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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
$7x-3=5x+5$ $+3 \quad +3$ $7x = 5x+8$ $-5x \quad -5x$ $\frac{2x}{2} = \frac{8}{2}$ $x=4$	$7x-3=7x+5$ $+3 \quad +3$ $7x = 7x+8$ $-7x \quad -7x$ $0 = 8$?? $0 \neq 8$!!	$7x-3=-3+7x$ $-7x \quad -7x$ $-3=-3$
• DIFFERENT COEFFICIENTS ($x=0$ if constant terms are same)	• SAME COEFFICIENT • DIFFERENT CONSTANTS	• SAME COEFFICIENT • SAME CONSTANT
$3x+4=8x-9$ ✓ $-4x-5=6-11x$ ✓ $9+\frac{1}{2}x=5x-1$ ✓	$6x+5=8+6x$ $12-15x=2-15x$ $\frac{5}{4}x-1=1+\frac{5}{4}x$	$10x-4=-4+10x$ $-2x+5=-2x+5$ $7+9x=9x+7$
$ax+b=cx+d \ (a \neq c)$ $x=\frac{d-b}{a-c}$	$x+b=x+c$ $-x \quad -x$ $b \neq c$	$x+a=x+a$ $-a \quad -a$ $x=x$

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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.

$11x - 2x + 15 = 8 + 9x + 7$ $9x + 15 = 9x + 15$ COEFFICIENTS → SAME CONSTANT → SAME 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
$3(x - 14) + 1 = -4(x - 12)$ $3x - 42 + 1 = -4x + 48$ $3x - 41 = -4x + 48$ DIFF. COEFFICIENT DIFF. CONSTANTS ONE UNIQUE SOLUTION!	$\frac{1}{2}x + 3(12 - 2x) = \frac{1}{2}x - 5(x + 7)$ $\frac{1}{2}x + 36 - 6x = \frac{1}{2}x - 5x - 35$ $-5\frac{1}{2}x + 36 = -4\frac{1}{2}x - 35$ DIFF. DIFF. ONE UNIQUE SOLUTION

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$-3x + 32 - 7x = -2(5x + 10)$ $-10x + 32 = -10x - 20$ SAME COEFFICIENTS, DIFFERENT CONSTANT NO SOLUTION	$3(3x - 5) + 15x = -5(-4x - 5) + 4x$ $24x - 15 = 24x + 25$ NO SOLUTION
$3(3x + 1) = 2(x + 2) - 1$ $9x + 3 = 2x + 3$ DIFF. COEFFICIENTS SAME CONSTANTS ONE UNIQUE SOLUTION $x=0$	$-3(3x + 8) = 4(7x - 6)$ DIFF. COEFFICIENTS SAME CONSTANTS $-9x - 24 = 28x - 24$ ONE SOLUTION $x=0$

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Independent Practice:

Classify each solution:

$18x + \frac{1}{2} = 6(3x + 25)$	$8 - 9x = 15x + 7 + 3x$
$5(x + 9) = 5x + 45$	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. $3(2x-3) = 45x$
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. $-7(6x+8) = 7(-6x-8)$	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. $3(2x-3) = 3(2x-4)$

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Activating Prior Knowledge:

We can write equivalent expressions…

$3(3x-5)+14-7x$	$-5-(2x-11)+3(5x-12)$

Closure:

Write 2 equations that have no solution, and two equations that have infinitely many solutions.

Teacher Notes:

Lesson 7 from ENY
HW Khan: Linear equations with one, zero, or infinite solutions.