# Unit 2: Quadratic and Absolute Value Functions

## Solving quadratic inequalities

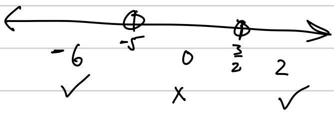
When solving quadratic inequalities, turn it into an equation first
when determining the intervals, use test points to see if the inequality is true

Ex: $2x^2 + 7x - 15 > 0$

$$2x^2 + 7x - 15 = 0$$

$$(2x-3)(x+5) = 0$$

$$x = \frac{3}{2} \quad x = -5$$




So... $x \in (-\infty, -5) \cup (\frac{3}{2}, \infty)$

## Using the discriminant for inequalities

$b^2 - 4ac < 0$ no solutions, always positive/negative depending on concavity

$b^2 - 4ac = 0$ exactly one solution

$b^2 - 4ac > 0$ two solutions / real roots

## Sum and Products of the roots

in the general function of a quadratic $f(x) = ax^2 + bx + c$

Sum of the roots $r_1 + r_2 = \frac{-b}{a}$

product of the roots $r_1 \cdot r_2 = \frac{c}{a}$

## Solving absolute value inequalities

There are many forms to write $|x|$ ...

$$|x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases} \quad \text{or} \quad |x| = \sqrt{x^2}$$

To solve the inequalities, turn it into an equation then use test points

Ex: $|2x - 3| \leq 5$

**Method 1**

$$\left(\sqrt{(2x-3)^2}\right)^2 = (5)^2$$

$$(2x-3)^2 = 25$$

$$4x^2 - 12x + 9 = 25$$

$$4x^2 - 12x - 16 = 0$$

$$4(x^2 - 3x - 4) = 0$$

$$4(x-4)(x+1) = 0$$

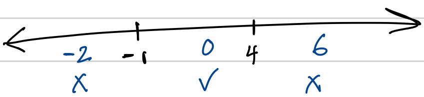
$$x = 4 \quad x = -1$$

**Method 2**

$$2x - 3 = 5 \qquad 2x - 3 = -5$$

$$2x = 8 \qquad 2x = -2$$

$$x = 4 \qquad x = -1$$




## Transformations with absolute value and squaring

transformations can occur as ...

$g(x) = |f(x)|$ outputs are "absolute valued"

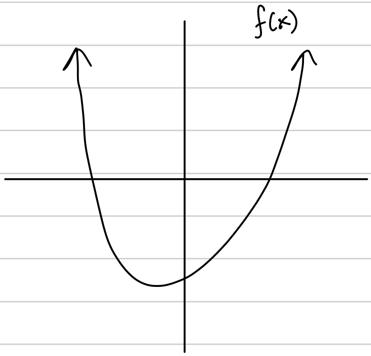
$g(x) = f(|x|)$ inputs are "absolute valued"

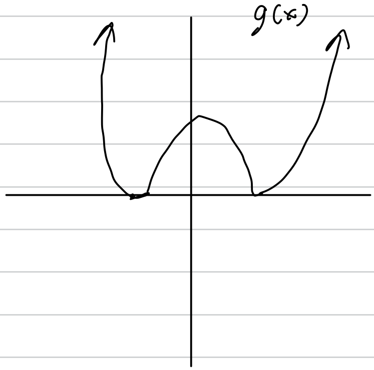
$g(x) = [f(x)]^2$ outputs are squared

$g(x) = |f(x)|$

any parts of the graph that is below the x-axis will have the same magnitude except in the positive y

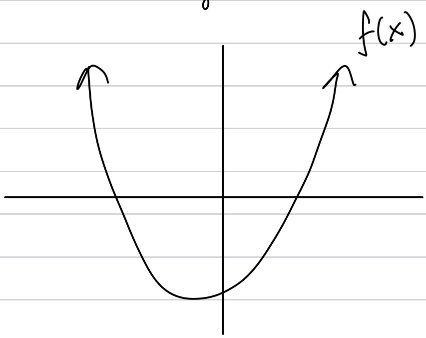
Ex: $g(x) = |f(x)|$

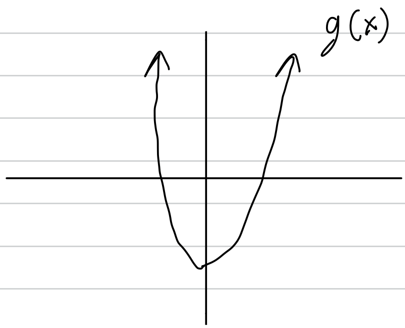



$g(x) = f(|x|)$

The graph will be a reflection of the positive x-values over the y-axis




$g(x) = [f(x)]^2$

any points where the y value is 0 or 1 will remain the same, negative values will become positive, values between 0 and 1 will become smaller and values above 1 will become bigger