

Solving Multi-Step Equations

Objectives:

- ...to solve multi-step equations involving integers, decimals, and fractions
- ...to solve equations with variable terms on both sides

Assessment Anchor:



Not Applicable

NOTES

To solve a multi-step equation:

1. Perform any distributive property shown in the equation.
2. Combine any like terms in the equation (do not cross the = sign)
3. Now you should see a two step equation remaining, please follow the steps for solving two step equations.

EXAMPLES

1)

$$2(x + 5) = -11$$

$$-3(y + 10) = -9$$

Distribute

$$2(x + 5) = -11$$

$$-3(y + 10) = -9$$

Subtract 10 on both sides

$$2x + 10 = -11$$

$$\underline{-10 \quad -10}$$

Divide by 2 on both sides

$$\frac{2x}{2} = \frac{-21}{2}$$

$$x = -\frac{21}{2} \text{ or}$$

$$-10\frac{1}{2} \text{ or}$$

$$-10.5$$

Solving Multi-Step Equations

2) $-13 = 5 + 4x - 6x$ $7 = 2 + 5y - 8$

Combine like terms
Subtract 5 on both sides
Divide by -2 on both sides

$$\begin{array}{r} -13 = 5 + 4x - 6x \\ -13 = -2x + 5 \\ \underline{-5 \quad -5} \\ -18 = -2x \\ \underline{-2 \quad -2} \\ 9 = x \end{array}$$
$$7 = 2 + 5y - 8$$

3) $\frac{1}{2}(4x - 10) = -7$ $-17 = \frac{1}{3}(y + 9)$

Distribute
Add 5 on both sides
Divide by 2 on both sides

$$\begin{array}{r} \frac{1}{2}(4x - 10) = -7 \\ 2x - 5 = -7 \\ \underline{\quad +5 \quad +5} \\ \frac{2x}{2} = \frac{-2}{2} \\ x = -1 \end{array}$$
$$-17 = \frac{1}{3}(y + 9)$$

4) $1.3 + 4x - 2.8 = 0.3$ $3.4 = 3 - 2x + 1.2$

Combine like terms
Add 1.5 on both sides
Divide by 4 on both sides

$$\begin{array}{r} 1.3 + 4x - 2.8 = 0.3 \\ 4x - 1.5 = 0.3 \\ \underline{\quad +1.5 \quad +1.5} \\ \frac{4x}{4} = \frac{1.8}{4} \\ x = 0.45 \end{array}$$
$$3.4 = 3 - 2x + 1.2$$

Solving Multi-Step Equations

MORE EXAMPLES

5) $-2(4x - 3) = 10$

6) $3x + 7x - 8 = -19$

7) $-35 = -3x + 8 + 5x$

8) $14 = -\frac{1}{2}(8x + 12)$

9) $3.4 + 0.5y + 1.1 = -4.5$

Solving Multi-Step Equations

EVEN MORE EXAMPLES – Careful Here!!

10) $4(2x - 11) - 6x = -3$

11) $-32 = -3 + 7x + 3(x - 2)$

12) $2.3 + 0.02(x + 20) - 4.8 = -9$

Solving Multi-Step Equations

MORE NOTES

To solve an equation with variables on both sides:

1. Perform any distributive property shown in the equation.
2. Combine any like terms in the equation (do not cross the =)
3. Try to get all the variable terms on one side of the equation
 - a. It doesn't matter which side you choose
 - b. Make sure you follow the rules for equations
4. Now get all the constants (regular numbers) on the OTHER side of the equation.
 - a. You must have your variable term on one side, and your constant term on the other
 - b. Make sure you follow the rules for equations
5. Divide to get the variable all by itself

EXAMPLES

1)

$$3x + 20 = x - 8$$

$$7x - 8 = 9x + 7$$

Subtract x on both sides

$$\begin{array}{r} 3x + 20 = x - 8 \\ -x \quad -x \\ \hline 2x + 20 = -8 \end{array}$$

$$7x - 8 = 9x + 7$$

Subtract 20 on both sides

$$\begin{array}{r} 2x + 20 = -8 \\ -20 \quad -20 \\ \hline 2x = -28 \end{array}$$

Divide by 2 on both sides

$$\begin{array}{r} 2x = -28 \\ \hline x = -14 \end{array}$$

***Alternate way...

Subtract 3x on both sides

$$\begin{array}{r} 3x + 20 = x - 8 \\ -3x \quad -3x \\ \hline 20 = -2x - 8 \end{array}$$

Add 8 on both sides

$$\begin{array}{r} 20 = -2x - 8 \\ +8 \quad +8 \\ \hline 28 = -2x \\ \hline -2 \quad -2 \end{array}$$

same answer!

$$-14 = x$$

Solving Multi-Step Equations

2) $-13 + 7x = -3x - 33$ $8 - 5x = 9 + x$

Add 3x on both sides

$$\begin{array}{r} -13 + 7x = -3x - 33 \\ + 3x \quad + 3x \\ \hline -13 + 10x = -33 \end{array}$$

Add 13 on both sides

$$\begin{array}{r} -13 + 10x = -33 \\ + 13 \quad \quad + 13 \\ \hline 10x = -20 \end{array}$$

Divide by 10 on both sides

$$\frac{10x}{10} = \frac{-20}{10}$$
$$x = -2$$

3) $-10x + 15 = 17 - 6x$ $3x - 7 = 5x + 9$

Add 10x on both sides

$$\begin{array}{r} -10x + 15 = 17 - 6x \\ + 10x \quad \quad + 10x \\ \hline 15 = 17 + 4x \end{array}$$

Subtract 17 on both sides

$$\begin{array}{r} 15 = 17 + 4x \\ - 17 \quad - 17 \\ \hline -2 = 4x \end{array}$$

Divide by 4 on both sides

$$\frac{-2}{4} = \frac{4x}{4}$$
$$x = -0.5 \text{ or } -\frac{1}{2}$$

4) $-6x + 10 = -8x + 18$ $9 - 3x = 3x - 12$

Add 8x on both sides

$$\begin{array}{r} -6x + 10 = -8x + 18 \\ + 8x \quad \quad + 8x \\ \hline 2x + 10 = 18 \end{array}$$

Subtract 10 on both sides

$$\begin{array}{r} 2x + 10 = 18 \\ - 10 \quad \quad - 10 \\ \hline 2x = 8 \end{array}$$

Divide by 2 on both sides

$$\frac{2x}{2} = \frac{8}{2}$$
$$x = 4$$

Solving Multi-Step Equations

MORE EXAMPLES

5) $-7x + 11 = 19 - x$

6) $18 - 12y = -22 - 7y$

7) $8 - 5y = -3y - 31$

8) $49 + 2x = 6x + 52$

9) $2(x + 7) - 34 = 4x - 11x + 4(x - 1)$