

**Questions**

1. Solve for  $x$  when  $\frac{2}{3}x = \frac{1}{15}x + \frac{3}{5}$ .
2. Solve for  $x$  when  $\frac{x}{2} + \frac{x}{5} = \frac{7}{10}$ .
3. Solve for  $x$  when  $20 - \frac{1}{3}x = \frac{1}{2}x$ .
4. Is 4 a solution to  $\frac{1}{2}(y - 2) + 2 = \frac{3}{8}(3y - 4)$ ?
5. Solve for  $x$  when  $0.3x - 0.2(3 - 5x) = -0.5(x - 6)$ .
6. Solve for  $x$  when  $\frac{4}{5}x - \frac{2}{3} = \frac{3x + 1}{2}$ .
7. Solve for  $x$  when  $\frac{4}{7}x + \frac{1}{3} = \frac{3x - 2}{14}$ .
8. Solve for  $x$  when  $-1 + 5(x - 2) = 12x + 3 - 7x$ .
9. Solve for  $x$  when  $9(x + 3) - 6 = 24 - 2x - 3 + 11x$ .

**Solutions**

1. The LCD (lowest common denominator) is 15, so multiply the equation by 15 to remove the fractions.

$$\begin{aligned} \frac{2}{3}x &= \frac{1}{15}x + \frac{3}{5} \\ 15 \cdot \left(\frac{2}{3}x\right) &= 15 \cdot \left(\frac{1}{15}x + \frac{3}{5}\right) \\ 10x &= 15 \cdot \frac{1}{15}x + 15 \cdot \frac{3}{5} \text{ distribute!} \\ 10x &= x + 9 \text{ simplify} \\ 10x - x &= x + 9 - x \text{ addition principle} \\ 9x &= 9 \text{ simplify} \\ \frac{1}{9} \cdot 9x &= \frac{1}{9} \cdot 9 \text{ multiplication principle} \\ x &= 1 \text{ simplify} \end{aligned}$$

3. LCD is 6.

$$\begin{aligned} 20 - \frac{1}{3}x &= \frac{1}{2}x \\ 6 \cdot \left(20 - \frac{1}{3}x\right) &= 6 \cdot \frac{1}{2}x \\ 6 \cdot 20 - 6 \cdot \frac{1}{3}x &= 3x \\ 120 - 2x &= 3x \\ 120 - 2x + 2x &= 3x + 2x \\ 120 &= 5x \\ \frac{1}{5} \cdot 120 &= \frac{1}{5} \cdot 5x \\ 24 &= x \end{aligned}$$

2. LCD is 10.

$$\begin{aligned} \frac{x}{2} + \frac{x}{5} &= \frac{7}{10} \\ 10 \cdot \left(\frac{x}{2} + \frac{x}{5}\right) &= 10 \cdot \frac{7}{10} \\ 10 \cdot \frac{x}{2} + 10 \cdot \frac{x}{5} &= 7 \\ 5x + 2x &= 7 \\ 7x &= 7 \\ \frac{1}{7} \cdot 7x &= \frac{1}{7} \cdot 7 \\ x &= 1 \end{aligned}$$

4. You could substitute  $y = 4$  to check, but I am going to solve it instead. LCD is 8.

$$\begin{aligned} \frac{1}{2}(y-2) + 2 &= \frac{3}{8}(3y-4) \\ 8 \cdot \left( \frac{1}{2}(y-2) + 2 \right) &= 8 \cdot \frac{3}{8}(3y-4) \\ 8 \cdot \frac{1}{2}(y-2) + 8 \cdot 2 &= 3(3y-4) \\ 4(y-2) + 16 &= 9y - 12 \\ 4y - 8 + 16 &= 9y - 12 \\ 4y + 8 &= 9y - 12 \\ 4y + 8 - 9y - 8 &= 9y - 12 - 9y - 8 \\ -5y &= -20 \\ \frac{1}{-5} \cdot (-5y) &= \frac{1}{-5} \cdot (-20) \\ y &= 4 \end{aligned}$$

5.

$$\begin{aligned} 0.3x - 0.2(3 - 5x) &= -0.5(x - 6) \\ 0.3x - 0.6 + x &= -0.5x + 3 \\ 1.3x - 0.6 &= -0.5x + 3 \\ 1.3x - 0.6 + 0.5x + 0.6 &= -0.5x + 3 + 0.5x + 0.6 \\ 1.8x &= 3.6 \\ \frac{1}{1.8} \cdot 1.8x &= \frac{1}{1.8} \cdot 3.6 \\ x &= 2 \end{aligned}$$

6. LCD is 30.

$$\begin{aligned} \frac{4}{5}x - \frac{2}{3} &= \frac{3x+1}{2} \\ 30 \cdot \left( \frac{4}{5}x - \frac{2}{3} \right) &= 30 \cdot \frac{3x+1}{2} \\ 30 \cdot \frac{4}{5}x - 30 \cdot \frac{2}{3} &= 30 \cdot \frac{1}{2} \cdot (3x+1) \end{aligned}$$

Note in above I wrote  $\frac{3x+1}{2}$  as  $\frac{1}{2} \cdot (3x+1)$ . Doing this helps reduce errors!

$$\begin{aligned} 24x - 20 &= 15 \cdot (3x+1) \\ 24x - 20 &= 45x + 15 \\ 24x - 20 - 45x + 20 &= 45x + 15 - 45x + 20 \\ -21x &= 35 \\ \frac{1}{-21} \cdot (-21x) &= \frac{1}{-21} \cdot 35 \\ x &= -\frac{35}{21} = -\frac{5}{3} \end{aligned}$$

7. LCD is 42.

$$\begin{aligned} \frac{4}{7}x + \frac{1}{3} &= \frac{3x-2}{14} \\ \frac{4}{7}x + \frac{1}{3} &= \frac{1}{14}(3x-2) \\ 42 \cdot \left( \frac{4}{7}x + \frac{1}{3} \right) &= 42 \cdot \frac{1}{14}(3x-2) \\ 42 \cdot \frac{4}{7}x + 42 \cdot \frac{1}{3} &= 3(3x-2) \\ 24x + 14 &= 3(3x-2) \\ 24x + 14 &= 9x - 6 \\ 24x + 14 - 9x - 14 &= 9x - 6 - 9x - 14 \\ 15x &= -20 \\ \frac{1}{15} \cdot 15x &= \frac{1}{15} \cdot (-20) \\ x &= -\frac{20}{15} = -\frac{4}{3} \end{aligned}$$

8.

$$\begin{aligned} -1 + 5(x-2) &= 12x + 3 - 7x \\ -1 + 5x - 10 &= 5x + 3 \\ 5x - 9 - 5x &= 5x + 3 - 5x \\ -9 &= 3 \end{aligned}$$

We have to interpret what we have found. Since  $-9$  never equals  $3$ , the equation is never true no matter what value of  $x$  we put in. This means the equation has no solution.

9.

$$\begin{aligned} 9(x+3) - 6 &= 24 - 2x - 3 + 11x \\ 9x + 27 - 6 &= 21 + 9x \\ 9x + 21 &= 21 + 9x \\ 9x + 21 - 9x &= 21 + 9x - 9x \\ 21 &= 21 \end{aligned}$$

We have to interpret what we have found. Since  $21$  is always equal to  $21$ , the equation is true for any value of  $x$  that we try. Therefore, there are an infinite number of solutions.