Precalculus 4.3 Key Points

Inequality and Interval Notation:

Intervals can be expressed using inequality notation or interval notation:

Inequality Notation	Interval Notation
$x > 2$	$(2, \infty)$
$x \leq -3$	$(-\infty, -3]$
$6 > x > -2$	$(-2, 6)$
$-11 \leq x \leq 10$	$[-11, 10]$
$x < 1$ or $x \geq 5$	$(-\infty, 1)\cup[5, \infty)$

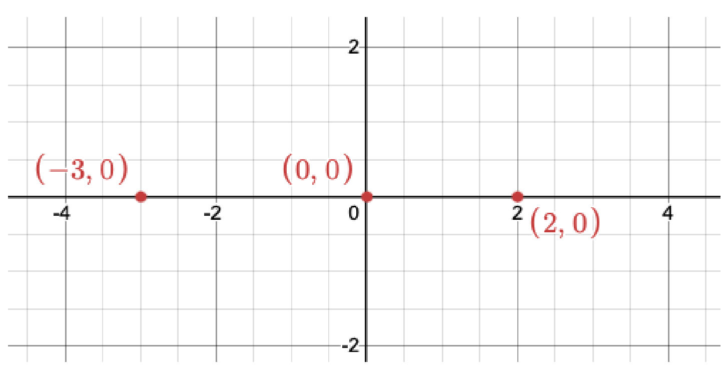
Parentheses indicate that the value is not included in the interval, while brackets indicate that the value is included in the interval. When one of the bounds is $-\infty$ or ∞, use parenthesis for that bound.
"∪" is the union symbol, indicating that multiple smaller intervals are included in the entire interval

Solving Rational Inequalities:

To graph inequalities, there are two methods you can use. You may find that it is more convenient to use one of methods rather than the other based on the specific problem

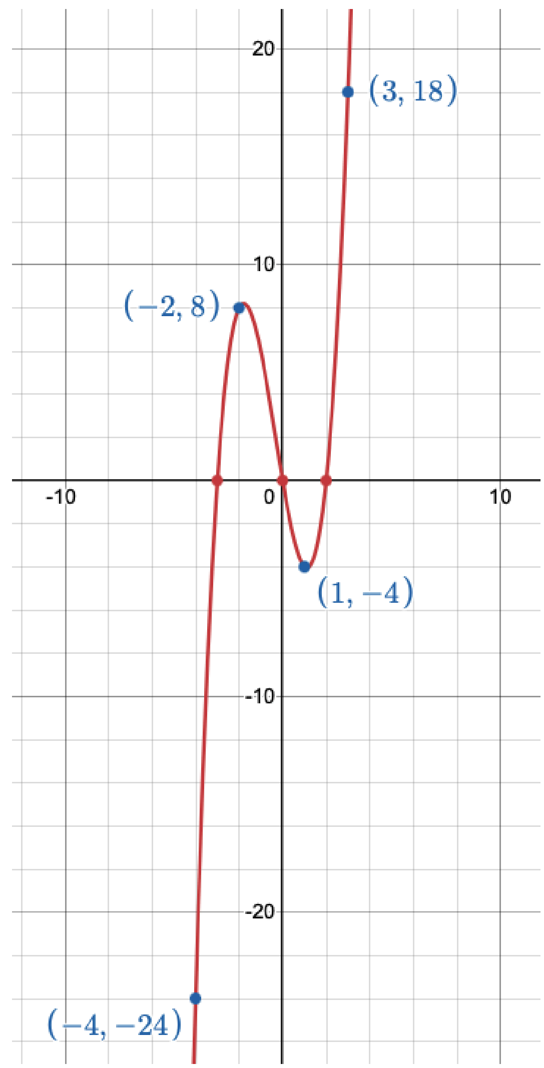
Method 1: Test Point Method
This method involves graphing the inequality and testing points to solve

$x(x+3)(x-2) > 0$
First, we will solve for the zeroes while treating the inequality like the equation $y = x(x+3)(x-2)$



Now, we can test points to the left and right of each zero to generate an approximate graph.
Note: Since we are solving the inequality, all that we care about is whether the in-between points are greater than or less than 0

Test Range	Example Test	Result
$x < -3$	$x = -4,\ y = (-4)(-4+3)(-4-2) = -24$	$-$
$-3 < x < 0$	$x = -2,\ y = (-2)(-2+3)(-2-2) = 8$	$+$
$0 < x < 2$	$x = 1,\ y = (1)(1+3)(1-2) = -4$	$-$
$x > 2$	$x = 3,\ y = (3)(3+3)(3-2) = 18$	$+$



Returning to the original problem, we need to identify where $x(x+3)(x-2) > 0$

There are two regions that have y-values which are greater than zero, which we determined through the test points

Thus, the solution to the inequality is:
Interval Notation: $(-3, 0) \cup (2, \infty)$
Inequality Notation: $-3 < x < 0$ or $x > 2$

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Method 2: Sign Chart
We can also use a sign chart to solve inequalities

$(x + 13)(x + 1)(x - 5)(x - 11) \leq 0$
Again, begin by solving for the zeroes. This time, put them into a chart with each of the factors like so:

	-13	-1	5	11	
$(x + 13)$					
$(x + 1)$					
$(x - 5)$					
$(x - 11)$					

Like with the previous method, pick test points. Plug them into each factor to determine whether it is positive or negative. Finally, multiply the positives and negatives together in each column to determine whether $(x + 13)(x + 1)(x - 5)(x - 11)$ is positive or negative in that interval

	-13	-1	5	11	
$(x + 13)$	$-$	$+$	$+$	$+$	$+$
$(x + 1)$	$-$	$-$	$+$	$+$	$+$
$(x - 5)$	$-$	$-$	$-$	$+$	$+$
$(x - 11)$	$-$	$-$	$-$	$-$	$+$
	$+$	$-$	$+$	$-$	$+$

Thus, the solution to the inequality is:
Interval Notation: $[-13, -1] \cup [5, 11]$
Inequality Notation: $-13 \leq x \leq -1$ or $5 \leq x \leq 11$