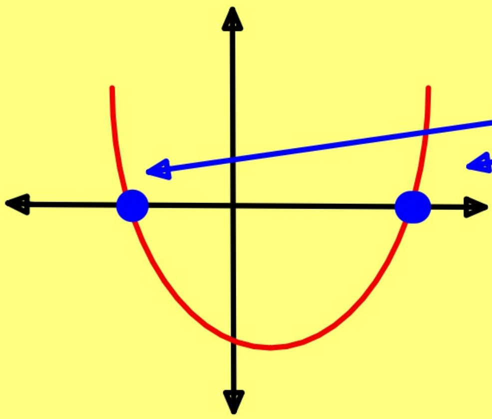
Sec 3.6
Polynomial Inequalities

We will be finding where polynomials are greater than or less than zero.
In order to know where they're "above" or " below" zero, we need to find where they cross, or, the x-intercepts.



If we know where the parabola crosses the x-axis, we can determine on which intervals the polynomial is greater than, or less than, zero.

Steps-
1. Get a zero on one side of the inequality
2. Determine where it equals zero
3. Test an x value in each interval to determine if greater than, or less than, zero

Solve (answer all in interval notation)

$(x+3)(x-5) \geq 0$

$(x+1)(x-7) \leq 0$

below or on

$x = -1$ & 7

$(-)(-)$ | $(+)(-)$ | $(+)(+)$

-2 -1 0 7 8

$+$ $-$ $+$

$[-1, 7]$

If the inequality had been > 0?

$(-\infty, -1) \cup (7, \infty)$

$x^2 - 4x + 3 \geq 0$ → ooo where is this graph on, or above, the x-axis?

1. Get a zero
2. Factor
3. Determine x-intercepts
4. Test on all sides of all x-intercepts.

$(x-3)(x-1) \geq 0$

$x = 3$ & 1

$(-)(-)$ | $(-)(+)$ | $(+)(+)$

1 3

0 2 4

$+$ $-$ $+$

$(-\infty, +1] \cup [3, \infty)$

$9x^2 - 6x + 1 < 0$

$x^2 - 6x + 9$

$(x - \frac{3}{9})(x - \frac{3}{9}) < 0$

$(x - 1/3)(x - 1/3)$

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

$x = 1/3$

$(-)(-) \mid (+)(+)$

$1/3$

$0 \quad 1$

$+ \quad +$

What if the inequality had been > 0 ?

$\mathbb{R}$ $(-\infty, \infty)$

no solution

$3x^2 - 5x \le 0$

$x(3x-5) \le 0$

$x = 0$ & $5/3$

$(-)(-)$ | $(+)(-)$ | $(+)(+)$

0 $5/3$

-1 1 2

$+$ $-$ $+$

$[0, 5/3]$

$x^2 \le 2x + 2$

neg

$$x^2 - 2x - 2 \le 0$$

+ | − | +

$1-\sqrt{3}$ $\quad$ $1+\sqrt{3}$

need zeros...

$$x = \frac{2 \pm \sqrt{4 - 4(-2)}}{2}$$

$$= \frac{2 \pm \sqrt{12}}{2}$$

$$= \frac{2 \pm 2\sqrt{3}}{2} = 1 \pm \sqrt{3}$$

-1 $\quad$ 0 $\quad$ 3

my test #'s plugged into $x^2 - 2x - 2$ since we don't have factors

Answer $\rightarrow$ $[1-\sqrt{3}, 1+\sqrt{3}]$

Suggested Practice
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1,3,5,9,21,25

Solutions-

1. $(-\infty,-2)\cup(4,\infty)$

3. $[-3,7]$

5. $(-\infty,1)\cup(4,\infty)$

9. $\emptyset$

21. $(-\infty,-3/2)\cup(0,\infty)$

25. $[2-\sqrt{2},\,2+\sqrt{2}]$