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LEARNING OBJECTIVE: We will know when a linear equation has one unique solution, no solution, or infinitely many solutions. (G8M4L6)

CONCEPT DEVELOPMENT:

Linear Equations either have one solution, no solutions, or infinitely many solutions.

One Solution	No Solution	Infinitely Many Solutions
$7x - 3 = 5x + 5$ $-5x \quad -5x$ $2x - 3 = 5$ $+3 \quad +3$ $\frac{2x}{2} = \frac{8}{2}$ $x = 4$	$7x - 3 = 7x + 5$ $-7x \quad -7x$ $-3 \neq 5$?!?! No solution	$\cancel{7x} - 3 = -3 + \cancel{7x}$ $\cancel{-7x} \quad \cancel{-7x}$ $-3 = -3$ Infinitely many solutions
• Different coefficients • If constant terms are equal, $x = 0$!	• Same coefficients • Different constant	• Same coefficients • Same constant
$3x + 4 = 8x - 9$ $-4x - 5 = 6 - 11x$ $9 + \frac{1}{2}x = 5x - 1$	• $5x - 3 = 5x + 7$ • $6x + 5 = 8 + 6x$ • $10x + 100 = 10x - 100$ • $12 - 15x - 2 - 15x$ $\frac{5}{4}x - 1 = 1 + \frac{5}{4}x$	$2x - 4 = -4 + 2x$ $10x - 4 = -4 + 10x$ $3x = 3x$ $-2x + 5 = -2x + 5$ $3(x+5) = \frac{1}{3}(9x + 45)$ $7 + 9x = 9x + 7$
$ax + b = cx + d \ (a \neq c)$ $-cx \quad -cx$ $ax - cx + b = d$ $-b \quad -b$ $ax - cx = d - b$ $\frac{x(a-c)}{a-c} = \frac{d-b}{a-c}$ $x = \frac{d-b}{a-c}$	$x + b = x + c$ $b \neq c$ No numbers work!!	$x + a = x + a$ $a = a$ $x = x$ All numbers work!!

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Guided Practice:

Steps for Classifying Solutions to Linear Equations

1. If possible, create simpler expressions by distributing, combining like terms, etc.
2. Look at the *structure* of the equation. **Circle** the coefficients and **underline** the constant terms.
3. Determine the classification of the equation.

$11x - 2x + 15 = 8 + 9x + 7$ $9x+15 = 9x+15$ Same coefficient Same constant Infinitely many solutions	$-7(3x + 1) - 5 = -13x - 4(3 + 2x)$ $-21x+(-7)-5 = -13x-12-8x$ $-21x-12 = -21x-12$ Same coefficient Same constant Infinitely many solutions
$3(x - 14) + 1 = -4(x - 12)$ $3x-42+1 = -4x+48$ $3x-41 = -4x+48$ Different coefficients 1 solution Different constants $x \neq 0$	$\frac{1}{2}x + 3(12 - 2x) = \frac{1}{2}x - 5(x + 7)$

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$-3x + 32 - 7x = -2(5x + 10)$

$-10x+32 = -10x-20$

Same coefficient
different constant
No solution.

$3(3x - 5) + 15x = -5(-4x - 5) + 4x$

$9x-15+15x = 20x+25+4x$

$24x-15 = 24x+25$

Same coefficients
different Constants.

NO SOLUTIONS!!

$3(3x + 1) = 2(x + 2) - 1$

$-3(3x + 8) = 4(7x - 6)$

$-9x-24 = 28x-24$

Different coefficients
1 solution
Same Constant,
$x=0$

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Independent Practice:

Classify each solution:

$18x + \frac{1}{2} = 6(3x + 25)$	$8 - 9x = 15x + 7 + 3x$ 8-9x = 18x+7 Different coefficients 1 Solution Different constant X≠D
$5(x + 9) = 5x + 45$	Write an equation that uses the distributive property and has **one unique solution**. How do you know it will have one solution? Solve it to verify.
Write your own equation that uses the distributive property and has **infinitely many solutions.** How do you know it will have infinitely many solutions? Try to solve it to verify.	Write your own equation that uses the distributive property and has **no solutions**. How do you know it has no solutions? Try to solve it to verify.

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Activating Prior Knowledge:

We can write equivalent expressions…

$3(3x-5)+14-7x$ $= 9x-15+14-7x$ $= 2x-1$ $3(3x-5)+14-7x = 2x-1$	$-5-(2x-11)+3(5x-12)$ $-5-2x+11+15x-36$ $13x-30$

Closure:

Write ~~2~~ 1 equation~~s~~, that has no solution, and ~~two~~ 1 equation~~s~~ that has infinitely many solutions.

$x = x$

$\frac{1}{3}(9x+3) = 3(x+\frac{1}{3})$

$39+5x = 26+5x$

$10x+10 = 10x-10$

Teacher Notes:

Lesson 7 from ENY

HW Khan: Linear equations with one, zero, or infinite solutions.