

Solving Rational Inequalities

Oct 21/2014

- (1) Rearrange all terms to one side, the other side zero.  
\*\*\* do NOT cross multiply \*\*\*
- (2) Write expression with single, common denominator, removing any common factors (holes).
- (3) Determine any vertical asymptotes from the simplified denominator.
- (4) Determine any zeroes from the simplified numerator.
- (5) Use an interval table (sign chart) to check for positive and negative intervals.
- (6) Write your solution, keeping in mind ALL restrictions (holes, VAs, real-world considerations).

Oct 19-7:38 PM

Why we CANNOT use cross multiplication on rational inequalities:

For a rational equation:  $\frac{x+3}{x+1} = \frac{x-2}{x-3}$

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

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

For a rational inequality:

Because there is a variable involved, we don't know if we multiplied by a positive or negative. Should direction of the inequality change?

$$\frac{x+3}{x+1} \geq \frac{x-2}{x-3}$$

$$(x-3)(x+3) \geq (x-2)(x+1)$$

OR?

$$(x-3)(x+3) \leq (x-2)(x+1)$$

Oct 21-9:19 AM

Ex.1 Solve  $x - 1 < \frac{12}{x}$  (see p.291 for similar example)

$$\frac{(x-1) \cdot x}{1} - \frac{12}{x} < 0$$

$$\frac{x^2 - x - 12}{x} < 0$$

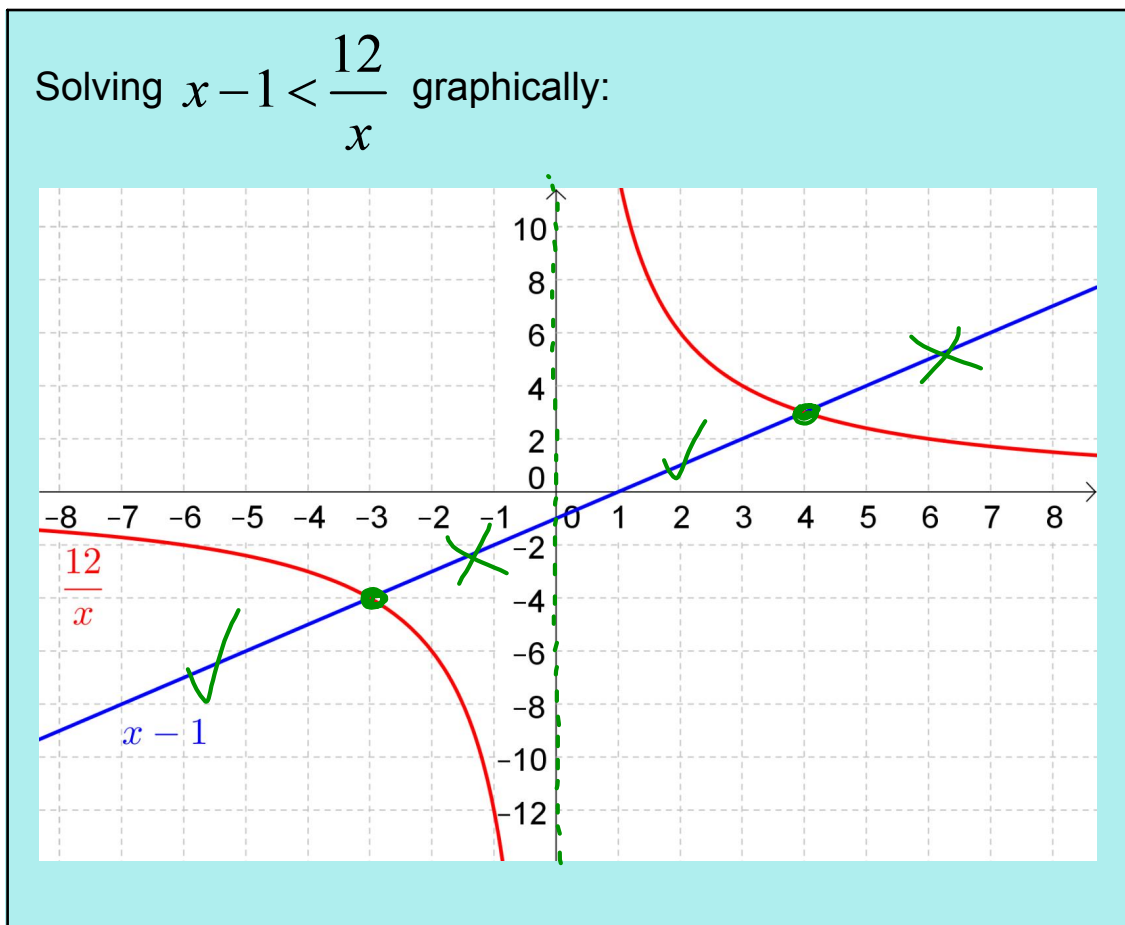
holes: none  
 VA:  $x=0$   
 zeros:  $x=4, -3$

$$\frac{(x-4)(x+3)}{x} < 0$$

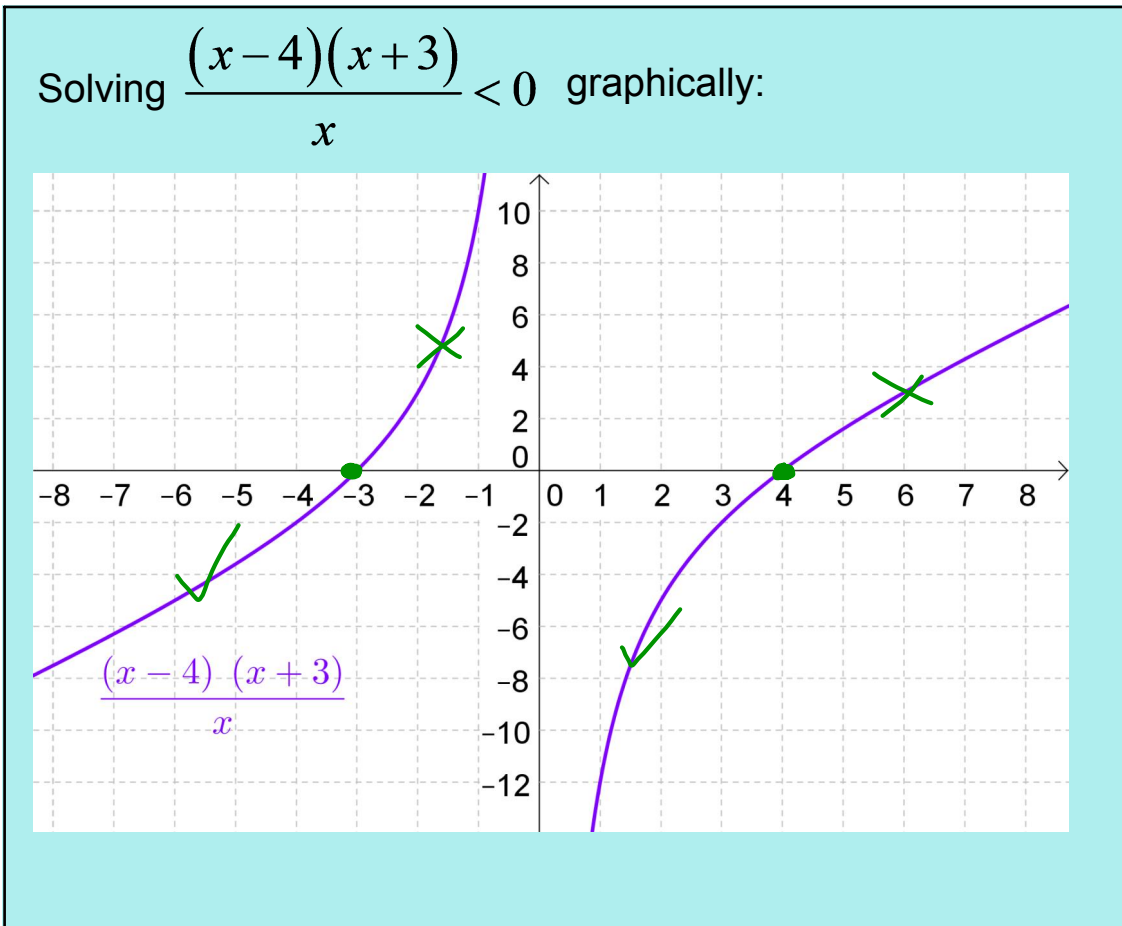
	$x < -3$	$-3 < x < 0$	$0 < x < 4$	$x > 4$
$x-4$	-	-	-	+
$x+3$	-	+	+	+
$x$	-	-	+	+
result	-	+	-	+

Solution is  $x < -3$  or  $0 < x < 4$  ✓  
 $(-\infty, -3) \cup (0, 4)$  ✓  
 $(-\infty, -3)$  OR  $(0, 4)$  ✓

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Ex.2 Solve  $\frac{x}{x-1} < \frac{5x-3}{(x-1)(x+1)}$

$$\frac{x}{x-1} \frac{(x+1)}{(x+1)} - 1 \frac{(5x-3)}{(x-1)(x+1)} < 0$$

$$\frac{x^2+x-5x+3}{(x-1)(x+1)} < 0$$

$$\frac{x^2-4x+3}{(x-1)(x+1)} < 0$$

$$\frac{(x-1)(x-3)}{(x-1)(x+1)} < 0$$

hole:  $x=1$   
 VA:  $x=-1$   
 zero:  $x=3$

$$\frac{x-3}{x+1} < 0, x \neq 1$$

	$(-\infty, -1)$	$(-1, 3)$	$(3, \infty)$
$x-3$	-	-	+
$x+1$	-	+	+
result	+	-	+

Solution is:  $-1 < x < 1$  or  $1 < x < 3$

Oct 21-10:01 AM

Assigned Work:

p.295 # 1, 4acf, 5ace (7), 9, 13

$$7. \frac{3x-8}{2x-1} > \frac{x-4}{x+1}$$

$$\frac{3x-8}{2x-1} - \frac{x-4}{x+1} > 0$$

$$\frac{(3x-8)(x+1) - (x-4)(2x-1)}{(2x-1)(x+1)} > 0$$

$$\frac{3x^2 - 5x - 8 - (2x^2 - 9x + 4)}{(2x-1)(x+1)} > 0$$

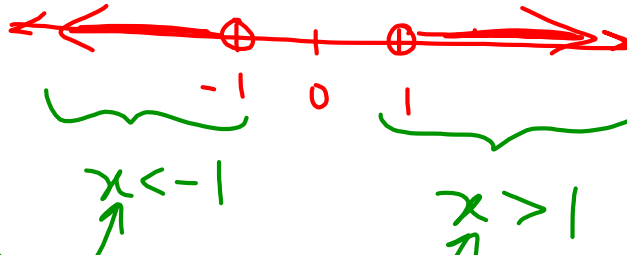
$$\frac{x^2 + 4x - 12}{(2x-1)(x+1)} > 0$$

$$\frac{(x+6)(x-2)}{(2x-1)(x+1)} > 0$$

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$$13. \left| \frac{x}{x-4} \right| \geq 1$$

hint:  $|x| > 1$



Oct 22-3:04 PM