

# Graphing polynomials fact sheet

## Steps:

1. Use the Leading Coefficient test to find the end behavior of a given polynomial function.
2. Find the zeroes of a polynomial function.
  - a. **\*\*Graph does not need to have any zeroes if the degree is even**
3. Find other points on the graph to make it detailed.
4. Graph the polynomial function.

### Finding Roots

Synthetic division

Complete the square

-Move the "C" term over (+2) only if a=1 and b is even  $(b/2)^2 = (-6/2)^2 = 9$

-Factor the perfect square trinomial and combine constants

Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

## Synthetic division

Rational roots = P/Q = Factors of Constant  
Factors of leading coefficient

$$y = x^4 + 2x^3 - 7x^2 + 2x - 8$$

1 | 1 2 -7 2 -8

1 3 -4 -2 -10 (1, -10)

### Functions with odd degrees-

- Must cross the x-axis at least once

Must have at least one real root or any odd number of real roots

- Doesn't necessarily have any real roots
- May have any combination of even #'s of

### Functions with even degrees-

- imaginary and real roots

## Leading coefficient test

Case	End Behavior of graph
When $n$ is odd and $a_n$ is positive	Graph falls to the left and rises to the right
When $n$ is odd and $a_n$ is negative	Graph rises to the left and falls to the right
When $n$ is even and $a_n$ is positive	Graph rises to the left and right
When $n$ is even and $a_n$ is negative	Graph falls to the left and right

## Upper and lower bound

Upper bound- when the resulting polynomial signs are all the same, you have reached the upper bound

lower bound- when the resulting polynomial signs alternate, you have reached the Lower bound

$$\begin{array}{cccccc} - & + & - & + & - & \\ + & + & + & + & + & \end{array}$$

## Descartes rule of signs

Number of possible **positive** real roots is at most the number of sign changes in the polynomial or less by any even number

$$y = x^4 + 5x^3 + 5x^2 - 5x - 6$$

1 possible positive real root

Number of possible **negative** is at most the number of sign changes if  $f(-x)$  or less by any even number

$$y = x^4 + 5x^3 + 5x^2 - 5x - 6$$

$$y = x^4 - 5x^3 + 5x^2 + 5x - 6$$

3 possible negative real roots