Algebra 1 Name:

1.3 Explain - Solving Equations with Variables on Both Sides - Notes

Essential Question: How can you solve an equation that has variables on both sides?

Main Ideas/ Questions	Notes/Examples
What You Will Learn	• Solve linear equations that have variables on both sides • Identify special solutions of linear equations • Use linear equations to solve real-life problems
The Ultimate Goal	**Goal:** to get the variable you are solving for on one side of the equation by itself with a coefficient of positive one. Example: $x = 5$
Solving Equations with Variables on Both Sides	**Steps to Solve Equations** **Step 1:** Use the distributive property to remove any grouping symbols. **Step 2:** Simplify the expression on each side of the equation. **Step 3:** Collect the variables on one side of the equation and the constant terms on the other side. **Step 4:** Isolate the variable (add/subtract then multiply/divide).

Practice: Solve each equation using inverses. Show all work.

1. $12 - 3x = -6x$

CT: $+3x$ | VT: $+3x$

This side has no constants, so make it the VT side.

$12 = -3x$

$\frac{12}{-3} = \frac{-3x}{-3}$

$-4 = x$

2. Check your solution to #1.

(Plug -4 in for x:)

$12 - 3(-4) = -6(-4)$

$12 + 12 = 24$

$24 = 24$ ✓

3. $7 - 5z = 17 + 5z$

VT: -7 | CT: -7

$-5z = 10 + 5z$

$-5z \quad -5z$

$-10z = 10$

$\frac{-10z}{-10} = \frac{10}{-10}$

$z = -1$

4. Check your solution to #3.

(Plug -1 in for z)

$7 - 5(-1) = 17 + 5(-1)$

$7 + 5 = 17 - 5$

$12 = 12$ ✓

5. $8 + 6x - 10x = 16 - 8x$

Combine like terms first!

$8 - 4x = 16 - 8x$

VT: -8 | CT: -8

$-4x = 8 - 8x$

$+8x \quad +8x$

$4x = 8$

$\frac{4x}{4} = \frac{8}{4}$

$x = 2$

6. $9x - 12 = \frac{1}{4}(32x + 56)$

Distribute first!

$9x - 12 = 8x + 14$

VT: $+12$ | CT: $+12$

$9x = 8x + 26$

$-8x \quad -8x$

$x = 26$

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Identifying Special Solutions of Linear Equations

Equations may have.....

- 1 solution
- Infinitely Many Solutions – ***identity*** – an equation that is true for all values of the variable (Ex. -2 = -2)
- No Solution – an equation that is not true for any value of the variable (Ex. 6 = 0)

Practice: Identify the number of solutions. Justify your answer by showing all work.

7. $5x + 2(5x + 3) = 15x$

$5x + 10x + 6 = 15x$

CT $15x + 6 = 15x$ VT

$-15x \quad -15x$

$6 \neq 0$ FALSE!

The statement $6 \neq 0$ is never true. So, the equation has NO solution.

NO SOLUTION

8. $-2(4y + 1) = -8y - 2$

VT $-8y - 2 = -8y - 2$ CT

$+8y \quad +8y$

$-2 = -2$ True!

The statement $-2 = -2$ is always true. So, the equation is an identity and has infinitely many solutions.

Using Linear Equations to Solving Real-Life Problems

9. You and your friend drive toward each other. The equation $50h = 5(38 - 9h)$ represents the number h of hours until you and your friend meet. When will you meet?

$50h = 5(38 - 9h)$

VT $50h = 190 - 45h$ CT

$+45h \quad +45h$

$\frac{95h}{95} = \frac{190}{95}$ $h = 2$

We will meet in 2 hours

10. A boat leaves New Orleans and travels upstream on the Mississippi River for 4 hours. The return trip takes only 2.8 hours because the boat travels 3 miles per hour faster downstream due to the current. How far does the boat travel upstream? Distance = (rate)(time)

x = speed of boat traveling upstream (rate)

Distance upstream = Distance downstream

$4x = 2.8(x + 3)$

VT $4x = 2.8x + 8.4$ CT

$-2.8x \quad -2.8x$

$\frac{1.2x}{1.2} = \frac{8.4}{1.2}$ $x = 7$ miles per hour

So, the distance is 7(4) = 28 miles

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	Practice: Solve each equation using inverses. Show all work. 1. $12 - 3x = -6x$ 2. Check your solution to #1. 3. $7 - 5z = 17 + 5z$ 4. Check your solution to #3. 5. $8 + 6x - 10x = 16 - 8x$ 6. $9x - 12 = \frac{1}{4}(32x + 56)$

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7. $5x + 2(5x + 3) = 15x$

8. $-2(4y + 1) = -8y - 2$

The statement _____ is never true. So, the equation has _____ solution.

The statement _____ is always true. So, the equation is an _____ and has _____ _____ solutions.

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