

# Polynomial Basics

A **monomial** is a single number or product of variables and numbers (i.e.  $4$ ,  $4x^2$ ,  $-2xy^3$ )

A **polynomial** is the sum or difference of multiple monomials.

1 term: monomial

$$x$$

2 terms: binomial

$$x + 1$$

3 terms: trinomial

$$x^2 + x + 1$$

4+ terms: polynomial

$$x^3 + x^2 + x + 1$$

The degree of a monomial is the sum of its exponents.

Identify the degree of each monomial.

**A.**  $z^6$   
 $z^6$  *Identify the exponent.*

The degree is 6.

**B.**  $5.6$   
 $5.6 = 5.6x^0$  *Identify the exponent.*

The degree is 0.

**C.**  $8xy^3$   
 $8x^1y^3$  *Add the exponents.*

The degree is 4.

**D.**  $a^2bc^3$   
 $a^2b^1c^3$  *Add the exponents.*

The degree is 6.

The **degree of a polynomial** is given by the degree of its highest term.

$-4x^2 + 3x^5 - 1$  has a degree of 5

**Standard form** of a polynomial lists the terms by degree in descending order.

$4x^5 + x^4 - 2x^2 + x + 1$

The **leading coefficient** is the coefficient of the first term in standard form.

$5x^2 + 3x$  has a leading coefficient of 5

Polynomial degrees:

Degree 0: Constant

Degree 1: Linear

Degree 2: Quadratic

Degree 3: Cubic

Degree 4: Quartic

Degree 5: Quintic

Degree 6+: nth degree polynomial

i.e.  $x^{10}$  means a 10<sup>th</sup> degree polynomial

Polynomials are classified according to their degree and the # of terms.

Classify each polynomial:

$$P(x) = 5x^4 - 2x$$

Quartic binomial

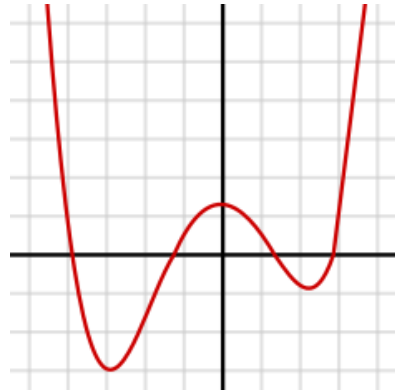
$$N(x) = 4 + 3x + 2x^2 - 5x^5$$

Quintic polynomial

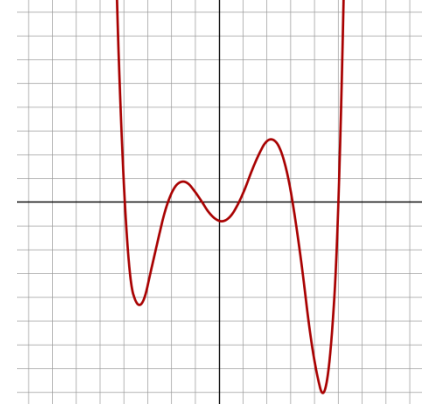
The end behavior of an even degree polynomial (2, 4, 6, etc.) will be the same for both sides.

i.e. both will go to positive  $\infty$ , or both to negative  $\infty$ .

4<sup>th</sup> degree:



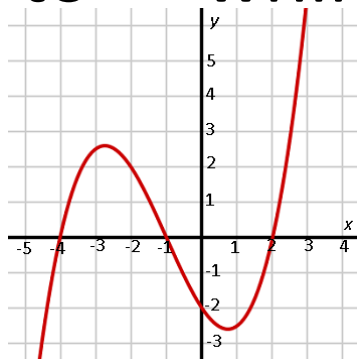
6<sup>th</sup> degree:



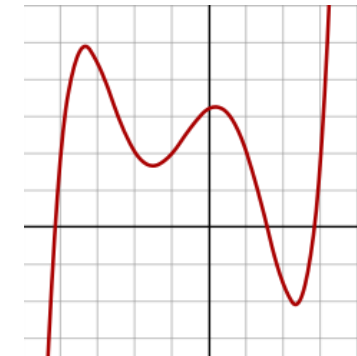
The end behavior of an odd degree polynomial (1, 3, 5, etc.) will go in opposite directions.

i.e. one goes to  $\infty$  while the other goes to  $-\infty$ .

3<sup>rd</sup> degree:



5<sup>th</sup> degree:



Even degree function end behavior will go to positive  $\infty$  unless it has been reflected.

Odd degree function end behavior will be

As  $x \rightarrow \infty$ ,  $f(x) \rightarrow \infty$  and As  $x \rightarrow -\infty$ ,  $f(x) \rightarrow -\infty$   
unless it has been reflected.

In general, a polynomial function will have one fewer relative maximum/minimum than its degree.

A 5<sup>th</sup> degree polynomial has 4 relative max/mins.

