# Multi-Step equations with fractions and decimals

Lesson 2.2

Solving One-Step Equations:

"An equation is like a balance scale because it shows that two quantities are equal. The scales remained balanced when the same weight is added (or removed from) to each side."

$$x + 2 = 5$$
  $x + (-5) = -2$ 

#### What does it mean to <u>Solve</u> an equation?

- "To solve an equation containing a variable, you find the value (or values) of the variable that make the equation true."
- "Get the variable alone on one side of the equal sign...using inverse operations, which are operations that undo each other."

**Inverse Operations** 

Addition and Subtraction are inverse operations because they undo each other.

Multiplication and division are inverse operations because they undo each other.

Using Reciprocals:

2/3x = 12

In order to solve the equation above, you need to divide by 2/3. Remember: To divide a fraction, you multiply by its reciprocal. In other words: flip it!

> 3/2\*2/3x= 1x 3/2\* 12/1= 18 So x = 18.

Solving Two-Step Equations

"A two-step equation is an equation that involves two operations."

PEMDAS tells us to multiply or divide before we add or subtract, but to solve equations, we do just the opposite: we add or subtract **before** we multiply or divide. To Solve Multi-Step Equations:

- 1) "Clear the equation of fractions and decimals."
- 2) Apply the Distributive Property as needed.
- 3) "Combine like terms."
- 4) "Undo addition and subtraction."
- 5) "Undo multiplication and division."

#### Multi-step equations

- We have added to the level of difficulty by solving equations with 2 steps, by combining like terms first, and by using the distributive property.
- Now we increase the difficulty again by solving equations with fractions and decimals.

#### Equations with Variables on Both Sides:

# Use the Addition or Subtraction property of Equality to get the variables on one side of the equation.

#### Example

• For example: 
$$\frac{2}{3}n-6=22$$

Our steps are the same in this problem. First we add six to both sides, then we multiply both sides by the reciprocal 3/2 and then solve. Let's try it.

Let's try  

$$\frac{2}{3}n - 6 = 22$$

$$\frac{+6}{-46}$$

$$\frac{2}{3}n = 28$$

$$\frac{3}{2} \cdot \frac{2}{3}n = 28 \cdot \frac{3}{2}$$

$$n = 14 \cdot 3$$

$$n = 42$$

#### Another example

• Sometimes we have to distribute the fraction like this:

$$\frac{2}{3}(m-6) = 3$$
$$\frac{2}{3}m - 4 = 3$$
$$\frac{2}{3}m = 7$$
$$\frac{3}{2} \cdot \frac{2}{3}m = 7 \cdot \frac{3}{2}$$
$$m = \frac{21}{2}or 10\frac{1}{2}$$

• 1.2n + 3.4 = 10

• 
$$\frac{4}{(a+6)} = 2$$

• 1.2n + 3.4 = 10 n = 5.5

• 
$$\frac{4}{7}$$
 + 6) = 2

• 1.2n + 3.4 = 10 n = 5.5

• 
$$\frac{4}{7}$$
 + 6) = 2 a = -5/2

#### Another example

$$\frac{14+n}{2} - 8 = 10 + 8 = 10$$

First add 8 to both sides

$$\frac{14+n}{2} = 18$$
 (2)

Next multiply both sides by 2

Subtract 14 from both sides and solve.

$$-\frac{12+x}{2}=13$$

$$\frac{93+80+r}{3}=90$$

$$-\frac{12+x}{2}=13$$

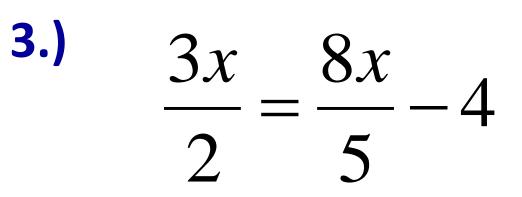
$$\frac{93+80+r}{3}=90$$

$$-\frac{12+x}{2}=13$$
 X = -38

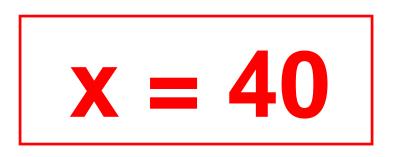
$$\frac{93+80+r}{3} = 90 \qquad R = 97$$

# <u>Clear the equation of fractions</u>

•Multiply each side by the LCD to get rid of the fraction or fractions. Solving linear equations involving fractions



Multiply both sides of the equation by **10 (each term)** 

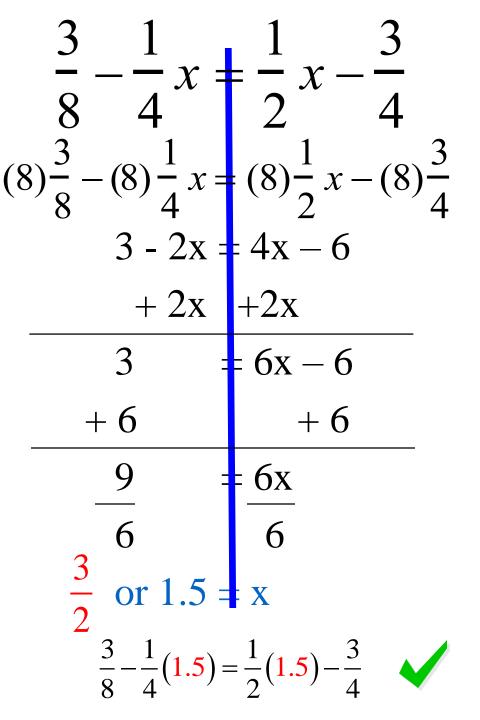


<sup>1</sup> To remove fractions from an equation: <sup>1</sup> Multiply both sides of the equation (each term) by

Multiply both sides of the equation (each term) by the least common denominator

#### Solve

- 1. Draw "the river"
- 2. Clear the fraction multiply each term by the LCD
- 3. Simplify
- 4. Add 2x to both sides
- 5. Simplify
- 6. Add 6 to both sides
- 7. Simplify
- 8. Divide both sides by 6
- 9. Simplify
- 10. Check your answer



# Special Case #1 6) 2x + 5 = 2x - 31. Draw "the river" 2. Subtract 2x from both sides 5 = -3

3. Simplify

This is never true! No solutions