Direct Variation

Statement (key words)
• $y$ varies directly as $x$
• $y$ is directly proportional to $x$

Equation of Variation:

$$y = mx \text{ or } y = kx$$

where $k$ is the constant of variation or the constant of proportionality.

Example:

Assume that $y$ is directly proportional to $x$. Use the given $x$-value and $y$-value to find a linear model that relates $y$ and $x$.

$x = 2, y = 14$

$$y = kx$$

$$14 = k(2)$$

$$7 = k$$

$$y = 7x$$
Direct Variation as an $n^{th}$ Power

Statement (key words)
• $y$ varies directly as the $n$th power of $x$
• $y$ is directly proportional to the $n$th power of $x$

Equation of Variation:

$$y = kx^n$$

where $k$ is the constant of variation or the constant of proportionality.

Example:

Use the given value of $k$ to complete the table for the direct variation model $y = kx^2$

$$k = \frac{1}{4}$$

<table>
<thead>
<tr>
<th>$x$</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y = kx^2$</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>16</td>
<td>25</td>
</tr>
</tbody>
</table>
**Inverse Variation**

Statement (key words)
- \( y \) varies inversely as \( x \)
- \( y \) is inversely proportional to \( x \)

Equation of Variation:

\[ y = \frac{k}{x} \quad \text{or} \quad xy = k \]

where \( k \) is the constant of variation or the constant of proportionality.

**Example:**

Determine whether the variation model is of the form \( y = kx \) or \( y = \frac{k}{x} \), and find \( k \).

<table>
<thead>
<tr>
<th>( x )</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>

\[ y = \frac{k}{x} \quad \text{or} \quad xy = k \]

**Direct**

\[ \frac{2}{5} = k \]

\[ y = \frac{2}{5}x \]