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Module 3 Solving Linear Equations of One Variable
Lesson 5 Solving Multi-Step Linear Equations

guided notes

Lesson Objectives

- Solve equations involving more than one step.
- Solve multi-step equations involving fractions.
- Solve multi-step equations using the Distributive Property.
- Solve equations that are identities.
- Solve equations that have no solution.

A multi-step equation is an equation requiring more than one **step** to solve it.

Terms with variables are like terms if they have the same **variables** to the same **powers**.

Solve: $2x + 3x = 10$

$\underline{5x} = \underline{10}$

$\frac{5x}{5} = \frac{10}{5}$

$x = \underline{2}$

To check this solution, replace each x with **2** and see if the resulting statement is true.

Check: $2x + 3x = 10$

$2(\underline{2}) + 3(\underline{2}) \stackrel{?}{=} 10$

$\underline{4} + \underline{6} \stackrel{?}{=} 10$

$10 = 10$ ✓

To solve an equation with variables on both sides you get all the terms involving **variables** on one side of the equation and all the **numerical terms** on the other side.

Solve: $6p + 5 = 8p + 1$

$\underline{-2p} + 5 = \underline{1}$

$\underline{-2p} = \underline{-4}$

$\underline{p} = \underline{2}$

Check: $6p + 5 = 8p + 1$

$\underline{6(2) + 5} \stackrel{?}{=} \underline{8(2) + 1}$

$\underline{12 + 5} \stackrel{?}{=} \underline{16 + 1}$

$\underline{17} = \underline{17}$ ✓

The solution is $\underline{2}$.

Solve: $9x + 5 - x = 4x + 3$

$\underline{8x} + 5 = 4x + 3$

$\underline{4x} + 5 = 3$

$4x = \underline{2}$

$x = \underline{-\frac{1}{2}}$

Check: $9x + 5 - x = 4x + 3$

$9\underline{\left(-\frac{1}{2}\right)} + 5 - \underline{\left(-\frac{1}{2}\right)} \stackrel{?}{=} 4\underline{\left(-\frac{1}{2}\right)} + 3$

$\underline{\left(\frac{-9}{2}\right)} + 5 + \underline{\left(-\frac{1}{2}\right)} \stackrel{?}{=} \underline{-2} + 3$

$1 = 1$ ✓

The solution is $\underline{\left(-\frac{1}{2}\right)}$.

Solve: $y + y + 1 + y + 2 = 3y + 3$

$\underline{3y + 3} = 3y + 3$

$\underline{3} = 3$

The equation above is an $\underline{\text{identity}}$ because it is true for $\underline{\text{every}}$ value of the variable. The solution set is $\{\underline{\text{all real numbers}}\}$.

Solve: $x - 4 + x + 1 = 2x + 7$

$\underline{2x - 3} = 2x + 7$

$\underline{-3} = 7$

The solution set is $\underline{\varnothing}$.

1. Solve: $4B + 2 = 37 - B$

$\underline{5B + 2} = 37$

$5B = \underline{35}$

$\underline{B} = 7$

The solution is $\underline{7}$.

2 Solve: $z + 7 + 3z = 2z + 5 + 2z + 2$

$\underline{4z = 7}\ = 4z + 7$

$7 = \underline{7}$

This equation is an **identity**.

The solution set is {**all real numbers**}.

Example: $4(3m - 2) + 1 = 17$

$\underline{12m - 8}\ + 1 = 17$

$12m - \underline{7}\ = 17$

$12m = \underline{24}$

$\underline{m}\ = \underline{2}$

The solution is **2**.

Example: $\frac{1}{2}j - 6 = -20 - \frac{2}{3}j$

$\underline{6}\cdot\left(\frac{1}{2}j - 6\right) = \underline{6}\cdot\left(-20 - \frac{2}{3}j\right)$

$\underline{3j - 36}\ = -120 - 4j$

$\underline{7j}\ - 36 = -120$

$7j = \underline{-84}$

$j = \underline{-12}$

The solution is **–12**.

To eliminate fractions in an equation, multiply both sides by the

least common denominator.

3 Solve: $13z = 3(16 - z)$

$\underline{13z}\ = \underline{48 - 3z}$

$\underline{16z}\ = \underline{48}$

$\underline{z}\ = \underline{3}$

The solution is **3**.

4 Solve: $4(t + 3) = 2(2t + 1)$

$\underline{4t + 12}\ = \underline{4t + 2}$

$\underline{12}\ = \underline{2}$

The equation has **no** solution.

The solution set is **∅**.

5 Solve: $\frac{1}{6}w = 2 - \frac{1}{9}w$

$\underline{18} \cdot \left(\frac{1}{6}w\right) = \underline{18} \cdot \left(2 - \frac{1}{9}w\right)$

$\underline{3w} = \underline{36 - 2w}$

$\underline{5w} = \underline{36}$

$\underline{w} = \frac{36}{5} = 7\frac{1}{5}$

The solution is $\underline{7\frac{1}{5}}$.

When solving a multi-step equation:

- Eliminate parentheses by using the Distributive Property.
- Simplify each side of the equation as needed, by combining like terms.
- Get all the variable terms on one side of the equation and all the numerical terms on the other side.
- Simplify each side of the equation as needed, by combining like terms.
- Divide both sides by the variable's coefficient.

An equation is a mathematical statement that has the same value on either side of the equal sign. Every step in solving an equation will have an equal sign in it.