## 3.4: Solve Equations with Variables on Both Sides

**Goals:** \*Solve an equation with variables on both sides \*Decide if an equation has one solution, no solution or an infinite number of solutions

## To solve an equation with variables on both sides:

- S Simplify
- **D** Distribute
- C Combine
- **B** 1<sup>st</sup>: Variables (add or subtract to other side)
  - 2<sup>nd</sup>: Numbers using reverse PEMDAS
- A Answer

<b>Ex:</b> $7 - 8x = 4x - 17$	<b>Ex:</b> $13 + 5x = 2x - 7$
+8x +8x	-2x -2x
7 = 12x - 17	13 + 3x = -7
+17 +17	<u>-13</u> - <u>13</u>
24 = 12x	3x = -20
$\overline{12}$ $\overline{12}$	$\overline{3}$ $\overline{3}$
r-2	$r = -\frac{20}{2}$
$\lambda = 2$	× 3

<b>Ex:</b> $9x - 5 = \frac{1}{4}(16x + 60)$	<b>Ex:</b> $4x - 5 = \frac{1}{5}(5x + 20)$
Ex: $9x - 5 = \frac{1}{4}(16x + 60)$	<b>Ex:</b> $4x - 5 = \frac{1}{5}(5x + 20)$

9x - 5 = 4x + 15	4x - 5 = x + 4
-4x $-4x$	$\underline{-x}$ $\underline{-x}$
5x - 5 = 15	3x - 5 = 4
<u>+5 +5</u>	<u>+5 +5</u>
5x = 20	$\underline{3x} = \underline{9}$
5 5	3 3
x = 4	<i>x</i> = 3

**Ex:** A car dealership sold 78 new cars and 67 used cars this year. The number of new cars sold by the dealership has been increasing by 6 cars each year. The number of used cars sold by the dealership has been decreasing by 4 cars each year. If these trends continue, in how many years will the number of new cars sold be twice the number of used cars sold?

```
New = Twice Used (x = number of years)

78 + 6x = 2(67 - 4x)

78 + 6x = 134 - 8x

78 + 14x = 134

14x = 56

x = 4 4 years
```

**Ex:** A music website sold 94 single songs and 67 albums today. The number of single downloads has been increasing by 22 each day and the number of album downloads has been decreasing by 5 each day. If these trends continue, in how many days will the number of single downloads be ten times the number of album downloads?

```
Singles = 10 times Albums x = number of days

94 + 22x = 10(67 - 5x)

94 + 22x = 670 - 50x

94 + 72x = 670

72x = 576

x = 8 days
```

\*\*RECALL (from 1.4)\*\*

**<u>SOLUTION</u>**: The value of the variable that makes the equation true.

The directions "Solve" really mean: Tell me what x can be

When solving equations with variables on both sides the equation can have:

**1** solution: *x* = # (The number you get *x* equaling is the only number that *x* can be)

No solutions: There is no number that x can possibly be (0 = 10 or any false statement indicates this)

or

All Real Numbers (could be solutions): x can be any number (0 = 0 or any true statement indicates this)

## Solve:

Ex: 3x = 3(x + 4)3x = 3x + 12-3x - 3x0 = 12

**No Solution Ex:** 5x - 6 = (x - 1)5

5x - 6 = 5x - 5-6 = -5No Solution

**Ex:** 3(4x+6) = 9(2x+2)

$$12x + 18 = 18x + 18$$
  

$$18 = 6x + 18$$
  

$$0 = 6x$$
  

$$0 = x$$

2x + 10 = 2x + 10 -2x - 2x 10 = 10Any Number Ex: 4(3x + 2) = 2(6x + 4) 12x + 8 = 12x + 8 8 = 8Any Number Ex: -3(2x - 7) = 6(4 - x) -6x + 21 = 24 - 6x 21 = 24No Solution

**Ex:** 2x + 10 = 2(x + 5)

Find the perimeter of the square.

