

Equations – Rational (Fractional)

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Rational Equations have expressions of the form $\frac{\text{Expression \#1}}{\text{Expression \#2}}$

Example 01: Solve for x: $\frac{2}{x^2 + x - 6} - \frac{1}{x^2 - 5x + 6} = 0$

Solution:

Step	Equation	Reason
0	$\frac{2}{x^2 + x - 6} - \frac{1}{x^2 - 5x + 6} = 0$	
1	$\frac{2}{(x+3)(x-2)} - \frac{1}{(x-2)(x-3)} = 0$	Factor $x \neq -3, 2, 3$
2	$\frac{2(x-3)}{(x+3)(x-2)(x-3)} - \frac{1(x+3)}{(x-2)(x-3)(x+3)} = 0$	Common Denominator
3	$\frac{2x-6}{(x^2-9)(x-2)} - \frac{x+3}{(x^2-9)(x-2)} = 0$	
4	$\frac{[2x-6] - [x+3]}{(x^2-9)(x-2)} = 0$	
5	$\frac{2x-6-x-3}{(x^2-9)(x-2)} = 0$	
6	$\frac{x-9}{(x^2-9)(x-2)} = 0$	
7	$x-9=0$ $x=9$	Linear Equation

Graph:



Example 02: Solve for x:

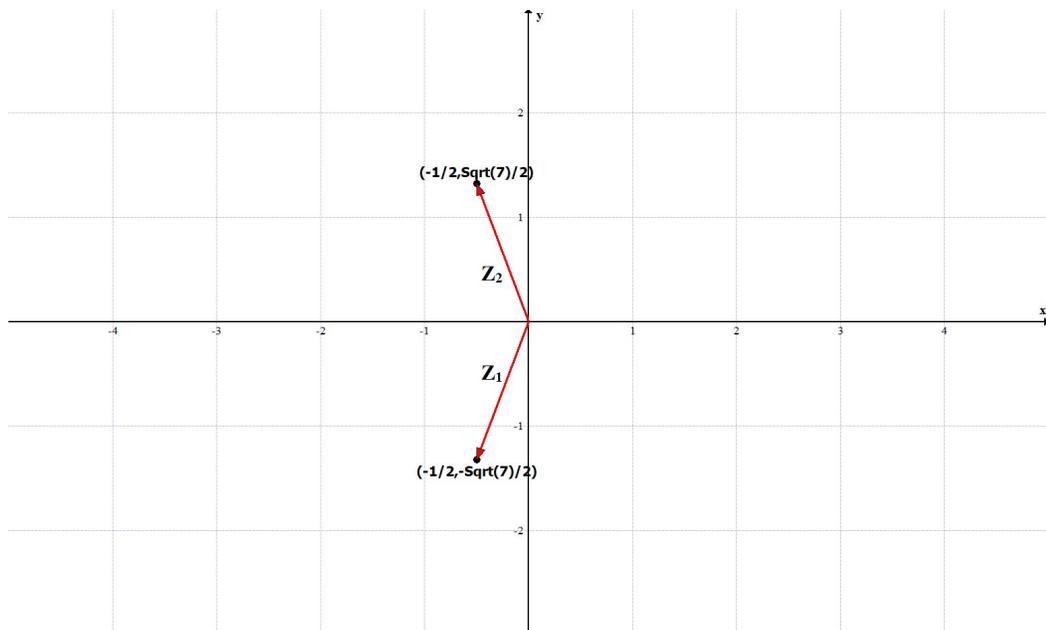
$$1. \frac{x}{x-2} = \frac{1}{x+2} \quad \text{Cross Multiply}$$

$$2. \frac{x}{x-2} - \frac{1}{x+2} = 0 \quad \text{Common Denominator}$$

Solution:

Step	Equation	Reason
0	$\frac{x}{x-2} = \frac{1}{x+2}$	$x \neq -2, 2$
1	$x(x+2) = x-2$ [$x \neq -2$; $x \neq 2$] $x^2 + 2x = x - 2$	Cross Multiply
2	$x^2 + x + 2 = 0$ $a = 1$; $b = 1$; $c = 2$	Quadratic Equation
3	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	
4	$x = \frac{-[1] \pm \sqrt{[1]^2 - 4[1][2]}}{2[1]}$	
5	$x = \frac{-1 \pm \sqrt{-7}}{2} = \frac{-1 \pm \sqrt{7} i}{2}$	

Graph:



Equation 03: Solve for x: $\frac{5}{3x+5} = \frac{3}{5x-3}$

Solution:

Step	Equation	Reason
0	$\frac{5}{3x+5} = \frac{3}{5x-3}$	$x \neq -\frac{5}{3}, \frac{3}{5}$
1	$5(5x-3) = 3(3x+5)$	Cross Multiply
2	$25x-15 = 9x+15$	Linear Equation
3	$25x-9x = 15+15$	
4	$16x = 30$ $x = \frac{30}{16} = \frac{15}{8} = 1 \frac{7}{8}$	

Graph:

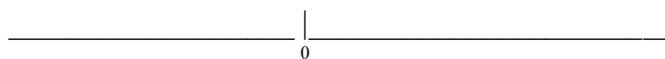


Equation 04: Solve for x: $\frac{3}{3x+5} = \frac{5}{5x-3}$

Solution:

Step	Equation	Reason
0	$\frac{3}{3x+5} = \frac{5}{5x-3}$	$x \neq -\frac{5}{3}, \frac{3}{5}$
1	$3(5x-3) = 5(3x+5)$	Cross Multiply
2	$15x-9 = 15x+25$	Linear Equation
3	$0 = 34$ False! NO Solution!	

Graph: NO SOLUTION!



Equation 05: Solve for x: $\frac{4}{x-3} - \frac{3}{x+3} = \frac{2}{x^2-9}$

Solution:

Step	Equation	Reason
0	$\frac{4}{x-3} - \frac{3}{x+3} = \frac{2}{x^2-9}$	$x \neq -3, 3$
1	$\frac{4(x+3)}{(x-3)(x+3)} - \frac{3(x-3)}{(x+3)(x-3)} = \frac{2}{(x-3)(x+3)}$	Common Denominator
2	$\frac{4(x+3) - 3(x-3)}{(x-3)(x+3)} = \frac{2}{(x-3)(x+3)}$	
3	$4(x+3) - 3(x-3) = 2$	Linear Equation
4	$4x + 12 - 3x + 9 = 2$	
5	$x + 21 = 2$ $x = -19$	

Graph:

