

## PreCalculus Class Notes RF8 Solving Rational Equations Algebraically and Graphically

**Solving algebraically.** Two equivalent methods.

$$\frac{x+4}{2x} = \frac{1}{3x} + 3$$

Rewrite with a common denominator	Multiply by the LCD
$\frac{3(x+4)}{3(2x)} = \frac{2(1)}{2(3x)} + \frac{6x(3)}{6x}$ $\frac{3(x+4)}{6x} = \frac{2(1)}{6x} + \frac{6x(3)}{6x}$ $6x\left(\frac{3(x+4)}{6x}\right) = 6x\left(\frac{2(1)}{6x}\right) + 6x\left(\frac{6x(3)}{6x}\right)$ $3(x+4) = 2(1) + 6x(3)$	$6x\left(\frac{x+4}{2x}\right) = 6x\left(\frac{1}{3x}\right) + 6x(3)$ $\cancel{6x}^3\left(\frac{x+4}{\cancel{2x}^2}\right) = \cancel{6x}^2\left(\frac{1}{\cancel{3x}}\right) + 6x(3)$ $3(x+4) = 2(1) + 6x(3)$

$$3(x+4) = 2(1) + 6x(3)$$

$$3x + 12 = 2 + 18x$$

$$10 = 15x$$

$$\frac{10}{15} = x$$

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

Alternative methods for check of rational equations

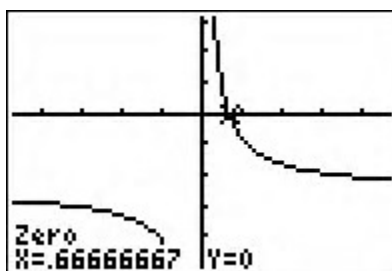
Check in ORIGINAL equation	Check for undefined values
$\frac{\frac{2}{3} + 4}{2\left(\frac{2}{3}\right)} = \frac{1}{3\left(\frac{2}{3}\right)} + 3$ $3.5 = 3.5$	$x \neq 0 \text{ so } x = \frac{2}{3} \text{ is OK}$

**Solve graphically:**  $\frac{x+4}{2x} = \frac{1}{3x} + 3$

Set equal to 0 first:  $\frac{x+4}{2x} - \frac{1}{3x} - 3 = 0$

Graph  $y = \frac{x+4}{2x} - \frac{1}{3x} - 3$ , use Calc Zero

Plot1 Plot2 Plot3 $\sqrt{Y1} = \frac{x+4}{2x} - \frac{1}{3x} - 3$ $\sqrt{Y2} =$ $\sqrt{Y3} =$ $\sqrt{Y4} =$ $\sqrt{Y5} =$ $\sqrt{Y6} =$
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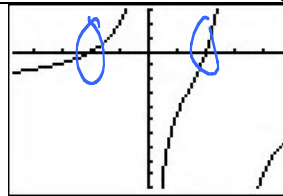
Ans+Frac $\frac{2}{3}$
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$$\frac{5x}{3-x} - \frac{4}{x} = \frac{3}{1} x(3-x)$$

Solve algebraically

Solve graphically

$$\begin{aligned} 5x - 4(3-x) &= 3x(3-x) \\ 5x - 12 + 4x &= 9x - 3x^2 \\ 9x - 12 &= 9x - 3x^2 \\ -12 &= -3x^2 \\ 4 &= x^2 \\ \pm 2 &= x \end{aligned}$$



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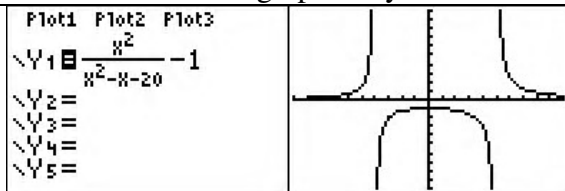
WINDOW
Xmin=-4.7
Xmax=4.7
Xscl=1
Ymin=-10
Ymax=3.1
Yscl=1
Xres=1
    
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$$x = -2, x = 2$$

$$\frac{x^2}{x^2 - x - 20} = 1$$

Solve graphically

Solve algebraically



$$x^2 = x^2 - x - 20$$

$$0 = -x - 20$$

$$x = -20$$

$$(x+2)\frac{(x-3)}{x} + \frac{3(x)}{x+2} + \frac{6}{x^2+2x} = 0$$

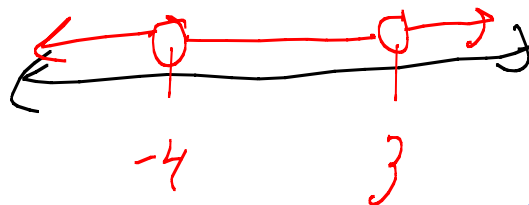
$$x \neq 0, x \neq -2$$

Solve algebraically	Solve graphically
$(x+2)(x-3) + 3x + 6 = 0$ $x^2 - x - 6 + 3x + 6 = 0$ $x^2 + 2x = 0$ $x(x+2) = 0$ $x=0 \quad   \quad x=-2$	<p style="text-align: center;">No solution</p>

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

$$x \neq -4, x \neq 3$$

Solve algebraically	Solve graphically
$x^2 - x - 6 = (x+2)(x-3)$ $x^2 - x - 6 = x^2 - x - 6$ $0 = 0$	



$$(-\infty, -4) \cup (-4, 3) \cup (3, \infty)$$

$$\{x \mid x \in \mathbb{R}, x \neq -4, x \neq 3\}$$