Lesson 36: Rational Equations

Objectives:

- Solve equations containing rational expressions.
- Solve equations containing rational functions.

Lesson 36: Rational Equations

There are 2 ways to solve rational equations.

The first way is using cross multiplication.

This method can only be used when there is a proportion -- a single fraction equal to a single fraction.

Lesson 36: Rational Equations

Example 1: Solve.

a.) $\frac{7}{r+2} = \frac{6}{r-5}$

$(r+2)(r-5)$

$7(r-5) = 6(r+2)$

$7r - 35 = 6r + 12$

$-6r + 35 \quad -6r + 35$

$r = 47$

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Example 1: Solve.

b.) $\frac{4}{x-1} = \frac{x+1}{12}$ →

$$\frac{4\,(x-1)(12)}{(x-1)} = \frac{(x+1)(x-1)(12)}{12}$$

→ $48 = x^2 - 1$

$-48 \qquad -48$

$0 = x^2 - 49$

$0 = (x-7)(x+7)$

$x-7=0 \qquad x+7=0$

$x=7 \qquad x=-7$

Alt. way

$\pm\sqrt{49} = \sqrt{x^2}$

$\pm 7 = x$

$x=7 \quad x=-7$

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The second method for solving rational equations can be used when the equation is not a proportion -- when there are more than 2 fractions in the equation.

In this case, you multiply both sides of the equation by the least common denominator. After you distribute to each fraction in the equation, this results in all the denominators canceling out.

** THIS WAY WORKS EVERY TIME!**

Lesson 36: Rational Equations

Solving a Rational Equation

Step 1: Find the domain of the variable in the equation. Find what values x cannot be – these are values that make the denominator equal 0.

Step 2: Find the LCD of all of the denominators.

Step 3: Multiply every term in the equation (on both sides) by the LCD. (This should get rid of all of the denominators.)

Step 4: Solve the resulting equation.

Step 5: Verify your solution.

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Example 2: Solve.

$$\frac{t}{2} + \frac{t}{5} = \frac{1}{1}$$

C: 1

U: 2 · 5

LCD: 10

$$\frac{10}{1}\left(\frac{t}{2}\right) + \frac{10}{1}\left(\frac{t}{5}\right) = \left(\frac{1}{1}\right)\frac{10}{1}$$

$$\rightarrow 5t + 2t = 10$$

$$\rightarrow \frac{7t}{7} = \frac{10}{7}$$

$$\boxed{t = \frac{10}{7}}$$

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$m \neq 0$

Example 3: Solve.

$$\frac{3m+2}{5m} + \frac{2m-1}{2m} = \frac{4}{1}$$

C: m
U: 5 · 2
LCD: 10m

$$\frac{10m}{1}\left(\frac{(3m+2)}{5m}\right) + \frac{10m}{1}\left(\frac{(2m-1)}{2m}\right) = \left(\frac{4}{1}\right)\frac{10m}{1}$$

$$2(3m+2) + 5(2m-1) = 40m$$

$$6m + 4 + 10m - 5 = 40m$$

$$16m - 1 = 40m$$

$$-16m \quad -16m$$

$$-1 = 24m$$

$$\frac{-1}{24} = \frac{24m}{24}$$

$$m = -\frac{1}{24}$$

Lesson 36: Rational Equations

$x \neq 2 \quad x \neq -2$

Example 4: Solve.

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

C: $(x-2)$

U: $(x+2)$

LCD: $(x-2)(x+2)$

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

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

$$x^2 - 2x + x^2 + 4x + 4 = x^2 + 5x + 6$$

$$2x^2 + 2x + 4 = x^2 + 5x + 6$$

$$-x^2 \quad -5x \quad -6 \qquad -x^2 \quad -5x \quad -6$$

$$x^2 - 3x - 2 = 0$$

↓

$x^2 - 3x - 2 = 0$

$a = 1 \quad b = -3 \quad c = -2$

$$x = \frac{3 \pm \sqrt{(-3)^2 - 4(1)(-2)}}{2(1)}$$

$$x = \frac{3 \pm \sqrt{9 + 8}}{2}$$

$$\boxed{x = \frac{3 \pm \sqrt{17}}{2}}$$

$\_ \cdot \_ = -2$

$\_ + \_ = -3$

Can't factor

So.... $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

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$y \neq -2$

C: $(y+2)(3)$

U: 5

LCD: $15(y+2)$

Example 5: Solve.

$$\frac{3}{(y+2)} + \frac{7}{15} = \frac{23}{3y+6}$$

$3 \cdot 5$ $\qquad$ $3(y+2)$

$$\frac{15(y+2)}{1}\cdot\frac{3}{(y+2)} + \frac{15(y+2)}{1}\cdot\frac{7}{15} = \frac{5}{15(y+2)}\cdot\frac{23}{3(y+2)}$$

$$15(3) + 7(y+2) = 5(23)$$

$$45 + 7y + 14 = 115$$

$$7y + 59 = 115$$

$$-59 \quad -59$$

$$\frac{7y}{7} = \frac{56}{7}$$

$$y = 8$$

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Objectives:

- Solve equations containing rational expressions.
- Solve equations containing rational functions.

Can you?

Lesson 36: Rational Equations

Homework:

Assignment 36

Always CHECK your answer with your domain. If it doesn't work, cross that answer off! (Hint, hint for your quiz!)