NAME:_____   Math _____ , Period _____

Mr. Rogove   Date:_____

Learning Objective: We will solve linear equations with variables on both sides of the equal sign. (G8M4L3)

Concept Development:
Four Properties of Equality are used in solving linear equations

Addition Property of Equality	Subtraction Property of Equality
If $A = B$, then $A + C = B + C$	If $A = B$, then $A - C = B - C$
Examples:	*Examples:*
If $x - 2 = 7$, then $x - 2 + 2 = 7 + 2$	If $x + 3 = 18$, then $x + 3 - 3 = 18 - 3$
Multiplication Property of Equality	**Division Property of Equality**
If $A = B$, then $A \times C = B \times C$	If $A = B$ $(and\ C \neq 0)$, then $\dfrac{A}{C} = \dfrac{B}{C}$
Examples:	*Examples*:
If $\dfrac{1}{3}x = 6$, then $\left(\dfrac{1}{3}x\right) \times 3 = 6 \times 3$	If $3x = 12$, then $\dfrac{3x}{3} = \dfrac{12}{3}$

Solving Equations: Review and Tips
- When solving an equation, your ultimate goal is to "**solve for *x***" or "**isolate the variable.**" You will perform a sequence of moves in order to get your variable to equal to a constant term.
- It will often be easier to **combine like terms** and get simpler expressions on each side of your equation prior to beginning your math moves.
- You must keep both sides of your equation (on either side of the equal sign) **in balance**. See properties of equality above.

Guided Practice:

Steps for Solving Linear Equations with Variables on Both Sides
1. Use the properties of equality to get all of your variable terms on one side of the equation, and your constant terms on the other side.
2. Combine like terms.
3. Use the properties of equality to isolate your variable.
4. Check your solution.

$$2x - 3 = 4x$$
$$-2x \qquad -2x$$
$$\frac{-3}{2} = \frac{2x}{2}$$

$$\boxed{-\frac{3}{2} = x}$$

CHECK

$$2\left(-\frac{3}{2}\right) - 3 \overset{?}{=} 4\left(-\frac{3}{2}\right)$$

$$-3 - 3 \overset{?}{=} -6$$

$$-6 \overset{\checkmark}{=} -6$$

✶

$$1\underline{x} - 9 = \frac{3}{5}x$$
$$-\frac{3}{5}x \qquad -\frac{3}{5}x$$
$$\frac{2}{5}x - 9 = 0$$
$$\qquad +9 \quad +9$$
$$\frac{5}{2}\left(\frac{2}{5}x\right) = 9\left(\frac{5}{2}\right)$$

$$\boxed{x = \frac{45}{2}}$$

CHECK:

$$\frac{45}{2} - 9 \overset{?}{=} \frac{3}{5}\left(\frac{45}{2}\right)$$

$$\frac{45}{2} - \frac{18}{2} \overset{?}{=} \frac{3}{5}\left(\frac{45}{2}\right)^{9}_{1}$$

$$\frac{27}{2} \overset{\checkmark}{=} \frac{27}{2}$$

$$\left(\frac{3}{5}x - 21 = 15\right)$$

→ $$\frac{4}{9}x + 11 = -25$$
$$\qquad -11 \quad -11$$
$$\frac{9}{4}\left(\frac{4}{9}x\right) = \left(-36\right)^{-9}\frac{9}{4}$$

$$\boxed{x = -81}$$

CHECK:

$$\frac{4}{9}\left(\frac{-81}{1}\right)^{-9} + 11 \overset{?}{=} -25$$

$$-36 + 11 \overset{?}{=} -25$$

$$-25 \overset{\checkmark}{=} -25$$

$$\frac{1}{5}x + 13 + x = 1 - 9x + 22$$

$$\frac{6}{5}x + 13 = -9x + 23$$

$$+\frac{45}{5}x \qquad +9x$$

$$\frac{51}{5}x + 13 = 23$$

$$-13 \quad -13$$

$$\frac{5}{51}\left(\frac{51}{5}x\right) = 10\left(\frac{5}{51}\right)$$

$$\boxed{x = \frac{50}{51}}$$

CHECK:

$$\frac{1}{5}\left(\frac{\overset{10}{50}}{51}\right) + 13 + \frac{50}{51} = 1 - \frac{9}{1}\left(\frac{50}{51}\right) + 22$$

$$\frac{10}{51} + 13 + \frac{50}{51} = 1 - \frac{450}{51} + 22$$

$$\frac{60}{51} + 13 = 23 - \frac{450}{51}$$

$$-13 \quad -13 \quad \frac{}{51}$$

$$\frac{60}{51} = 10 - \frac{450}{51}, \quad \frac{60}{51} = \frac{510}{51} - \frac{450}{51} \quad \frac{60}{51} \checkmark \frac{60}{51}$$

$$\overset{-6}{-4 + (-2)} = \overset{-6}{-6}$$

$$\boxed{-10+6} + (-10)+6 = -26 - 2(-10)$$

$$x + 6 + x + 8 = -26 - 2x$$

CLT

$$2x + 14 = -26 - 2x$$

$$-2x \qquad -2x$$

$$14 = -26 - 4x$$

$$+26 \quad +26$$

$$\frac{40}{-4} = \frac{-4x}{-4} \qquad \boxed{x = -10}$$

$$2(3x + 2) = \underline{2x} - 1 + \underline{x}$$

$$6x + 4 = 3x - 1$$

$$-3x \qquad -3x$$

$$3x + 4 = -1$$

$$-4 \quad -4$$

$$\frac{3x}{3} = \frac{-5}{3} \qquad \boxed{x = -\frac{5}{3}}$$

$$-4(\overset{\frown}{3x - 6}) = 2(\overset{\frown}{x + 14}) + 2x$$

$$-12x + 24 = 2x + 28 + 2x$$

$$-12x + 24 = 4x + 28$$

$$+12x \qquad +12x$$

$$24 = 16x + 28$$

$$-28 \qquad -28$$

$$\frac{-4}{16} = \frac{16x}{16}$$

$$\boxed{-\frac{1}{4} = x}$$

Independent Practice:

$3x + 2 - x = 11x + 9$	$\dfrac{1}{3}x - 5 = x - 171$
$2x = 11x + 7$	
$29 - 3x = 5x + 5$	$3(x + 10) + 4x = 6(4x - 1) + 2$

ACTIVATING PRIOR KNOWLEDGE:

We know how to solve two step equations

$4x + 1 = 13$	$5x - 8 = 2$
$-1 \quad -1$ $\dfrac{4x}{4} = \dfrac{12}{4}$ CHECK $4(3)+1 \overset{?}{=} 13$ $12+1=13$ $13 \overset{\checkmark}{=} 13$ $\boxed{x=3}$	$+8 \quad +8$ $\dfrac{5x}{5} = \dfrac{10}{5}$ $x = 2$ CHECK $5(2)-8 \overset{?}{=} 2$ $10-8 = 2$ $2 \overset{\checkmark}{=} 2$

CLOSURE:

Is there a mistake? If so, where?

Step #	Equation
	$2x - 3 - 8x = 14 + 2x - 1$
1	$-6x - 3 = 2x + 13$
2	$-6x - 3 + 3 = 2x + 13 + 3$
3	$-6x = 2x + 16$
4	$-6x + 2x = 16$
5	$-8x \quad \boxed{-4x} = 16$
6	$\dfrac{-4x}{-4} = \dfrac{16}{-4}$
7	$x = -4 \quad -2$

TEACHER NOTES:

Lesson 4 in ENY Mod 4
HW: Khan Solving EVBS