

Intro to college math: Chapter 2.2
Multi-step Equations

- * Multiplication property of equality: multiplying both sides of an equation by the same nonzero number will not change the solution set.

$$\text{if } A = B, \text{ then } A \cdot C = B \cdot C$$

- * Division property of equality: dividing both sides of an equation by the same nonzero number will not change the solution set.

$$\text{if } A = B, \text{ then } \frac{A}{C} = \frac{B}{C}$$

* Goal is to get variable on one side of the = sign by itself.

1. Solve the following equation by multiplying both sides by -1.

$$-x = 5$$

$$\frac{-x}{-1} = \frac{5}{-1}$$

$$x = -5$$

* If there is a (-) in front of the x , divided both sides by (-1) to cancel out the (-) sign.

2. Solve the following equation by multiplying both sides by -1.

$$-8 = -x$$

$$\frac{-8}{-1} = \frac{-x}{-1}$$

$$8 = x$$

* If there is a (-) in front of the x , divided both sides by (-1) to cancel out the (-) sign.

* Remember, if dividing (-) number by (-) number, you get a (+) number.

3. Solve the following equation using the method shown in the examples in this section.

$$5y + 7 = 42$$

$$\begin{array}{r} 5y + 7 = 42 \\ -7 \quad -7 \\ \hline 5y = 35 \\ \underline{5} \quad \underline{5} \end{array}$$

$$y = 7$$

* Goal: get variable on one side of = sign by itself.

* Move number on left side to right side by doing opposite

* Divide both sides by the number in front of your variable.

4. Solve the following equation by first clearing the decimals.

$$-15a + 5 = -55$$

$$\begin{array}{r} -15a + 5 = -55 \\ -5 \quad -5 \\ \hline -15a = -60 \\ \underline{-15} \quad \underline{-15} \\ a = 4 \end{array}$$

* Goal: get variable on one side of = sign by itself.

* Move number on left side to right side by doing opposite

* Divide both sides by the number in front of your variable.

5. Solve: $-42 = 5x - 2$

$$\begin{array}{r} -42 = 5x - 2 \\ +2 \quad +2 \\ \hline -40 = 5x \\ \underline{5} \quad \underline{5} \\ -8 = x \end{array}$$

* Goal: get variable on one side of = sign by itself.

* then move any number on right side to left side by doing opposite (add/ subtract)

* then divide both sides by the number in front of the variable

6. Solve: $-33 = 5x - 3$

$$\begin{array}{r} -33 = 5x - 3 \\ +3 \quad +3 \\ \hline -30 = 5x \\ \underline{5} \quad \underline{5} \\ -6 = x \end{array}$$

* Goal: get variable on one side of = sign by itself.

* then move any number on right side to left side by doing opposite (add/ subtract)

* then divide both sides by the number in front of the variable

* In most cases, I move the variables to the left side of the = sign, and the numbers to the right side of the = sign. But occasionally, it is easier to go the other way.

7. Solve the following equation. $6s + 7s - 5s = -48$

$$\begin{array}{r} 6s + 7s - 5s = -48 \\ \underline{8s} = \underline{-48} \\ \underline{8} \quad \underline{8} \\ s = -6 \end{array}$$

* Combine like terms on each side of the = sign.

* Now divide both sides by the number in front of the variable.

8. Solve the following equation. $-27 + 3 = 2s + 4s + 6s$

$$\begin{array}{r} -27 + 3 = 2s + 4s + 6s \\ \underline{-24} = \underline{12s} \\ \underline{12} \quad \underline{12} \\ -2 = s \end{array}$$

* Combine like terms on each side of the = sign.

* Now divide both sides by the number in front of the variable.

9. Solve. $8p = -4p - 36$

$$\begin{array}{r} 8p = -4p - 36 \\ +4p \quad +4p \\ \hline 12p = -36 \\ \underline{12} \quad \underline{12} \\ p = \boxed{-3} \end{array}$$

* move the variable on the right to the left by add / subtract.

* divide both sides by number in front of variable.

10. Solve. $-6x = -4x - 6$

$$\begin{array}{r} -6x = -4x - 6 \\ +4x \quad +4x \\ \hline -2x = -6 \\ \underline{-2} \quad \underline{-2} \\ x = \boxed{3} \end{array}$$

* move the variable on the right to the left by add / subtract.

* divide both sides by number in front of variable.

11. Solve. $12x - 15 = -3x + 15$

$$\begin{array}{r} 12x - 15 = -3x + 15 \\ +3x \quad +3x \\ \hline 15x - 15 = 15 \\ +15 \quad +15 \\ \hline 15x = 30 \\ \underline{15} \quad \underline{15} \\ x = \boxed{2} \end{array}$$

* move any variable on right to the left by adding / subtract.

* move any number on left to right, by add / subtract

* Divide both sides by number in front of x

12. Solve the equation for the variable.

$$9z - 60 = -6z + 60$$

$$\begin{array}{r} 9z - 60 = -6z + 60 \\ +6z \quad \quad +6z \end{array}$$

$$\begin{array}{r} 15z - 60 = 60 \\ +60 \quad +60 \end{array}$$

$$\begin{array}{r} 15z = 120 \\ \hline 15 \end{array}$$

$$z = \boxed{8}$$

← * move any variable on right to the left by adding / subtract.

← * move any number on left to right, by add / subtract

← * Divide both sides by number in front of z