1 Literal Equations 2.5

By the end of this section, you should be able to solve the following problems.

1. Solve for the indicated variable.

\[ 5y - 3x = -2 \quad \text{for } x \]

2. Solve for the given variable.

\[ F = \frac{9}{5}C + 32 \quad \text{for } C \]

3. Solve for the indicated variable.

\[ A = \frac{h}{2}(b_1 + b_2) \quad \text{for } b_1 \]

2 Concepts

In previous sections, you studied how to solve an equation for a particular number. In this section we use the exact same reasoning to solve for a particular letter. Below is an example.
2.1 Example

Solve the following equation for $x_1$.

\[ y - y_1 = m(x - x_1) \]

\[ y - y_1 = mx - mx_1 \]

\[ -mx \quad - mx \]

\[ y - y_1 - mx = -mx_1 \]

\[ \frac{y - y_1 - mx}{-m} = -\frac{mx_1}{-m} \]

\[ \frac{y - y_1 - mx}{-m} = x_1 \]

We don’t like negative signs in our denominators, so change the denominator to a positive and change all the signs in the numerator to get.

\[ \frac{y_1 + mx - y}{m} = x_1 \]

In our next example we also solve for a single letter.

2.2 Example

Solve the following equation for $x$.

\[ Tx + by = r \]
Our next example is the familiar perimeter equation.

2.3 Example

Solve for \( l \) in the following equation.

\[
P = 2l + 2w
\]

\[
-2w - 2w
\]

\[
P - 2w = 2l
\]

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

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

When dividing both sides by a letter or number, make sure to divide the entire expression on both sides by that letter or number. For example, when solving for \( R \) in the expression below we divide the entire
expression on both sides by $h$

$$Rh = a + b - de$$

$$\frac{Rh}{h} = \frac{a + b - de}{h}$$

$$R = \frac{a + b - de}{h}$$

3 Exercises

1. Solve for the indicated variable.

$$5y - 3x = -2; \text{ for } x$$

2. Solve for C.

$$F = \frac{9}{5} C + 32$$

3. Solve for the indicated variable.

$$A = \frac{h}{2} (b_1 + b_2); \text{ for } b_1$$
4 Solutions

1. Solve for the indicated variable.

\[ 5y - 3x = -2 \; ; \; for \; x \]

\[
\begin{align*}
-5y & - 5y \\
-3x &= -2 - 5y \\
\frac{-3x}{-3} &= \frac{-2 - 5y}{-3} \\
x &= \frac{-2 - 5y}{-3} \\
x &= \frac{5y + 2}{3}
\end{align*}
\]

2. Solve for C.

\[ F = \frac{9}{5} C + 32 \]

\[
\begin{align*}
-32 & - 32 \\
\frac{5}{9}(F - 32) &= \frac{5}{9} \left( \frac{9}{5} \right) C \\
\frac{5}{9}(F - 32) &= C
\end{align*}
\]

3. Solve for the indicated variable.

\[ A = \frac{h}{2}(b_1 + b_2) \; ; \; for \; b_1 \]
(2) \( A = \left(2 \frac{h}{2}(b_1 + b_2) \right) \)

\[
\frac{2A}{h} = \frac{h(b_1 + b_2)}{h} = b_1 + b_2
\]

\[
- b_2 - b_2
\]

\[
\frac{2A}{h} - b_2 = b_1
\]