

## Warm-Up

11/6/17

Simplify the following expressions.

1.  $10c + c = 11c$

2.  $8.2b + 3.8b - 12b = 0$

3.  $5m + 2(2m - 7)$

4.  $6x - (2x + 5)$

⑤  $5m + 4m - 14$

$$9m - 14$$

④  $6x - 2x - 5$

$$4x - 5$$

## Essential Question 11/6/17

- How can I solve equations with variables on both sides of the equal sign?

## Learning Objective

- I can solve multi-step equations.

## Solving Equations with Variables on both Sides - NOTES

Goal: Get ONE variable alone on one side of = sign.

1. Use Distributive Property, if necessary.
2. Combine like terms, if necessary
3. Move one variable by adding its inverse to both sides of =.
4. Solve as usual.

$$\begin{array}{r} 24 \\ -15 \\ \hline 9 \end{array}$$

$$24 + 15 = 35 + 4$$

1.

$$12k + 15 = 35 + 2k$$

Original problem

$$\begin{array}{r} -2k \quad -2k \\ \hline \end{array}$$

Move variables to one side.

$$\begin{array}{r} 10k + 15 = 35 \\ -15 \quad -15 \\ \hline \end{array}$$

Eliminate adding or subtracting

$$\begin{array}{r} 10k = 20 \\ \hline 10 \quad 10 \end{array}$$

Eliminate multiplying or dividing

$$\boxed{k = 2}$$

Solution! Remember...Check Your Answer!

2.  $3(a+22) = 12a + 30$  Original Problem

$3a + 66 = 12a + 30$  Do the Distributive Property First!!!

$\begin{array}{r} -3a \quad -3a \\ \hline 66 = 9a + 30 \end{array}$  Move Variables to one Side.

$\begin{array}{r} -30 \quad -30 \\ \hline 36 = 9a \end{array}$  Eliminate adding or subtracting

$\begin{array}{r} 36 = 9a \\ \hline 9 \quad 9 \end{array}$  Eliminate multiplying or dividing

$\boxed{4 = a}$  Solution! Remember...Check Your Answer!

$$3. \quad 3(\overset{3-5}{x+1}) - 5 = 5x - 2 \quad \text{Original Problem}$$

$$3x + 3 - 5 = 5x - 2 \quad \text{Do the Distributive Property First!!!}$$

$$3x - 2 = 5x - 2 \quad \text{Combine Like Terms}$$

$$-\cancel{3x} \quad -3x \quad \text{Move Variables to one Side.}$$

$$\begin{array}{r} -2 = 2x - 2 \\ + 2 \quad \quad + 2 \end{array} \quad \text{Eliminate adding or subtracting}$$

$$\begin{array}{r} 0 = 2x \\ \hline 2 \quad \quad 2 \end{array} \quad \text{Eliminate multiplying or dividing}$$

$$\boxed{x = 0}$$

Solution! Remember...Check Your Answer!



## Try This!

$$5. \quad 7 - 3x = x - 4(2 + x)$$

$$7 - 3x = \cancel{x} - 8 - 4x$$

$$\begin{array}{r} 7 - 3x = -3x - 8 \\ + 3x \quad + 3x \end{array}$$

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$$7 = -8$$

false statement

No solution.

# Post-It Check 1

Solve for x

$$3x - 8 = 5(x - 4)$$

$$\begin{array}{r} 3x - 8 = 5x - 20 \\ -3x \quad -3x \\ \hline \end{array}$$

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

$$\frac{12}{2} = \frac{2x}{2} \quad x = 6$$



## Post-It Check 2

Solve for x

$$8(2x - 3) = 4(4x - 8)$$

$$\begin{array}{r} 16x - 24 = 16x - 32 \\ -16x \quad \downarrow \quad -16x \quad \downarrow \\ \hline \end{array}$$

$$-24 = -32$$

false statement

No solution

HMMM.....Take a look at the following examples:

6.  $6(4x - 5) = 24x - 30$

$$24x - 30 = 24x - 30$$

True Statement  
many solutions.

$$7. \quad 5(3x + 5) = 3(5x + 1)$$

$$\begin{array}{r} \cancel{15x} + 25 = \cancel{15x} + 3 \\ -\cancel{15x} \qquad -\cancel{15x} \\ \hline \end{array}$$

$$25 = 3$$

False statement

No Solution

The Rules:

- When you solve an equation and you end with a **true statement**, the solution set will be: many.

Example:  $3(x+2) = 3x+6$

**Many Solutions!**

When you solve an equation and you end with a **false statement**, the solution set will be: no solution.

$$3(x + 2) = 3x + 4$$

**No Solutions!**

## Try This!

8.  $\cancel{2x} + 5 = \cancel{2x} - 3$

$$5 = -3$$

False Statement

No Solution

## Try This!

9.  $3(x+1) - 5 = 3x - 2$

$$3x + 3 - 5 = 3x - 2$$

$$3x - 2 = 3x - 2$$

True Statement

Many Solution  $\Downarrow$

## Class Work # 10 -15 11/6/17

$$10. \quad 6x + 7 = 8x - 13$$

$$\begin{array}{r} \cancel{6x} + 7 = \cancel{8x} - 13 \\ \hline 7 = 2x - 13 \\ +13 \qquad +13 \\ \hline \end{array}$$

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

$$\boxed{10 = x}$$



$$11. \quad 6(y + 2) - 4 = -10$$

$$6y + 12 - 4 = -10$$

$$6y + \cancel{8} = -10$$

$$\begin{array}{r} 6y \\ \hline 6y \end{array} \quad \begin{array}{r} -10 \\ \hline -8 \end{array}$$

$$-3 = y$$

$$12. \quad 4(2x - 8) = 3(2 - 3x)$$

$$\begin{array}{r} 8x - 32 = 6 \\ +9x \qquad \qquad \qquad -9x \\ \hline 17x - 32 = 6 \\ \qquad \qquad \qquad +32 \quad +32 \\ \hline 17x = 38 \\ \frac{17x}{17} = \frac{38}{17} \quad \boxed{x = 2.23} \end{array}$$

$$13. \quad 4(r + 20) = \frac{1}{5}(20r + 400)$$

$$4r + 80 = 4r + 80$$

True Statement  
Many Solutions

$$14. -2x = (-3x) + 12 - 2x$$

$$\begin{array}{r} -2x = -5x + 12 \\ +5x \quad +5x \\ \hline \end{array}$$

$$\begin{array}{r} \cancel{3x} = \frac{12}{\cancel{3}} \\ \phantom{\cancel{3x}} = 4 \end{array}$$

$$x = 4$$

$$15. \quad 8(b + 1) + 4 = 3(2b - 8) - 16$$

$$8b + 8 + 4 = 6b - 24 - 16$$

$$\begin{array}{r} 8b + 12 = 6b - 40 \\ -6b \qquad -6b \\ \hline \end{array}$$

$$\begin{array}{r} 2b + 12 = -40 \\ -12 \qquad -12 \\ \hline \end{array}$$

$$\begin{array}{r} 2b = -52 \\ \hline 2 \qquad 2 \end{array}$$

$$b = -26$$

# More Practice

# 11/6/17

## Solving Equations with Variables on Both Sides of the Equal Sign II

Solve each equation below. Then use the answers to complete the cross number puzzle.



### Across

1.  $3x + 4 = 2x + 16$
2.  $3a = 5a + 22$
4.  $5a - 3a = a + 205$
5.  $n - 20 = 8 - n$
6.  $-3x + 4 = -2x - 19$
7.  $0.4y + 0.6y = 3y - 36$
8.  $2n = 0.5n + 30$
9.  $2(x - 6) = 3x - 218$

### Down

1.  $5y - 8 = y + 32$
2.  $3n = 10 + 4n$
3.  $4(x + 2) = 2x + 38$
4.  $2y - 50 = 3y - 74$
5.  $4c - 3c = 6c - 65$
6.  $n - 12 = \frac{1}{2}n + 94$
8.  $\frac{1}{2}x = x - 13$
10.  $3a + 6 = 3a + 4$

## More Practice

### 2-Step Equations

**Solve each equation.**

1)  $3 + 6n = 3(8n - 5)$

$$2) \quad 4(x - 5) + 1 = 36 - 7x$$



$$3) 14 + 4b = -6(4b - 7)$$

$$4) -20 + 8p = 7(p - 4)$$

$$5) -6v - 7 = 3(v + 3) + 2$$

$$6) 4(3a + 1) = -24 + 5a$$

- 7) Molly wanted to make note cards by cutting pieces of paper in half. Before starting she got three more pieces to use. When she was done she had 24 half-pieces of paper. With how many pieces did she start?

8) A wise man once said, "400 reduced by 4 times my age is 140." What is his age?

9) Eduardo's Bikes rents bikes for \$16 plus \$8 per hour. DeShawn paid \$64 to rent a bike. For how many hours did he rent the bike?

10) Sumalee won 73 super bouncy balls playing the bean bag toss at the county fair. At school she gave three to every student in her math class. She only has 4 remaining. How many students are in her class?