Day 3 – Solving Multi-Step Equations

Multi-step equations mean you might have to add, subtract, multiply, or divide all in one problem to isolate the variable. When solving multi-step equations, you are using inverse operations, which is like doing PEMDAS in reverse order or in other words "<u>D</u>on't <u>C</u>all <u>M</u>e <u>A</u>fter <u>M</u>idnight."

Guided Example: $7(x - 4) + 4x = -28 + 2x$

<u>D</u>istribute: multiply term outside parentheses by what's inside

<u>C</u>ombine Like Terms: with the signs of the term

<u>M</u>ove Variable: isolate variable with inverse operations

<u>A</u>dd or Subtract: using properties of equality (inverse operations)

<u>M</u>ultiply or Divide: using properties of equality (inverse operations)

$$7(x-4) + 4x = -28 + 2x$$
$$7x - 28 + 4x = -28 + 2x$$
$$11x - 28 = -28 + 2x$$
$$\ -2x \qquad\qquad -2x$$
$$9x - 28 = -28$$
$$+28 \qquad +28$$
$$\frac{9x}{9} = \frac{0}{9}$$

Multi - Step Equations with the <u>Distributive Property</u>

$$X = 0$$

Practice: Solve each equation, showing all steps, for each variable.

a. $2(n + 5) = -2$

$(2 \cdot n)\ (2 \cdot 5)$

$$2(n+5) = -2$$
$$2n + 10 = -2$$
$$-10 \quad -10$$
$$\frac{2n}{2} = \frac{-12}{2}$$
$$n = -6$$

b. $4(2x - 7) + 5 = -39$

$(4 \cdot 2x)\ (4 \cdot -7)$

$$4(2x-7) + 5 = -39$$
$$8x - 28 + 5 = -39$$
$$8x - 23 = -39$$
$$+23 \quad +23$$
$$\frac{8x}{8} = \frac{16}{8}$$
$$X = 2$$

c. $6x - (3x + 8) = 16$

$(-1 \cdot 3x)\ (-1 \cdot 8)$

$$6x - 1(3x+8) = 16$$
$$6x - 3x - 8 = 16$$
$$3x - 8 = 16$$
$$+8 \quad +8$$
$$\frac{3x}{3} = \frac{24}{3}$$
$$X = 8$$

Multi - Step Equations with Combining Like Terms

Practice: Solve each equation, showing all steps, for each variable.

a. $-5n + 6n + 15 - 3n = -3$

$$(-5n + 6n - 3n) + 15 = -3$$
$$-2n + 15 = -3$$
$$-15 \quad -15$$
$$\frac{-2n}{-2} = \frac{-18}{-2}$$
$$n = 9$$

b. $3x + 12x - 20 = 25$

$$(3x + 12x) - 20 = 25$$
$$15x - 20 = 25$$
$$+20 \quad +20$$
$$\frac{15x}{15} = \frac{45}{15}$$
$$X = 3$$

c. $-2x + 4x - 12 = 40$

$$2x - 12 = 40$$
$$+12 \quad +12$$
$$\frac{2x}{2} = \frac{52}{2}$$
$$X = 26$$

4

Multi - Step Equations with Variables on Both Sides

Practice: Solve each equation, showing all steps, for each variable

a. $5p - 14 = 8p + 4$

$$-5p \quad | \quad -5p$$
$$-14 = 3p + 4$$
$$-4 \quad | \quad -4$$
$$\frac{-18}{3} = \frac{3p}{3}$$
$$-6 = p$$

b. $8x - 1 = 23 - 4x$

$$+4x \quad \quad +4x$$
$$12x - 1 = 23$$
$$+1 \quad | \quad +1$$
$$\frac{12x}{12} = \frac{24}{12}$$
$$x = 2$$

c. $5x + 34 = -2(1 - 7x)$

$$5x + 34 = -2 + 14x$$
$$-5x \quad \quad -5x$$
$$34 = -2 + 9x$$
$$+2 \quad | \quad +2$$
$$\frac{36}{9} = \frac{9x}{9}$$
$$4 = x$$

Error Analysis with Solving Equations

1. Rachel solved the following equation on her homework. However, she solved it incorrectly. Describe the mistake Rachel made and what she should have done instead. Then resolve the equation to find the correct answer.

$$✗ \quad -2(7 - y) + 4 = -4$$
$$-14 - 2y + 4 = -4$$
$$-10 - 2y = -4$$
$$-2y = 6$$
$$y = -3$$

Distributing:

Mistake: $(-2)(-y) = +2y$ instead of $-2y$

Correction Solution: $-2(7-y) + 4 = -4$
$$-14 + 2y + 4 = -4$$
$$-10 + 2y = -4$$
$$+10 \qquad +10$$
$$\frac{2y}{2} = \frac{6}{2}$$
$$y = 3$$

2. Mikayla solved the following equation on her homework. However, she solved it incorrectly. Describe the mistake Mikayla made and what she should have done instead. Then resolve the equation to find the correct answer.

$$2(x + 3) = -3(-x + 1) ✓$$
$$2x + 6 = 3x - 3 ✓$$
$$5x + 6 = -3$$
$$5x = -9$$
$$x = -\frac{5}{9}$$

Mistake: Moving the variable: subtract 3x from both sides, not add

Correction Solution: $2(x+3) = -3(-x+1)$
$$2x + 6 = 3x - 3$$
$$-2x \quad | \quad -2x$$
$$6 = 1x - 3$$
$$+3 \quad | \quad +3$$
$$9 = x$$

5