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 Solve 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

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

$$+6 \quad +6$$

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

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

$$n = 14 \bullet 3$$

$$n = 42$$

Another example

- Sometimes we have to distribute the fraction like this:

$$\frac{2}{3}(m-6)=3$$

$$\frac{2}{3}m-4=3$$

$$\frac{2}{3}m=7$$

$$\frac{3}{2}\bullet\frac{2}{3}m=7\bullet\frac{3}{2}$$

$$m=\frac{21}{2}\,or\,10\frac{1}{2}$$

Try This

- $1.2n + 3.4 = 10$
- $\frac{4}{7}(a + 6) = 2$

Try This

- $1.2n + 3.4 = 10$ $n = 5.5$
- $\frac{4}{7}(a + 6) = 2$

Try This

- $1.2n + 3.4 = 10$ $n = 5.5$
- $\frac{4}{7}(a + 6) = 2$ $a = -5/2$

Another example

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

+8 +8

First add 8 to both sides

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

Next multiply both sides by 2

$$14 + n = 36$$

-14 -14

Subtract 14 from both sides and solve.

N = 22

Try This

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

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

Try This

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

X = 38

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

Try This

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

X = -38

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

R = 97

Clear the equation of fractions

- Multiply each side by the LCD to get rid of the fraction or fractions.

Solving linear equations involving fractions

3.) $$\frac{3x}{2} = \frac{8x}{5} - 4$$

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

x = 40

To remove fractions from an equation:
Multiply both sides of the equation **(each term)** by the least common denominator

Solve

$$\frac{3}{8}-\frac{1}{4}x=\frac{1}{2}x-\frac{3}{4}$$

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

$$(8)\frac{3}{8}-(8)\frac{1}{4}x=(8)\frac{1}{2}x-(8)\frac{3}{4}$$

$$3-2x=4x-6$$

$$+2x \quad +2x$$

$$3=6x-6$$

$$+6 \quad +6$$

$$\frac{9}{6}=\frac{6x}{6}$$

$$\frac{3}{2} \text{ or } 1.5 = x$$

$$\frac{3}{8}-\frac{1}{4}(1.5)=\frac{1}{2}(1.5)-\frac{3}{4}$$

Special Case #1

6) $2x + 5 = 2x - 3$

1. Draw "the river"
2. Subtract 2x from both sides
3. Simplify

$-2x \qquad -2x$

$5 = -3$

This is never true!

No solutions