

Solving Equations With Parentheses

When solving equations containing parentheses, we must remove the parentheses by using the Distributive Property before we can solve. Removing parentheses will often give like terms which can be combined.

EXAMPLE:

$9x - 3(2x - 1) = 15$	Use the Distributive Property to remove the parentheses.
$9x - 6x + 3 = 15$	Combine like terms.
$3x + 3 = 15$	
$3x + 3 + (-3) = 15 + (-3)$	Add the opposite of 3 to both sides.
$3x = 12$	Combine like terms on both sides.
$\frac{1}{3} \times 3x = 12 \times \frac{1}{3}$	Multiply by the reciprocal of 3.
$x = 4$	

CHECK: $9(4) - 3[2(4) - 1] = 15$ Note: Use order of Operation to simplify

$$\begin{aligned}
 36 - 3[8 - 1] &= 15 \\
 36 - 3[7] &= 15 \\
 36 - 21 &= 15 \\
 15 &= 15 \quad \text{TRUE}
 \end{aligned}$$

EXAMPLE:

$5 - 1(9 - 6x) = 2x - 2$	
$5 - 9 + 6x = 2x - 2$	Use the Distributive Property to remove the parentheses.
$-4 + 6x = 2x - 2$	Combine like terms.
$-4 + 6x + (-2x) = -2x + 2x - 2$	Add the opposite of $2x$ to both sides combine like terms.
$-4 + 4x = -2$	
$-4 + 4 + 4x = -2 + 4$	Add the opposite of -4 to both sides.
$4x = 2$	Combine like terms on both sides.
$\frac{1}{4} \times 4x = 2 \times \frac{1}{4}$	Multiply both sides by the reciprocal of 4.
$x = \frac{2}{4}$	Reduce fraction.
$x = \frac{1}{2}$	

CHECK: $5 - \left[9 - 6 \times \left(\frac{1}{2} \right) \right] = 2 \times \left(\frac{1}{2} \right) - 2$

$$\begin{aligned}
 5 - \left[9 - \frac{6}{2} \right] &= \frac{2}{2} - 2 \\
 5 - [9 - 3] &= 1 - 2 \\
 5 - 6 &= -1 \\
 -1 &= -1 \quad \text{TRUE}
 \end{aligned}$$

Some equations have parentheses inside brackets. With these problems we must start from the inside and work our way out.

EXAMPLE:

$$-3[x + 4(x + 1)] = x + 4$$

Use the Distributive Property to remove the parentheses.

$$-3[x + 4x + 4] = x + 4$$

Combine like terms inside the brackets.

$$-3[5x + 4] = x + 4$$

$$-15x - 12 = x + 4$$

Use the Distributive Property to remove the brackets.

$$-15x + (-x) - 12 = -x + x + 4$$

Add the opposite of x to both sides.

$$-16x - 12 = 4$$

Combine like terms on both sides.

$$-16x - 12 + 12 = 4 + 12$$

Add the opposite of -12 to both sides

$$-16x = 16$$

$$\frac{-1}{16} \times -16 = 16 \times \frac{-1}{16}$$

Multiply on both sides by the reciprocal of -16 .

$$x = -1$$

CHECK:

$$-3[x + 4(x + 1)] = x + 4$$

$$-3[-1 + 4(-1 + 1)] = -1 + 4$$

$$-3[-1 + 4(0)] = -1 + 4$$

$$-3[-1 + 0] = -1 + 4$$

$$-3[-1] = -1 + 4$$

$$3 = 3 \quad \text{TRUE}$$

EXERCISES: Solve and check.

KEY:

1. $12y - 2(4y - 6) = 28$

1. $y = 4$

2. $10x + 1 = 2(3x + 5)$

2. $x = \frac{9}{4}$

3. $3a - 7 = 5(2a - 3) + 4$

3. $a = \frac{4}{7}$

4. $4(x - 2) + 2 = 4x - 2(2 - x)$

4. $x = -1$

5. $2[y - (4y - 5)] = 3y + 4$

5. $y = \frac{2}{3}$

6. $2(x - 3) = 2(4 - 2x)$

6. $x = \frac{7}{3}$

7. $3(a - 5) - 5a = 2a + 9$

7. $a = -6$

8. $3[4 - 2(x - 2)] = 3(2 - 4x)$

8. $x = -3$