Rational

Lesson 8: Linear Equations in Disguise

* Use cross-multiplication

$\frac{a}{b} \times \frac{c}{d}$

$ad = bc$

Classwork

Example 3

Can this equation be solved?

$$\frac{6+x}{7x+\frac{2}{3}} = \frac{3}{8}$$

$8(6+x) = 3(7x+\frac{2}{3})$

$48 + 8x = 21x + 2$
$\quad -8x \quad -8x$

$48 = 13x + 2$
$-2 \quad\quad -2$

$\frac{46}{13} = \frac{13x}{13}$

$\boxed{x \approx 3.5}$

Example 4

Can this equation be solved?

$$\frac{7}{3x+9} = \frac{1}{8}$$

$1(3x+9) = 7(8)$

$3x + 9 = 56$
$\quad -9 \quad -9$

$\frac{3x}{3} = \frac{47}{3}$

$x = 15.7$

$$\frac{(5+2x)}{(3x-1)} \times \frac{6}{7}$$

$$7(5+2x) = 6(3x-1)$$

$$35 + 14x = 18x - 6$$
$$-14x \qquad -14x$$

$$35 = 4x - 6$$
$$+6 \qquad +6$$

$$\frac{41}{4} = \frac{4x}{4}$$

$$10.25 = x$$

$$\frac{(2x+1)}{9} \times \frac{(1-x)}{6}$$

$$6(2x+1) = 9(1-x)$$

$$12x + 6 = 9 - 9x$$

$$+9x \qquad +9x$$

$$21x + 6 = 9$$

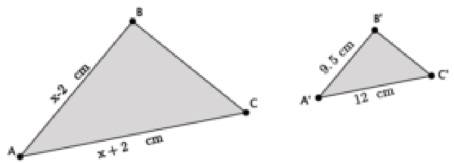
$$-6 \qquad -6$$

$$\frac{21x}{21} = \frac{3}{21}$$

$$x = \frac{1}{7} \text{ or } 0.14$$

Example 5 Ratios of corresponding segments are equal.

In the diagram below, $\triangle ABC \sim \triangle A'B'C'$. Using what we know about similar triangles, we can determine the value of x.



$$\frac{9.5}{(x-2)} = \frac{12}{(x+2)}$$

$$9.5(x+2) = 12(x-2)$$

$$9.5x + 19 = 12x - 24$$

$$19 = 2.5x - 24$$

$$43 = 2.5x$$

$$\boxed{17.2 = x}$$

Exercises

Solve the following equations of rational expressions, if possible.

1. $\frac{2x+1}{9} = \frac{1-x}{6}$

$3(x-1) - 8 = 4(1+x) + 5$

2. $\frac{5+2x}{3x-1} = \frac{6}{7}$

3. $\frac{x+9}{12} = \frac{-2x-\frac{1}{2}}{3}$

4. $\frac{8}{3-4x} = \frac{5}{2x+\frac{1}{4}}$

Lesson Summary

Some proportions are linear equations in disguise and are solved the same way we normally solve proportions.

When multiplying a fraction with more than one term in the numerator and/or denominator by a number, put the expressions with more than one term in parentheses so you remember to use the distributive property when transforming the equation. For example:

$$\frac{x+4}{2x-5} = \frac{3}{5}$$
$$5(x+4) = 3(2x-5).$$

The equation $5(x+4) = 3(2x-5)$ is now clearly a linear equation and can be solved using the properties of equality.

Problem Set

Solve the following equations of rational expressions, if possible. If the equation cannot be solved, explain why.

1. $\frac{5}{6x-2} = \frac{-1}{x+1}$
2. $\frac{4-x}{8} = \frac{7x-1}{3}$
3. $\frac{3x}{x+2} = \frac{5}{9}$
4. $\frac{\frac{1}{2}x+6}{3} = \frac{x-3}{2}$
5. $\frac{7-2x}{6} = \frac{x-5}{1}$
6. $\frac{2x+5}{2} = \frac{3x-2}{6}$
7. $\frac{6x+1}{3} = \frac{9-x}{7}$
8. $\frac{\frac{1}{3}x-8}{12} = \frac{-2-x}{15}$
9. $\frac{3-x}{1-x} = \frac{3}{2}$
10. In the diagram below, $\triangle ABC \sim \triangle A'B'C'$. Determine the lengths of AC and BC.