

Multi-Step Equations

There are 3 types of solutions:

Infinitely many, no solution, and one solution.

One Solution: An equation that has only one possible value for the variable.
Ex: $x = 2$

Infinitely Many Solutions (Identity Equation): Two sides of the equal sign must be the same - An equation that is true for every possible value of the variable. Ex: $3 = 3$

No Solution: The two sides of the equal sign are not the same - there is no value of the variable that makes the equation true.
Ex: $4 \neq 5$

Steps:

- 1) Distribute, if necessary.
- 2) Get rid of any fractions (multiply by LCD)
- 3) Combine like terms on same side, if necessary.
- 4) Move your variables to the left using inverse operation.
- 5) Move constants to the right
- 6) Solve for your variable.

1) What is the solution of $5 = 5m - 23 + 2m$?

$$5 = 5m - 23 + 2m \quad * \text{Combine like terms on same side}$$

$$5 = 5m + 2m - 23$$

$$5 = 7m - 23$$

$$5 + 23 = 7m - 23 + 23$$

$$28 = 7m$$

$$\frac{28}{7} = \frac{7m}{7}$$

$$4 = m$$

$$\frac{28}{7} = m$$

$$4 = m$$

2) $11m - 8 - 6m = 22$

$$11m - 6m - 8 = 22$$

$$5m - 8 = 22$$

$$5m - 8 + 8 = 22 + 8$$

$$5m = 30$$

$$\frac{5m}{5} = \frac{30}{5}$$

$$m = 6$$

- Steps:
- 1) Distribute if necessary
 - 2) Get rid of any fractions (multiply by LCD)
 - 3) Combine like terms on each side if necessary
 - 4) Move your variables to the left using inverse operations
 - 5) Move constants to the right
 - 6) Solve for your variable

3) What is the solution of $\frac{3x}{4} - \frac{x}{3} = 10$

$$\frac{3x}{4} - \frac{x}{3} = 10$$

* multiply by LCD.

LCD:

$$12 \left(\frac{3x}{4} - \frac{x}{3} \right) = (10) \cdot 12$$

4: 4, 8, 12...
3: 3, 6, 9, 12..

$$\frac{12 \cdot 3x}{1 \cdot 4} + \frac{12 \cdot (-x)}{1 \cdot 3} = 120$$

$$\frac{36x}{4} + \frac{-12x}{3} = 120$$

$$9x - 4x = 120$$

$$5x = 120$$

$$\frac{5x}{5} = \frac{120}{5}$$

$$x = 24$$

4) $5x + 3(x+4) = 28$

$$5x + 3(x) + 3(4) = 28$$

$$5x + 3x + 12 = 28$$

$$8x + 12 = 28$$

$$8x + 12 - 12 = 28 - 12$$

$$\frac{8x}{8} = \frac{16}{8}$$

$$x = 2$$

$$5) 4x - 3(x - 2) = 21$$

$$4x - 3(x) - 3(-2) = 21$$

$$4x - 3x + 6 = 21$$

$$x + 6 = 21$$

$$x + 6 - 6 = 21 - 6$$

$$x = 15$$

$$6) 2x - 5(x - 9) = 27$$

$$2x - 5(x) - 5(-9) = 27$$

$$2x - 5x + 45 = 27$$

$$-3x + 45 - 45 = 27 - 45$$

$$-3x = -18$$

$$\frac{-3x}{-3} = \frac{-18}{-3}$$

$$x = 6$$

$$x = 6$$