

## Rational Expressions and Equations Lesson #8: Rational Equations - Part Two

In this lesson, we will solve rational equations which reduce to quadratic equations. We will also consider equations which have no solutions.

Recall the following strategies when solving rational equations algebraically:

1. If the equation consists of a single rational expression on each side, use cross-multiplication to simplify the equation.
2. If the rational equation has more than one term, on either side, consider multiplying each term in the equation by the lowest common multiple of the denominators. *all denominators are removed.*
3. Use previously learned skills for solving linear or quadratic equations.
4. Always be aware there are domain restrictions when dealing with rational functions, and check your solutions accordingly, i.e. when verifying solutions, note that the solution **cannot be a nonpermissible value** since this would result in division by zero.



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- a) In the previous lesson, we solved the equation  $\frac{3}{x+1} + \frac{1}{x-1} = 2$  graphically.  
The solution is  $x = \underline{\quad}$  or  $x = \underline{\quad}$ .

- b) Solve the equation  $\frac{3}{x+1} + \frac{1}{x-1} = 2$  algebraically.



Consider the rational equation  $\frac{x^2 - 5x - 6}{x + 1} = \frac{2}{1}$ .

- a) Solve the following rational equation by cross-multiplication.

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

*zero the quadratic*

$$x^2 - 7x - 8 = 0$$

$$(x - 8)(x + 1) = 0$$

$\downarrow$                        $\downarrow$   
 $x = 8$      $x = -1$  ~~restricted~~

- b) Explain why one of the solutions to the quadratic equation formed in a) does not satisfy the original equation.

*$x = -1$  is a restricted value so it can't be a solution.*



State the nonpermissible value(s), solve the equation algebraically, and verify the solution(s).

a)  $\left[ \frac{x + \frac{2}{x}}{x + \frac{1}{x}} = 3 \right]$

$$x^2 + 2 = 3x$$

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

$$(x - 2)(x - 1) = 0$$

$\downarrow$                        $\downarrow$   
 $x = 2, 1$

b)  $\frac{x}{x^2 - 4} = \frac{2}{x + 2}$

$$x^2 + 2x = 2x^2 - 8$$

$$0 = x^2 - 2x - 8$$

$$0 = (x - 4)(x + 2)$$

$\downarrow$   
 $x = 4$  ~~restricted~~

**An Equation with No Solution**

Class Ex. #4



Show that the equation  $\frac{8x+10}{x-3} - 4 = \frac{10x+4}{x-3}$  has no solution.

$$8x+10 - 4x+12 = 10x+4$$

$$\frac{18}{6} = \frac{6x}{6}$$

$$\cancel{3} = x$$

restricted

∅

Complete Assignment Questions #1 - #7

#1-5

**Assignment**

In this assignment, a written verification is only required where indicated.  
All solutions must be checked for nonpermissible values.

1. In each case, state the nonpermissible value(s), solve the equation algebraically, and verify the solution(s).

a)  $\frac{4}{x+2} = 3$

b)  $\frac{3}{2x-1} = \frac{4}{x+7}$