

LEARNING TARGET: I will solve equations containing rational algebraic expressions.

Solving Rational Equations

There are two methods to solve rational equations. You can:

- Cross Multiply
- Multiply each side by the least common denominator

You must always check for extraneous solutions by substituting back into the original equation.

Cross Multiplying

Example 1: Solve.

$$\frac{3}{x+1} = \frac{9}{4x+5}$$

$$\begin{aligned} 9(x+1) &= 3(4x+5) \\ 9x+9 &= 12x+15 \\ \cancel{-9x-15} &\quad \cancel{-9x-15} \\ \hline -6 &= 3x \\ \frac{-6}{3} &= \frac{3x}{3} \\ \boxed{-2} &= x \end{aligned}$$

Check :

$$\frac{3}{-2+1} = \frac{9}{4(-2)+5}$$

$$\frac{3}{-1} = \frac{9}{-3}$$

$$-3 = -3$$

✓

* Can also plug each side of equation into $Y=$ on calc + use table function to make sure they are the same value on each side of the equation

Multiplying by LCD

Example 2: Solve.

$$x(x-5) \left(1 - \frac{8}{x-5} \right) = \frac{3}{x} (x-5)x$$

$$x(x-5) - 8x = 3(x-5)$$

$$x^2 - 5x - 8x = 3x - 15$$

$$\begin{array}{r} x^2 - 13x = 3x - 15 \\ -3x \quad -3x + 15 \\ \hline \end{array}$$

$$x^2 - 16x + 15$$

$$(x-1)(x-15)$$

$$x=1 \quad x=15$$

Check:

$$1 - \frac{8}{10} = \frac{3}{15}$$

$$\frac{2}{10} = \frac{1}{5}$$

$$\frac{1}{5} = \frac{1}{5} \checkmark$$

Check:

$$1 - \frac{8}{-4} = \frac{3}{1}$$

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

$$3 = 3 \checkmark$$

Example 3: Solve.

$$\frac{6}{x-3} = \frac{8x^2}{x^2-9} - \frac{4x}{x+3}$$

$$(x+3)(x-3) \left(\frac{6}{x-3} \right) = \left(\frac{8x^2}{(x+3)(x-3)} - \frac{4x}{x+3} \right) (x+3)(x-3)$$

$$6(x+3) = 8x^2 - 4x(x-3)$$

$$6x + 18 = 8x^2 - 4x^2 + 12x$$

$$4x^2 + 6x - 18$$

$$2(2x^2 + 3x - 9)$$

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

$$x = \frac{3}{2}$$

$$x = -3$$

Ext.

* can use Calc to help factor by finding zeros

* use calc to check by graphing both sides then use the table function to check