Solving Literal Equations Methods

Definition: A literal equation is, simply put, an equation that has a lot of letters or variables. For example,

\[ A = lw \]
(The formula for finding the area of a rectangle)

and

\[ E = mc^2 \]
(Einstein’s Theory of Relativity)

are both literal equations.

When given a literal equation, you will often be asked to solve the equation for a given variable. The goal is to isolate that given variable. The process is the same process that you use to solve linear equations; the only difference is that you will be working with a lot more letters, and you may not be able to simplify as much as you can with linear equations. This packet will hopefully show you the process in a simple manner so that you will be able to solve literal equations yourself. See examples before for the method to solving literal equations for a given variable:

- Solve \( A = bh \) for \( b \).

Since \( h \) is multiplied times \( b \), you must divide both sides by \( h \) in order to isolate \( b \).

\[
\begin{align*}
A &= bh \\
\frac{A}{h} &= \frac{b \cdot h}{h} \\
\frac{A}{h} &= b
\end{align*}
\]
• Solve \( P = 2l + 2w \) for \( w \).

First, you subtract \( 2l \) from both sides, then divide both sides by 2 to isolate \( w \).

\[
P = 2l + 2w
\]

\[
P = 2l + 2w
\]

\[
\frac{P - 2l}{2} = \frac{2w}{2}
\]

\[
\frac{P - 2l}{2} = w
\]

• Solve \( Q = \frac{(c + d)}{2} \) for \( d \).

Since \( (c+d) \) is divided by 2, you must first multiply both sides of the equation by 2. Then you have to subtract \( c \) from both sides in order to isolate \( d \).

\[
Q = \frac{(c + d)}{2}
\]

\[
2 \cdot Q = \frac{(c + d)}{2} \cdot 2
\]

\[
2Q = c + d
\]

\[
2Q = c + d
\]

\[
\frac{2Q - c}{-c} = \frac{d}{d}
\]

\[
2Q - c = d
\]
- Solve $V = \frac{3k}{t}$ for $t$.

Since $t$ is in the denominator, you must first multiply both sides by $t$ to get it out of the denominator. Then you need to divide both sides by $V$ in order to isolate $t$.

\[ V = \frac{3k}{t} \]
\[ V \cdot t = \frac{3k}{f} \cdot t \]
\[ \frac{V}{V} = \frac{3k}{V} \]
\[ t = \frac{3k}{V} \]

- Solve $Q = 3a + 5ac$ for $a$.

This one’s tricky! Initially, it seems hard to isolate the $a$, since it’s split up between two unlike terms, but as you see, if you simply factor the $a$ out of the two terms, then you are left with $a(3+5c)$. Then you just need to divide both sides by $(3+5c)$ in order to isolate $a$.

\[ Q = 3a + 5ac \]
\[ Q = a(3 + 5c) \]
\[ \frac{Q}{3+5c} = a \]