

**Notes 2.7 Pre-calc****Solving Equations in One Variable**

Equations involving rational expressions or fractions are rational equations. Every rational equation can be written in the form  $\frac{f(x)}{g(x)} = 0$

**Steps to solving the rational equation.**

- Find the LCD. (Least common denominator)
- Multiply all terms by the LCD to clear away the denominators.
- Solve for the variable.
- Sometimes the solutions are not solutions of the original equation so you must check each solution. Solutions that are not really solutions to the original equation are called **extraneous solutions**.

Solve the equation algebraically and graphically. Check for extraneous solutions

$$a) \frac{3}{x-1} + \frac{2}{x} = 8$$

$$\frac{x}{x} \cdot \frac{3}{x-1} + \frac{2(x-1)}{x(x-1)} = \frac{8}{1} \cdot \frac{x(x-1)}{x(x-1)}$$

$$\text{LCD } x(x-1)$$

$$\frac{3x}{x(x-1)} + \frac{2(x-1)}{x(x-1)} = \frac{8(x)(x-1)}{x(x-1)}$$

$$\frac{3x + 2(x-1) - 8(x)(x-1)}{x(x-1)} = 0$$

$$\text{numerator} = 0$$

$$3x + 2x - 2 - 8x^2 + 8x = 0$$

$$-8x^2 + 13x - 2 = 0$$

$$x = \frac{-13 \pm \sqrt{(-13)^2 - 4(-8)(-2)}}{2(-8)}$$

$$\frac{-13 \pm \sqrt{169 - 64}}{-16}$$

$$\frac{(-13 - \sqrt{105})}{-16}$$

$$1.452$$

$$\frac{(-13 + \sqrt{105})}{-16}$$

$$.172$$

$$a) \quad \frac{3}{x-1} + \frac{2}{x} = 8 \quad \text{Domain } x \neq 0; x \neq 1$$

$$x(x-1) \cdot \frac{3}{\cancel{x-1}} + \frac{2}{\cancel{x}} \cdot \cancel{x}(x-1) = \frac{8(x)(x-1)}{8x(x-1)}$$

$$3x + \frac{2(x-1)}{2x-2} = 8x^2 - 8x$$

$$0 = 8x^2 - 8x - 3x - 2x + 2$$

$$8x^2 - 13x + 2$$

$$x = \frac{13 \pm \sqrt{(-13)^2 - 4(8)(2)}}{2(8)}$$

$$\frac{13 \pm \sqrt{169 - 64}}{16}$$

$$\frac{13 \pm \sqrt{105}}{16} \Rightarrow \begin{matrix} .172 \\ 1.452 \end{matrix}$$

b)  $2 - \frac{3}{x+4} = \frac{12}{x^2+4x}$

$$\frac{2}{1} - \frac{3}{x+4} = \frac{12}{x(x+4)}$$

Domain  
 $x \neq -4$   
 $x \neq 0$

LCD  $x(x+4)$

$$(x)(x+4) \frac{2}{1} + \frac{-3}{\cancel{x+4}} \cancel{x(x+4)} = \frac{12}{\cancel{x(x+4)}} \cancel{x(x+4)}$$

$$2x(x+4) - 3x = 12$$

$$2x^2 + 8x - 3x - 12 = 0$$

$$2x^2 + 5x - 12 = 0$$

$$\underline{2x^2 + 8x} - \underline{3x - 12} = 0$$

-24	5
-1	24
-2	12
-3	8
-4	6

$$2x(x+4) - 3(x+4) = 0$$

$$(x+4)(2x-3) = 0$$

$$x+4=0$$

$$2x-3=0$$

$$\boxed{x = -4}$$

$$2x = 3$$

extraneous

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

$$c) \frac{4x}{x+4} + \frac{3}{x-1} = \frac{15}{x^2+3x-4}$$

$$(x-1)(x+4)$$

Domain

$$x \neq -4; x \neq 1$$

$$\frac{4x}{\cancel{(x+4)}} \cdot \cancel{(x+4)}(x-1) + \frac{3}{\cancel{(x-1)}} \cdot \cancel{(x-1)}(x+4) = \frac{15}{\cancel{(x-1)}\cancel{(x+4)}} \cdot \cancel{(x-1)}\cancel{(x+4)}$$

$$4x(x-1) + 3(x+4) = 15$$

$$4x^2 - 4x + 3x + 12 - 15 = 0$$

$$4x^2 - x - 3 = 0$$

$$4x^2 - 4x + 3x - 3 = 0$$

$$\begin{array}{r|l} -12 & -1 \\ \hline 1 & -12 \\ 2 & -6 \\ \hline 13 & -4 \end{array}$$

$$4x(x-1) + 3(x-1) = 0$$

$$(4x+3)(x-1) = 0$$

$$4x+3=0 \quad x-1=0$$

$$4x = -3$$

$$x = -\frac{3}{4}$$

~~$x=1$~~   
extraneous

$$d) \frac{x+2}{x} - \frac{4}{x-1} + \frac{2}{\frac{x^2-x}{x(x-1)}} = 0$$

Domain  
 $x \neq 0 \quad x \neq 1$

LCD  $x(x-1)$

$$\frac{(x+2) \cancel{x} (x-1)}{\cancel{x}} + \frac{-4}{\cancel{(x-1)}} \cdot \cancel{x(x-1)} + \frac{2}{\cancel{x(x-1)}} \cdot \cancel{x(x-1)} = 0$$

$$(x+2)(x-1) + -4x + 2 = 0$$

$$x^2 - 1x + 2x - 2 - 4x + 2 = 0$$

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

$$x(x-3) = 0$$

$$\cancel{x=0} \quad x-3=0$$

extraneous  $x=3$