Direct Variation

direct variation: an equation in the form 
\[ y = kx \], where \( k \neq 0 \).

\( k \) is the constant of variation, which is another way to express the slope of an equation of \( y = kx \).

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<table>
<thead>
<tr>
<th>The ( y ) value is (-3) times the value of ( x ).</th>
<th>The total cost ( C ) of gasoline is $3.00\ times the number of gallons ( g ).</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ( y ) value is ( \frac{2}{5} ) times the value of ( x ).</td>
<td>The total cost ( C ) of bulk jelly beans is $4.49\ times the number of pounds ( p ).</td>
</tr>
</tbody>
</table>
Another way to express the slope of a line is \( y = kx \).
Suppose $y$ varies directly as $x$, and $y = 9$ when $x = -3$. Find $x$ when $y = 15$.

\[ y = kx \]
\[ 9 = k(-3) \]
\[ \frac{9}{-3} = k \]
\[ -3 = k \]
\[ y = -3x \]
\[ 15 = -3x \]
\[ \frac{15}{-3} = x \]
\[ -5 = x \]

If $y = 15$ when $x = 12$, find $y$ when $x = 32$.

\[ y = kx \]
\[ 15 = k(12) \]
\[ \frac{15}{12} = k \]
\[ \frac{5}{4} = k \]
\[ y = \frac{5}{4}x \]
\[ y = \frac{5}{4}(32) \]
\[ y = 40 \]

If $y = -11$ when $x = 6$, find $x$ when $y = 44$.

\[ y = kx \]
\[ -11 = k(6) \]
\[ \frac{-11}{6} = k \]
\[ y = -\frac{11}{6}x \]
\[ 44 = -\frac{11}{6}x \]
\[ 44 = -\frac{11}{6}x (-\frac{6}{11}) \]
\[ 24 = x \]