

**Polynomial Function**

$$P(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_2 x^2 + a_1 x + a_0$$

The degree of each term is the exponent of that term.

The degree of the polynomial is the largest degree of any term.

**Classifying Polynomials by the degree**

<u>Degree</u>	<u>Name</u>	<u>Example</u>
0	constant	6
1	linear	$x + 3$
2	quadratic	$3x^2 - 6x + 9$
3	cubic	$x^3 - 27$
4	quartic	$x^4 + 2x^2 + 8$
5	quintic	$-31x^5$

**Classifying Polynomials by the number of terms**

<u>Number of Terms</u>	<u>Name</u>	<u>Example</u>
1	monomial	$-21x^4$
2	binomial	$2x^5 + 3$
3	trinomial	$x^2 + 7x + 3$
4 +	polynomial with $n$ terms	$x^6 + 7x^5 - 4x^2 + 5x + 1$

Examples: Write each polynomial in standard form. Then classify the polynomial by degree and number of terms.

$$9 + x^3$$

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

$$(-8d^3 - 7) + (-d^3 - 6)$$

Examples: Write each polynomial in standard form. Then classify the polynomial by degree and number of terms.

$$(-a^2 - 3) - (3a - a^2 - 5)$$

$$(3x + 1)(2x^2 - 3)$$

**End Behavior** – describes the far right and far left ends of the graph.

There are four possibilities:

$$\text{as } x \rightarrow -\infty, f(x) \rightarrow +\infty$$

$$\text{as } x \rightarrow +\infty, f(x) \rightarrow +\infty$$

$$\text{as } x \rightarrow -\infty, f(x) \rightarrow -\infty$$

$$\text{as } x \rightarrow +\infty, f(x) \rightarrow -\infty$$

$$\text{as } x \rightarrow -\infty, f(x) \rightarrow -\infty$$

$$\text{as } x \rightarrow +\infty, f(x) \rightarrow +\infty$$

$$\text{as } x \rightarrow -\infty, f(x) \rightarrow +\infty$$

$$\text{as } x \rightarrow +\infty, f(x) \rightarrow -\infty$$

**Right side** – If the leading coefficient is *positive* the right side is up  
*negative* the right side is down

**Left side** – If the degree of the polynomial is *even* the left side is the same as the right side  
*odd* the left side is opposite of the right side

Examples: Describe the end behavior of each polynomial function.

$$f(x) = 2x^3 + 7x^2 - 6x + 8$$

the leading coefficient (2) is positive so the right side is UP

the degree is odd (3) so the left side is opposite of the right side  
the left side is DOWN

$$\text{as } x \rightarrow +\infty, f(x) \rightarrow +\infty$$

$$\text{as } x \rightarrow -\infty, f(x) \rightarrow -\infty$$

$$f(x) = x^4 - 3x + 12$$

$$f(x) = -9x^5 - 12x^3$$