on the line, such as (2, 2) and (5, 0). Find the rate of change between the points.

rate of change = \( \frac{\text{change in time}}{\text{change in distance}} \)

\[
\begin{align*}
\text{rate of change} &= \frac{2 \text{ sec} - 0.5 \text{ sec}}{2 \text{ in} - 5 \text{ in.}} \\
&= \frac{1.5 \text{ sec}}{-3 \text{ in.}} \\
&= \frac{-1}{2} \text{ sec/in.}
\end{align*}
\]

Find four solutions of each equation. Write the solutions as ordered pairs.

37. \( y = 12x \)

**SOLUTION:**

Sample answer:

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y = 12x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>( y = 12(-1) )</td>
<td>-12</td>
</tr>
<tr>
<td>0</td>
<td>( y = 12(0) )</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>( y = 12(1) )</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>( y = 12(2) )</td>
<td>24</td>
</tr>
</tbody>
</table>

(2, 24)
38. \( y = \frac{1}{2}x \)

**SOLUTION:**
Sample answer:

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y = \frac{1}{2}x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>( y = \frac{1}{2}(-1) )</td>
<td>-( \frac{1}{2} )</td>
</tr>
<tr>
<td>0</td>
<td>( y = \frac{1}{2}(0) )</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>( y = \frac{1}{2}(1) )</td>
<td>( \frac{1}{2} )</td>
</tr>
<tr>
<td>2</td>
<td>( y = \frac{1}{2}(2) )</td>
<td>1</td>
</tr>
</tbody>
</table>

39. \( y = -3x + 5 \)

**SOLUTION:**
Sample Answer:

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y = -3x + 5 )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>( y = -3(-1) + 5 )</td>
<td>8</td>
</tr>
<tr>
<td>0</td>
<td>( y = -3(0) + 5 )</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>( y = -3(1) + 5 )</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>( y = -3(2) + 5 )</td>
<td>-1</td>
</tr>
</tbody>
</table>

(2, -1)

**Solve each problem using the percent equation.**

40. 9 is what percent of 25?

**SOLUTION:**

\[
9 = p \cdot 25
\]

\[
\frac{9}{25} = \frac{p \cdot 25}{25}
\]

0.36 = \( p \)

By definition, the percent is expressed as a decimal.

Convert 0.36 to a percent.

Since 0.36 = 36\%, 9 is 36\% of 25.

41. 48 is 64\% of what number?

**SOLUTION:**

\[
48 = 0.64 \cdot b
\]

\[
\frac{48}{0.64} = \frac{0.64 \cdot b}{0.64}
\]

75 = \( b \)

So, 48 is 64\% of 75.

42. 82\% of 45 is what number?

**SOLUTION:**

\[
a = 0.82 \cdot 45
\]

\[
= 36.9
\]

So, 82\% of 45 is 36.9.

**Solve each equation.**

43. \( 18 + 57 + x = 180 \)

**SOLUTION:**

\[
18 + 57 + x = 180
\]

\[
75 + x = 180
\]

\[
75 - 75 + x = 180 - 75
\]

\[
x = 105
\]

44. \( x + 27 + 54 = 180 \)

**SOLUTION:**

\[
x + 27 + 54 = 180
\]

\[
x + 81 = 180
\]

\[
x + 81 - 81 = 180 - 81
\]

\[
x = 99
\]

45. \( 85 + x + 24 = 180 \)

**SOLUTION:**

\[
85 + x + 24 = 180
\]

\[
x + 85 + 24 = 180
\]

\[
x + 109 = 180
\]

\[
x + 109 - 109 = 180 - 109
\]

\[
x = 71
\]

46. \( x + x + x = 180 \)

**SOLUTION:**

\[
x + x + x = 180
\]

\[
(1 + 1 + 1)x = 180
\]

\[
3x = 180
\]

\[
\frac{3x}{3} = \frac{180}{3}
\]

\[
x = 60
\]
9-3 Constant Rate of Change and Slope

47. \(2x + 3x + 4x = 180\)

\[\begin{align*}
\text{SOLUTION:} \\
2x+3x+4x &= 180 \\
(2+3+4)x &= 180 \\
9x &= 180 \\
x &= \frac{180}{9} \\
x &= 20
\end{align*}\]

48. \(2x + 3x + 5x = 180\)

\[\begin{align*}
\text{SOLUTION:} \\
2x+3x+5x &= 180 \\
(2+3+5)x &= 180 \\
10x &= 180 \\
x &= \frac{180}{10} \\
x &= 18
\end{align*}\]

49. The table shows the percent of forest land in different states.

<table>
<thead>
<tr>
<th>State</th>
<th>Percent of Land Covered by Forest</th>
<th>Area of State (Square Miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>11.9%</td>
<td>55,584</td>
</tr>
<tr>
<td>Kentucky</td>
<td>49.1%</td>
<td>36,728</td>
</tr>
<tr>
<td>Michigan</td>
<td>44.7%</td>
<td>56,804</td>
</tr>
<tr>
<td>New York</td>
<td>56.1%</td>
<td>47,214</td>
</tr>
<tr>
<td>Ohio</td>
<td>27.3%</td>
<td>40,548</td>
</tr>
</tbody>
</table>

a. For each state in the table, how many square miles of land are covered by forests? Round to the nearest square mile.

b. Which state has the greatest amount of forest land?

\[\begin{align*}
\text{SOLUTION:} \\
\text{a. Illinois:} \\
\alpha &= 0.11 \cdot 55,584 \\
&= 6114 \\
6114 \text{ square miles of land are covered by forests in Illinois.}
\end{align*}\]

\[\begin{align*}
\text{Kentucky:} \\
\alpha &= 0.49 \cdot 39,728 \\
&= 19,506 \\
19,506 \text{ square miles of land are covered by forests in Kentucky.}
\end{align*}\]

\[\begin{align*}
\text{Michigan:} \\
\alpha &= 0.447 \cdot 56,804 \\
&= 25,391 \\
25,391 \text{ square miles of land are covered by forests in Michigan.}
\end{align*}\]

\[\begin{align*}
\text{New York:} \\
\alpha &= 0.561 \cdot 47,214 \\
&= 26,487 \\
26,487 \text{ square miles of land are covered by forests in New York.}
\end{align*}\]

\[\begin{align*}
\text{Ohio:} \\
\alpha &= 0.273 \cdot 40,548 \\
&= 11,179 \\
11,179 \text{ square miles of land are covered by forests in Ohio.}
\end{align*}\]

b. New York has the greatest amount of forest land.