8.8 (Part 1) Solving Multi-Step Equations

Solving multi-step equations is all about isolating the variable.

Example: Solve the equation.

1.) $20(x + 2.5) = 15(2x + 1)$

$$20x + 50 = 30x + 15$$
$$-20x \qquad -20x$$
$$50 = 10x + 15$$
$$-15 \qquad -15$$
$$\frac{35}{10} = \frac{10x}{10}$$
$$x = 3.5 \text{ or } \frac{7}{2} \text{ or } 3\frac{1}{2}$$

2.) $12m + 12 = 6(3m + 3)$

$$12m + 12 = 18m + 18$$
$$-12m \qquad -12m$$
$$12 = 6m + 18$$
$$-18 \qquad -18$$
$$\frac{-6}{6} = \frac{6m}{6}$$
$$m = -1$$

Example: Solve the equation.

3.) $5(n - 3) = 3(n + 7)$

$$5n - 15 = 3n + 21$$
$$-3n \qquad -3n$$
$$2n - 15 = 21$$
$$+15 \quad +15$$
$$\frac{2n}{2} = \frac{36}{2}$$
$$n = 18$$

4.) $6(b - 2) = 2(2b + 8)$

$$6b - 12 = 4b + 16$$
$$-4b \qquad -4b$$
$$2b - 12 = 16$$
$$+12 \quad +12$$
$$\frac{2b}{2} = \frac{28}{2}$$
$$b = 14$$

Some equations have no solution. When this occurs, the solution is the null or empty set, shown by the symbol $\emptyset$ or {}. Other equations may have every number as their solution. An equation that is true for every value of the variable is call an identity. It is answered with "all real numbers".

Example: Solve the equation.

5.) $3(y - 5) + 25 = 3y + 10$

$3y - 15 + 25 = 3y + 10$

$3y + 10 = 3y + 10$
$-3y \qquad\qquad -3y$

$10 \stackrel{\checkmark}{=} 10$

ALL REAL NUMBERS

$\mathbb{R}$

6.) $-5s - 14 = 2(2s + 3) - 9s$

$-5s - 14 = 4s + 6 - 9s$

$-5s - 14 = -5s + 6$
$+5s \qquad\qquad +5s$

$-14 \neq 6$

NO SOLUTION

$\emptyset$

Example: Solve the equation.

7.) $14 + 8w = 4(8 + 2w)$

$14 + 8w = 32 + 8w$
$-8w \qquad\qquad -8w$

$14 \neq 32$

NO SOLUTION

$\emptyset$

8.) $-2(3r + 4) = -5r - 8 - r$

$-6r - 8 = -5r - 8 - r$

$-6r - 8 = -6r - 8$
$+6r \qquad\qquad +6r$

$-8 \stackrel{\checkmark}{=} -8$

ALL REAL NUMBERS

$\mathbb{R}$