

# Quadratic Inequalities



Be good at recognizing a quadratic equation. They are all polynomials of degree 2 (two is the highest power). There are 4 inequality symbols.

$$ax^2 + bx + c < 0 \text{ or } ax^2 + bx + c \leq 0 \text{ or } ax^2 + bx + c > 0 \text{ or } ax^2 + bx + c \geq 0$$

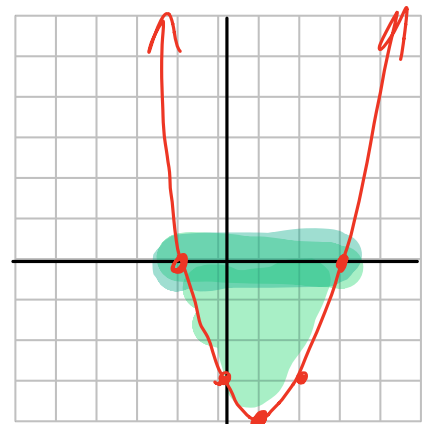
We have a number of strategies to solve these.

#1- We solve graphically - just like with the linear versions  
With one extra step.

Eg:  $x^2 - 2x - 3 \leq 0$

$$(x - 1)^2 - 3 - 1 \leq 0$$

$$(x - 1)^2 - 4 \leq 0$$



Once we have it graphed, we need to know which portion of the parabola is a solution to our inequality.

Our inequality is asking for all of the points that cause  $x^2 - 2x - 3$  to be  $\leq 0$ .

We can use test points (3 in this case to confirm our intuition) and we must also decide if we are to use ( $\circ$ , or  $\bullet$ ).

Answer is a solution set:

$$\{x \mid -1 \leq x \leq 3, x \in \mathbb{R}\}$$

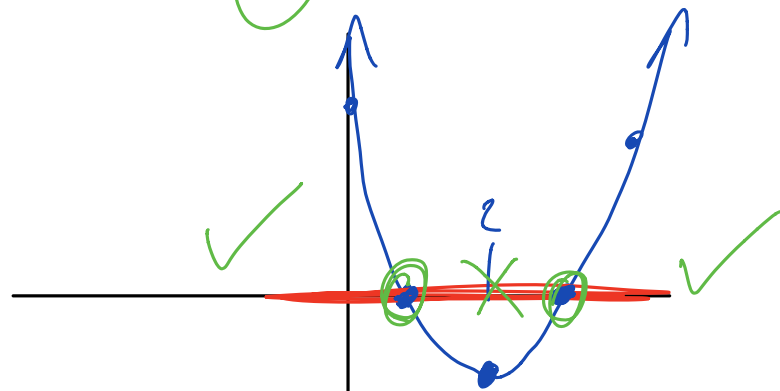
Eg2:

$$x^2 - 4x > -3$$

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

$$(x - 2)^2 + 3 - 4 > 0$$

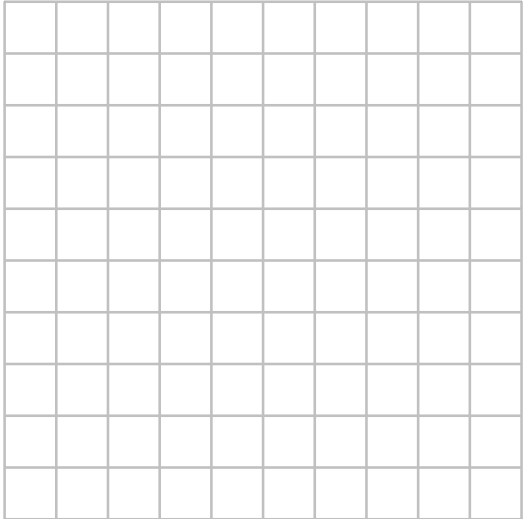
$$(x - 2)^2 - 1 > 0$$



set notation

$$\{x \mid -\infty < x < 1, 3 < x < \infty, x \in \mathbb{R}\}$$

Union  $(-\infty, 1) \cup (3, \infty)$


Complete the square	
Graph	
Which part of the parabola is a solution?	
(o, or •)	
Solution Set	$\{x \mid \quad, x \in \mathbb{R}\}$

### Method 2: Solve Algebraically

- Factor
  - ◆ In order to find the roots (zeroes)
- Put the points on a number line
- Test your intervals
- Write the solution set

Eg:  $x^2 - 2x - 3 \leq 0$

$(x - 3)(x + 1) \leq 0$



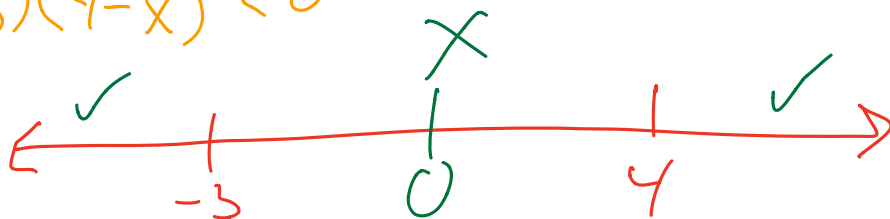
$\{x \mid -1 \leq x \leq 3, x \in \mathbb{R}\}$

Eg:  $-x^2 + x + 12 < 0$        $m \rightarrow -12$

$-x^2 - 3x + 4x + 12 < 0$        $a \rightarrow 1$   
 $4, -3$

$-x(x+3) + 4(x+3) < 0$

$(x+3)(4-x) < 0$



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

Eg:  $2x^2 - 3x > 2$

$2x^2 - 3x - 2 > 0$

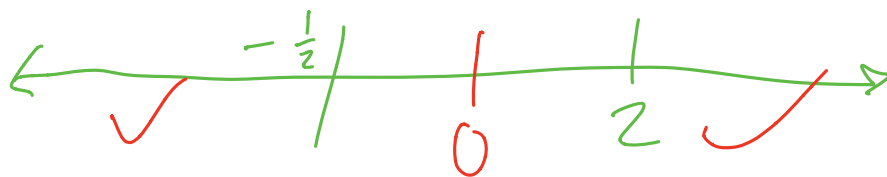
$2x^2 - 4x + x - 2 > 0$

$2x(x-2) + (x-2) > 0$

$(x-2)(2x+1) > 0$

$m \rightarrow -4$   
 $a \rightarrow -3$   
 $(1, -4)$

$2x+1 = 0$   
 $2x = -1$   
 $x = -\frac{1}{2}$



$\{x \mid -\infty < x < -\frac{1}{2}, 2 < x < \infty, x \in \mathbb{R}\}$