

Section P.8 Solving Basic Equations

Objectives

- Solve simple equations
- Solve equations involving fractions
- Solve equations involving decimals
- Solve equations for one variable in terms of another

Solving Simple Equations ← equation

Example: $4x + 1 = 17$

$$\begin{array}{r} -1 \quad -1 \\ \hline 4x = 16 \\ \hline x = 4 \end{array}$$

Example: $5(x + 2) = 20$

$$\begin{array}{r} 5x + 10 = 20 \\ -10 \quad -10 \\ \hline 5x = 10 \\ \hline \frac{5x}{5} = \frac{10}{5} \\ x = 2 \end{array}$$

→

$$\begin{array}{r} \cancel{5}(x+2) = \frac{20}{\cancel{5}} \\ \hline x+2 = 4 \\ -2 \quad -2 \\ \hline x = 2 \end{array}$$

Example: $5(x - 2) + 4 = 19$

$$\begin{array}{r} -4 \quad -4 \\ \hline \cancel{5}(x-2) = \frac{15}{\cancel{5}} \\ \hline x-2 = 3 \\ \hline \frac{x-2}{+2} = \frac{3}{+2} \\ \hline x = 5 \end{array}$$

Solve equations involving fractions

Example: $\frac{1}{3} + \frac{x}{5} = \frac{2}{3}$

LCD = 15

Multiply both sides
by LCD to clear
the fractions

$$15 \left[\frac{1}{3} + \frac{x}{5} \right] = 15 \cdot \frac{2}{3} \quad \leftarrow \begin{array}{l} \text{mult num.} \\ \text{+ denom.} \end{array}$$

$$\frac{15 \cdot 1}{1} + \frac{15 \cdot x}{1} = \frac{30}{1}$$

$$\frac{15}{3} + \frac{15x}{5} = 10 \quad \rightarrow \quad \frac{5}{-5} + 3x = \frac{10}{-5} \quad \rightarrow \quad \frac{15x}{5} = \frac{5}{3}$$

Example: $\frac{3x+1}{2} + \frac{2x}{3} = \frac{3}{2}$

LCD = 6

$$6 \left[\frac{3x+1}{2} + \frac{2x}{3} \right] = 6 \cdot \frac{3}{2}$$

$$\cancel{6} \cdot \frac{(3x+1)}{\cancel{2}} + \cancel{6} \cdot \frac{2x}{\cancel{3}} = \frac{18}{2} \quad \leftarrow \text{skip}$$

$$3(3x+1) + 2 \cdot 2x = 9$$

$$\underline{9x+3} + \underline{4x} = 9 \quad \rightarrow \quad \underline{13x+3} = 9$$

$$\begin{array}{r} -3 \\ -3 \\ \hline 13x = 6 \end{array} \quad \rightarrow \quad x = \frac{6}{13}$$

Example: $\frac{7x-1}{3} - x = 1$

LCD

$$\cancel{3} \cdot \frac{7x-1}{\cancel{3}} - \cancel{3} \cdot x = \cancel{3} \cdot 1$$

$$\underline{7x-1} - \underline{3x} = 3$$

$$4x-1 = 3$$

$$\begin{array}{r} +1 \\ +1 \\ \hline \end{array}$$

$$4x = 4$$

$$x = 1$$

Solve equations involving decimals $\frac{2}{10}$

Multiply both sides by the smallest power of 10 that clears the decimals.

Example: $-0.3(2x + 1) - 3 = 0.2x$

$$\begin{aligned} 10[-0.3(2x+1) - 3] &= 10 \cdot 0.2x \\ 10(-0.3)(2x+1) + (10)(-3) &= 2x \\ -3(2x+1) - 30 &= 2x \\ -6x - 3 - 30 &= 2x \\ -6x - 33 &= 2x \quad \rightarrow \quad -\frac{33}{8} = \frac{2x}{8} \\ +6x \quad +6x & \end{aligned}$$

decimals go out to tenths place

Example: $2.6(x - 1) = 4.5x$

$$\begin{aligned} 10(2.6)(x-1) &= 10(4.5x) \\ 26(x-1) &= 45x \\ 26x - 26 &= 45x \\ -26x \quad -26x & \\ -26 &= 19x \quad \rightarrow \quad -\frac{26}{19} = x \\ \frac{-26}{19} \quad \frac{19x}{19} & \end{aligned}$$

Example: $0.4(x - 2) - 0.05x = 0.7$

↑ mult by 100

Solve equations for one variable in terms of another

Example: Solve for y in terms of x : $\cancel{-x} + y = 3$

get y by itself

$$\begin{array}{r} \cancel{-x} + y = 3 \\ \underline{+x} \quad \underline{+x} \\ y = 3 + x \end{array}$$

Solve for x in terms of y

$$\begin{array}{r} -x + y = 3 \\ \underline{-y} \quad \underline{-y} \\ -x = 3 - y \\ x = y - 3 \end{array}$$

Example: Solve for y in terms of x : $\cancel{6x} + 3y = 12$

$$\begin{array}{r} \cancel{6x} + 3y = 12 \\ \underline{-6x} \quad \underline{-6x} \\ 3y = 12 - 6x \\ \underline{y} \quad \underline{y} \\ y = 4 - 2x \end{array}$$

Example: Solve for y in terms of x : $3x + 2y = 12$

Applications

The profit in dollars from selling x DVD players is given by $40x - 200$. Set up and solve an equation to find out how many DVD players must be sold to obtain a profit of \$800.

The perimeter of a right triangle is 12 inches. If the hypotenuse is 5 inches long and one of the legs is 3 inches long, find the length of the third side of the triangle.

A contractor is enclosing a rectangular courtyard with 100 feet of fence. If the width of the courtyard is 10 feet, find the length of the courtyard.

Homework: P.8: 1 – 37 (odd), 39, 43, 45