

### **Math Virtual Learning**

# Grade 8

## Solving Equations: Variables on One Side May 7, 2020



#### Math 8 Lesson: May 7, 2020

#### **Objective/Learning Target:** I can solve equations with variables on one side.

### Warm-Up: Answers on next slide Can you find solutions to these 2 puzzles? What strategies could you use?













## Warm-Up: Answer Key





### Video:

### Take notes on a piece of paper as you watch this video.

#### DISTRIBUTIVE PROPERTY Solve. 8 - 4(y + 1) = 16Distribute -4 to 8 - 4y - 4 = 16y + 1Combine like terms 4 - 4y = 168 and -4 on the left side of the equation.

## **Review:** One-Step Equations

#### Solving algebraic equations by balancing

You can use **inverse operations** to solve an equation. When you do, keep the equation balanced by performing addition, subtraction, multiplication, or division by the same number on **both sides**.



a) x + 2 = 9x + 2 - 2 = 9 - 2Subtract 2 from both sides. x = 7Simplify.  $\frac{2}{2}x = 2$ b)  $\frac{2}{3}x \div \frac{2}{3} = 2 \div \frac{2}{3}$ Divide both sides by  $\frac{2}{3}$ .  $\frac{2}{3}x \cdot \frac{3}{2} = 2 \cdot \frac{3}{2}$ Rewrite division as multiplication by the reciprocal of  $\frac{2}{3}$ . x = 3Simplify.

## **Review:** Two-Step Equations

- 1. Add or subtract to isolate the variable term.
- 2. Multiply or divide to solve for the variable.
- 3. Check your solutions.

```
Example:
      3x+5=-16
          -5 -5 Subtract
          3x = -21
         \frac{3x}{3} = \frac{-21}{3} Divide
           x = -7
   3(-7) + 5 = -16 Check
```

## How To: Multi-Step Equations

- 80

10

- 8

$$5(p-4) + 5p = -100$$

5p - 20 + 5p = -100

$$10p - 20 = -100$$
  
+20 + 20

**10p** 

р

10

① **Distribute**. (Multiply the outside term to each term inside the parentheses.)

5 multiplied by p and 5 multiplied by -4

Combine Like Terms. (Number terms can be combined with other number terms on the same side of the equal sign.)
 Variable terms can be combined with other variable terms on the same side of the equal sign.)
 5p can be combined with 5p on the left side

③ Add or Subtract on <u>both sides</u> of the equal sign. (Use the correct <u>inverse operation</u> to isolate the variable.) The inverse of -20 is +20, so add 20 to both sides

Multiply or Divide on <u>both sides</u> of the equal sign.
(Use the correct <u>inverse operation</u> to solve.)
10p means 10 x p, so divide by 10 on both sides

**(5)** Plug your answer back in to check. (See next slide)

## How To: Check Step

$$5(p-4) + 5p = -100$$

$$5(-12) + 5(-8) = -100$$

= -100

-100

(1) Plug in your answer for each variable. Where there is a p, we will instead put -8

② Solve using Order of Operations. (PEMDAS) Parentheses: combine - 8 and - 4.

Multiply: 5 times – 12 and 5 times – 8

Add/Subtract: -60 + -40 is equal to -100

③ If your <u>answers match</u> at the end, your solution is correct. If your answers do not match at the end, you have made a mistake somewhere.

- 100 <u>is</u> equal to - 100

### Example 1: Solve the equation and check your answer.



① Distribute. 7 x a <u>and</u> 7 x 7

**(2)** Combine Like Terms. 49 and -5 on the right side

**3** Add or Subtract on <u>both sides</u> of the equal sign. The inverse of 44 is -44, so subtract 44 from both sides

Multiply or Divide on <u>both sides</u> of the equal sign. *7a means 7 x a, so divide by 7 on both sides*

**(5)** Plug your answer back in to check.

Parentheses: Multiply: Subtract: 86 = 7(6 + 7) - 5 86 = 7(13) - 5 86 = 91 - 586 = 86

### Example 2: Solve the equation and check your answer.



① **Distribute.** *This problem does not have parentheses.* 

② Combine Like Terms.

- 6n and 5n on the right side

③ Add or Subtract. The variable is already isolated.

**(4)** Multiply or Divide on both sides of the equal sign.  $-n \mod -1 \times n$ , so divide by -1 on both sides

**(5)** Plug your answer back in to check.

*Multiply: Subtract:* 

7 = -6(-7) + 5(-7) 7 = 42 + -357 = 7

#### **Practice 1:** Solve by Combining Like Terms Answers on next slide

1) 
$$8 + r - 6r = -17$$
 2)  $-10 = 5n - 3n$ 

#### Practice 1 Answer:

1) 
$$8 + r - 6r = -17$$
  
 $8 - 5r = -17$   
 $-8 - 8$   
 $-5r = -25$   
 $-5 -5$   
 $r = 5$ 

2) 
$$-10 = 5n - 3n$$
  
 $-10 = 2n$   
2 2 2  
 $-5 = n$ 

### Practice 2: Solve Using Distributive Property

Answers on next slide

3) 84 = 7(r + 5)   
4) 
$$\frac{1}{2}(4x - 8) = -12$$

#### Practice 2 Answer:

3)

$$84 = 7(r + 5)$$

$$84 = 7r + 35$$

$$-35 - 35$$

$$4) \frac{1}{2}(4x - 8) = -12$$

$$2x - 4 = -12$$

$$49 = 7r$$

$$49 = 7r$$

$$7 = r$$

$$2x - 4 = -12$$

$$+4 + 4$$

$$\frac{2x}{2} = -8$$

$$2$$

$$x = -4$$

#### **Practice 3:** Solve Using Multi-steps Answers on next slide

5) 
$$\frac{1}{4}(16x + 20) + 2x = -25$$
 6)  $-99 = -3 + 3(8m + 8)$ 

#### **Practice 3 Answer:**

5) 
$$\frac{1}{4}(16x + 20) + 2x \neq -25$$
  
 $4x + 5 + 2x \neq -25$   
 $6x + 5 \neq -25$   
 $-5 \qquad -5$   
 $\frac{6x}{6} \neq -\frac{30}{6}$   
 $x = -5$ 

6) -99 = -3 + 3(8m + 8) - 99 = -3 + 24m + 24 -99 <del>+</del> 21 + 24m -21 -21  $-\frac{120}{24} = \frac{24m}{24}$ 

### Exit Ticket: Can you find the mistake?

 $4x - 2 - 2x - 3 \neq -15$  $2x - 1 \neq -15$ Step 1: Step 2: +1 $2 \mathbf{x}$ -14 Step 3 2xStep 4 2 Solution: х

### Exit Ticket: Can you find the mistake?

Step 1: Step 2:

Step 3

Step 4 Solution:

$$4\mathbf{x} - 2 - 2\mathbf{x} - 3 \neq -15$$

$$2\mathbf{x} - 1 \neq -15$$

$$+1 \neq +1$$

$$2\mathbf{x} \neq -14$$

$$\frac{2\mathbf{x}}{2} \neq \frac{-14}{2}$$

$$\mathbf{x} = -7$$

Answer: The mistake occurs in Step 1, combining -2 and -3 is -5, *not* -1.

## Additional Resources:

**Multi-Step Equations Practice** 

Khan Academy - Multi-step Equations Lesson & Practice