Lesson Objectives

- Solve algebraic equations with variables on the same side of the equation.
- Solve algebraic equations with variables on both sides of the equation.
- Solve algebraic equations in factored form.

\[
\begin{align*}
3x + 4 &= 25 \\
[2] \\
2x &= 21 \\
\frac{2x}{2} &= \frac{21}{2} \\
x &= 7
\end{align*}
\]

\[
\text{check:}
\begin{align*}
3x + 4 &= 25 \\
3(7) + 4 &= 25 \\
21 + 4 &= 25 \\
25 &= 25 \checkmark
\end{align*}
\]
Solve each equation.

a) \[
\begin{align*}
3 - 7x &= 10 \\
\underline{\text{Add } 7} \\
x &= -1
\end{align*}
\]

Check: \(x = 1\) ?

\[
\begin{align*}
3 - 7(1) &= 10 \\
3 - 7 &= 10 \\
-4 &\neq 10
\end{align*}
\]

\[
\begin{align*}
3 - 7(-1) &= 10 \\
3 + 7 &= 10 \\
10 &= 10 \checkmark
\end{align*}
\]
b) \[
\frac{1}{6}y - \frac{1}{3} = 2
\]
\[
\frac{1}{6}y = \frac{2}{3} + \frac{1}{3}
\]
\[
\frac{1}{6}y = \frac{3}{3}
\]
\[
y = 14
\]

6 \left[ \frac{1}{6}y - \frac{1}{3} \right] = \left[ 2 \right] 6

\[
y - \frac{2}{2} = \frac{12}{6}
\]
\[
y = \frac{12}{6} + \frac{2}{6} + \frac{2}{6}
\]
\[
y = 14
\]

*Clearing the fractions: multiply both sides by the LCD (or LCM)*
c) \[ \frac{1}{2}x + 1.5 - 0.5x = 4.5 \]
\[ 0.5x + 1.5 = 4.5 \]
Solution \[ 0.5x = 3 \]
\[ x = 6 \]
\[ x = 6 \] gives the solution of \( x + 1.5 - 0.5x = 4.5 \).

**Check:** Substitute the value of \( x = 6 \) into the original equation.

\[ x + 1.5 - 0.5x = 6 + 1.5 - 0.5 \cdot 6 \]
\[ = 4.5 \]

When \( x = 6 \), the equation \( x + 1.5 - 0.5x = 4.5 \) is true. \( x = 6 \) gives the solution.
c) \[2(\frac{x + 1.5 - 0.5x}{2} - \frac{x}{2}) = (4.5)^2 \]
\[2x + 3 - x = 9\]
\[x + \frac{3}{2} = 9\]
\[-\frac{3}{2} - \frac{3}{2}\]
\[x = 6\]
\[
(7.63 - 5.2x + 9.6) = 13.1 \times 100
\]

\[
763 - 520x + 960 = 1310
\]

\[
-520x + 1723 = 1310
\]

\[
-1723 -1723
\]

\[
-520x = -413
\]

\[
-520
\]

\[
-520
\]

\[
x = \frac{413}{520}
\]
Guided Practice

Solve.

1. \(6x + 2 = 8\)

\[
\begin{align*}
6x + 2 &= 8 \\
-2 &= -2 \\
6x &= 6 \\
\frac{6x}{6} &= \frac{6}{6} \\
x &= 1
\end{align*}
\]

2. \(\frac{3 - 3x}{3} = 20\)

\[
\begin{align*}
-3x &= 15 \\
\frac{-3x}{-3} &= \frac{15}{-3} \\
x &= -5
\end{align*}
\]

3. \((4x - 3 + 0.5x) = (1.5)2\)

\[
\begin{align*}
6x - 6 + x &= 3 \\
7x &= 9 \\
\frac{7x}{7} &= \frac{9}{7} \\
x &= \frac{9}{7}
\end{align*}
\]

4. \((\frac{9}{10}x - \frac{4}{5}) = (1)10\)

\[
\begin{align*}
9x - 8 &= 10 \\
+8 &= +8 \\
9x &= 18 \\
\frac{9x}{9} &= \frac{18}{9} \\
x &= 2
\end{align*}
\]

Clear the fraction:

\[
\begin{align*}
\frac{2(10)}{1} \cdot \frac{4}{81} &= \frac{8}{1} = 8
\end{align*}
\]
Solving equations with variables on BOTH sides:

The GOAL remains the same - isolate the variable. This means, try to move terms around so that the variable is all by itself on one side of the equal sign!

\[ 4x + 7 = x + 10 \]
Mary Ella:
\[
\begin{align*}
4x + 7 &= x + 10 \\
-x &
\end{align*}
\]
\[
\begin{align*}
3x + 7 &= 10 \\
-7 &
\end{align*}
\]
\[
\begin{align*}
2x &= 3 \\
\frac{2x}{2} &= \frac{3}{2} \\
x &= 1
\end{align*}
\]

Cole:
\[
\begin{align*}
4x + 7 &= x + 10 \\
&\quad \cancel{7} - \cancel{7}
\end{align*}
\]
\[
\begin{align*}
4x &= x + 3 \\
-\frac{4x}{4} &
\end{align*}
\]
\[
\begin{align*}
3x &= 3 \\
x &= 1
\end{align*}
\]
\[
\frac{4x + 7}{-4x} = \frac{x + 10}{-4x}
\]
\[
\frac{7}{-10} = \frac{-3x + 16}{-10}
\]
\[
\frac{-3}{-3} = \frac{-3x}{-3}
\]
\[
x = 1
\]

\[
\frac{4x + 7}{-10} = \frac{x + 10}{-10}
\]
\[
\frac{4x - 3}{-4x} = \frac{x}{-4x}
\]
\[
\frac{-3}{-3} = \frac{-3x}{-3}
\]
\[
x = 1
\]
c) \[8 \left( \frac{3}{4}x - \frac{1}{2} \right) = \frac{3}{8}x + 4\]

\[6x - 4 = 3x + 32\]

\[-3x\]

\[3x = 32\]

\[x = \frac{32}{3}\]

\[x = 12\]
**Method 2**

Solve by multiplying both sides of the equation by the LCD.

\[
8 \cdot \left( \frac{3}{4}x - \frac{1}{2} \right) = 8 \cdot \left( \frac{3}{8}x + 4 \right)
\]

\[
8 \cdot \frac{3}{4}x - 8 \cdot \frac{1}{2} = 8 \cdot \frac{3}{8}x + 8 \cdot 4
\]

\[
6x - 4 = 3x + 32
\]

\[
6x - 4 - 3x = 3x + 32 - 3x
\]

\[
3x - 4 = 32
\]

\[
3x - 4 + 4 = 32 + 4
\]

\[
3x = 36
\]

\[
\frac{3x}{3} = \frac{36}{3}
\]

\[
x = 12
\]

Multiply both sides by 8, the LCD of \(\frac{3}{4}, \frac{1}{2},\) and \(\frac{3}{8}\).

Use the distributive property.

Simplify.

Subtract 3x from both sides.

Simplify.

Add 4 to both sides.

Simplify.

Divide both sides by 3.

Simplify.

In **Method 1** and **Method 2**, the variable is isolated on the left side of the equation.

You can also isolate the variable on the right side of the equation. Remember to check your solution.
Guided Practice

Solve each equation. Check your solution.

5. \( 11 - 4x = x + 16 \)

\[
\begin{align*}
11 - 4x &= x + 16 \\
11 - 4x - x &= x + 16 - x \\
11 + ? &= 16 \\
11 + ? - 11 &= 16 - 11 \\
? &= 5 \\
?x &= ? \\
x &= ?
\end{align*}
\]

- Subtract \( x \) from both sides.
- Simplify.
- Subtract 11 from both sides.
- Simplify.
- Divide both sides by \( ? \).
- Simplify.
Guided Practice

Solve each equation. Check your solution.

5 11 - 4x = x + 16
Guided Practice

Solve each equation. Check your solution.

5. \(11 - 4x = x + 16\)

\[\begin{align*}
5x + 4x & = 11 + 16 \\
9x & = 27 \\
9x & = 27 \\
x & = 3
\end{align*}\]

6. \((3.4y - 5.2) = (3y + 2)10\)

\[\begin{align*}
3.4y - 52 & = 30y + 20 \\
34y - 52 & = 30y + 20 \\
4y & = 72 \\
y & = 18
\end{align*}\]

7. \(\frac{5}{9}y - \frac{1}{3} = \frac{2}{3}y + \frac{1}{3}\)