Lesson 1.3:

Solving Equations with Variables on Both Sides

Essential Question

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

Key Idea

Solving Equations with Variables on Both Sides

To solve equations with variables on both sides, collect the variable terms on one side and the constant terms on the other side.

Same idea as before...combine like terms!

Solve $15 - 2x = -7x$. Check your solution.

$+2x \quad +2x$

$15 = -5x$

$\div -5 \quad \div -5$

$-3 = x$

$15 - 2(-3) = -7(-3)$

$15 + (+6) = 21$

$21 = 21$ ✓

Solve $-2(x-5) = 6\left(2-\frac{1}{2}x\right)$.

$-2x+10 = 12-3x$

$+3x \quad +3x$

$x+10 = 12$

$-10 \quad -10$

$x = 2$

$-2(2-5) = 6(2-\frac{1}{2}(2))$

$-2(-3) = 6(2-1)$

$6 = 6(1)$

$6 = 6$ ✓

Solve the equation. Check your solution.

1. $-3x + 2 = 2x + 19$

$-2x \quad -2x$

$-5x = 19$

$\div -5 \quad \div -5$

$x = -\frac{19}{5}$

$-3(-\frac{19}{5}) = 2(-\frac{19}{5}) + 19$

$\frac{57}{5} = -\frac{38}{5} + 19$

$\frac{95}{5} = 19$ ✓

2. $2.5y + 6 = 4.5y - 1$

$-4.5y \quad -4.5y$

$-2y + 6 = -1$

$-6 \quad -6$

$-2y = -7$

$\div -2 \quad \div -2$

$y = \frac{7}{2}$

$2.5(\frac{7}{2}) + 6 = 4.5(\frac{7}{2}) - 1$

$8.75 + 6 = 15.75 - 1$

$14.75 = 14.75$ ✓

3. $6(4 - z) = 2z$

$24 - 6z = 2z$

$+6z \quad +6z$

$24 = 8z$

$\div 8 \quad \div 8$

$3 = z$

$6(4-3) = 2(3)$

$6(1) = 6$ ✓

Solve $3 - 4x = -7 - 4x$.

$+4x \quad +4x$

$3 \neq -7$

OH NO. This means that this equation has no solution.

Solve $6x + 4 = 4\left(\frac{3}{2}x + 1\right)$.

$6x + 4 = 6x + 4$

WOAH. Both sides are exactly the same! This means that the equation has infinitely many solutions since any value of x would work.

Solve the equation.

4. $2x + 1 = 2x - 1$

$-2x \quad -2x$

$1 \neq -1$

No solution

5. $\frac{1}{2}(6t-4)=3t-2$

$3t-2=3t-2$

infinitely many solutions

6. $\frac{1}{3}(2b+9)=\frac{2}{3}\left(b+\frac{9}{2}\right)$

$\frac{2}{3}b+3=\frac{2}{3}b+\frac{2}{3}\cdot\frac{9}{2}$

$\frac{2}{3}b+3=\frac{2}{3}b+3$ IMS

7. $6(5 - 2v) = -4(3v + 1)$

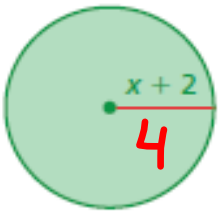
$30-12v \neq -12v-5$

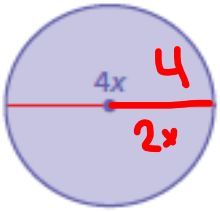
$+12v \quad +12v$

$30 \neq -5$

NS

The circles are identical. What is the area of each circle?





(A) 2 (B) 4 (●) 16π (D) 64π

$x+2=2x$

$-x \quad -x$

$2=x$

$A=\pi r^2$

$\pi 4^2$

$\pi 16$

A boat travels *x* miles per hour upstream on the Mississippi River. On the return trip, the boat travels 2 miles per hour faster. How far does the boat travel upstream?

$x \frac{mi}{hr} \cdot 3 hr = 3x \text{ mi}$

$(x-2)\frac{mi}{hr} \cdot 2.5 hr = 2.5(x-2) \text{ mi}$

$3x = 2.5(x-2)$

$3x = 2.5x - 5$

$-2.5x \quad -2.5x$

$.5x = -5$

$\div .5 \quad \div .5$

$x = -10$

$3(-10)$

$= -30 \text{ mi}$

8. WHAT IF? In Example 5, the diameter of the purple circle is $3x$. What is the area of each circle?

$1.5x = x + 2$

$-x \quad -x$

$.5x = 2$

$x = 4$

$r = 4 + 2 = 6$

πr^2

$\pi 6^2$

36π

9. A boat travels *x* miles per hour from one island to another island in 2.5 hours. The boat travels 5 miles per hour faster on the return trip of 2 hours. What is the distance between the islands?

$x \frac{mi}{hr} \cdot 2.5 hr = 2.5x \text{ mi}$

$(x+5)\frac{mi}{hr} \cdot 2 hr = 2(x+5) \text{ mi}$

$2.5x = 2(x+5)$

$2.5x = 2x + 10$

$.5x = 10$

$x = 20$

$2.5(20)$

$= \boxed{50 \text{ mi}}$