

4.3a Solve Equations Involving Fractions

Part 1: Do it Now

Solve the following equation:

$$\frac{x}{4} = 7$$

Hint: You can simplify equations involving one fraction by multiplying both sides by the denominator of the fraction.

$$4\left(\frac{x}{4}\right) = 4(7)$$

$$x = 4(7)$$

$$x = 28$$

Part 2: Solve Equations With One Fraction

You can simplify equations involving one fraction by multiplying both sides by the denominator of the fraction.

$$1) \quad 6 = \frac{1}{3}(8 + x)$$

Don't distribute the fraction;
multiply both sides by 3 to get rid
of the fraction.

$$3(6) = 3\left(\frac{1}{3}\right)(8+x)$$

$$18 = 1(8+x)$$

$$18 = 8 + x$$

$$18 - 8 = x$$

$$10 = x$$

$$x = 10$$

$$2) \quad \frac{7(x-5)}{4} = 7$$

$$4\left[\frac{7(x-5)}{4}\right] = 4(7)$$

$$7(x-5) = 4(7)$$

$$7x - 35 = 28$$

$$7x = 28 + 35$$

$$\frac{7x}{7} = \frac{63}{7}$$

$$x = 9$$

$$3) \quad \frac{1}{6}(2x + 4) = 5$$

$$6\left(\frac{1}{6}\right)(2x+4) = 6(5)$$

$$1(2x+4) = 6(5)$$

$$2x+4 = 30$$

$$2x = 30 - 4$$

$$\frac{2x}{2} = \frac{26}{2}$$

$$x = 13$$

Part 3: Solve Equations With More Than 1 Fraction

When eliminating more than 1 fraction, find the lowest common denominator of all the fractions and then multiply both sides of the equation by this value to eliminate the fractions.

$$4) \quad \frac{1}{3}(2x - 5) = \frac{3}{4}(x - 2)$$

Find the lowest common denominator:

3, 6, 9, 12

4, 8, 12

$$4\left(\frac{1}{3}\right)(2x-5) = 3\left(\frac{3}{4}\right)(x-2)$$

$$4(1)(2x-5) = 3(3)(x-2)$$

$$4(2x-5) = 9(x-2)$$

$$8x - 20 = 9x - 18$$

$$-20 + 18 = 9x - 8x$$

$$-2 = x$$

$$x = -2$$

Find the lowest common denominator:

$$5) \quad \frac{1}{5}(7x - 3) = \frac{1}{10}$$

5, 10, 15, 20
10, 20, 30

$$2 \cancel{10} \left(\frac{1}{5} \right) (7x - 3) = 1 \cancel{10} \left(\frac{1}{10} \right)$$

$$2(1)(7x - 3) = 1(1)$$

$$2(7x - 3) = 1$$

$$14x - 6 = 1$$

$$14x = 1 + 6$$

$$\frac{14x}{14} = \frac{7}{14}$$

$$x = \frac{1}{2}$$

Find the lowest common denominator:

$$6) \quad -\frac{3}{4}(d + 3) = \frac{4}{5}(3d - 2)$$

4, 8, 12, 16, 20
5, 10, 15, 20

$$\cancel{20}^5 \left(-\frac{3}{4} \right) (d + 3) = \cancel{20}^4 \left(\frac{4}{5} \right) (3d - 2)$$

$$5(-3)(d + 3) = 4(4)(3d - 2)$$

$$-15(d + 3) = 16(3d - 2)$$

$$-15d - 45 = 48d - 32$$

$$-45 + 32 = 48d + 15d$$

$$\frac{-13}{63} = \frac{\cancel{63}d}{\cancel{63}}$$

$$d = \frac{-13}{63}$$

$$7a) \quad \frac{k+2}{3} = \frac{k-4}{5}$$

Find the lowest common denominator:

3, 6, 9, 12, 15
5, 10, 15

$$5 \cancel{15} \left(\frac{k+2}{\cancel{3}} \right) = 3 \cancel{15} \left(\frac{k-4}{\cancel{5}} \right)$$

$$5(k+2) = 3(k-4)$$

$$5k+10 = 3k-12$$

$$5k-3k = -12-10$$

$$\frac{2k}{2} = \frac{-22}{2}$$

$$k = -11$$

Part 4: Cross Multiplication

Method:

- 1) Multiply the numerator of the left fraction with the denominator of the right fraction. Put the product on either side of the equation.
- 2) Multiply the numerator of the right fraction with the denominator of the left fraction. Put the product on the other side of the equation.
- 3) Solve for the variable

Note: Cross-multiplication can only be used if you have two rational expressions equal to each other. If you have more than two expressions, you must clear denominators using the lowest common denominator.

You could have used the method of cross multiplication for #7

Try solving using cross-multiplication:

7b) $\frac{k+2}{3} = \frac{k-4}{5}$

$$5(k+2) = 3(k-4)$$

$$5k+10 = 3k-12$$

$$5k-3k = -12-10$$

$$\frac{2k}{2} = \frac{-22}{2}$$

$$k = -11$$

Can you use cross multiplication for this question?.....

$$\frac{(k+2)}{3} \cdot (-7) = \frac{(k-4)}{5}$$

NO!

$$8) \quad \frac{5 - 2x}{3} = \frac{15x - 7}{2}$$

$$3(15x - 7) = 2(5 - 2x)$$

$$45x - 21 = 10 - 4x$$

$$45x + 4x = 10 + 21$$

$$\frac{49x}{49} = \frac{31}{49}$$

$$x = \frac{31}{49}$$

$$9) \quad \frac{1}{4}x + 3 = 2$$

$$4\left(\frac{1}{4}x + 3\right) = 4(2)$$

$$4\left(\frac{1}{4}x\right) + 4(3) = 4(2)$$

$$1x + 12 = 8$$

$$x = 8 - 12$$

$$x = -4$$

Make sure
each term on
both sides are
multiplied by
the LCD

$$10) \quad \frac{1}{5}m + \frac{2}{3} - 2 = m - \frac{2}{5}$$

Make sure
each term on
both sides are
multiplied by
the LCD

$$3 \cancel{15} \left(\frac{1}{\cancel{3}} m \right) + \cancel{15} \left(\frac{2}{\cancel{3}} \right) - 15(2) = 15(m) - \cancel{15} \left(\frac{2}{\cancel{3}} \right)$$

$$3m + 10 - 30 = 15m - 6$$

$$3m - 20 = 15m - 6$$

$$-20 + 6 = 15m - 3m$$

$$\frac{-14}{12} = \frac{12m}{12}$$

$$-\frac{7}{6} = m$$

$$11) \quad \frac{3}{2}x + \frac{x-4}{2} = \frac{x+14}{3}$$

Make sure
each term on
both sides are
multiplied by
the LCD

$$3 \cancel{6} \left(\frac{3}{\cancel{2}} x \right) + \cancel{6} \left(\frac{x-4}{\cancel{2}} \right) = \cancel{6} \left(\frac{x+14}{\cancel{3}} \right)$$

$$3(3x) + 3(x-4) = 2(x+14)$$

$$9x + 3x - 12 = 2x + 28$$

$$9x + 3x - 2x = 28 + 12$$

$$\frac{10x}{10} = \frac{40}{10}$$

$$x = 4$$

Before homework, make sure you can solve:

a) $\frac{3}{4}(x + 3) = 9$

$$4\left(\frac{3}{4}\right)(x+3) = 4(9)$$

$$3(x+3) = 4(9)$$

$$3x + 9 = 36$$

$$3x = 36 - 9$$

$$3x = 27$$

$$\frac{3x}{3} = \frac{27}{3}$$

$$x = 9$$

$$x = 9$$

b) $\frac{x - 5}{3} = \frac{x + 10}{6}$

$$6(x - 5) = 3(x + 10)$$

$$6x - 30 = 3x + 30$$

$$6x - 3x = 30 + 30$$

$$3x = 60$$

$$\frac{3x}{3} = \frac{60}{3}$$

$$x = 20$$

$$x = 20$$