**Algebra 2** Name ______________________________

**5-1 Polynomial Functions** Date ______________ **A#1**

**Goals:** a. To classify polynomials

b. To graph polynomial functions and describe end behavior

**Warm Up:** Rewrite each quadratic in standard form. What are the characteristics of standard form?

a. $9 - x^2$ b. $5x + 4x^2 - 7$

| Classify by Degree | | | Classify by Number of Terms | |
|---|---|---|---|---|
| **Degree** | **Name using Degree** | **Example** | **Number of Terms** | **Name Using Terms** |
| 0 | | $-9$ | 1 | |
| 1 | | $x - 8$ | 2 | |
| 2 | | $3x^2 + 6x - 1$ | 3 | |
| 3 | | $-3x^3$ | 1 | |
| 4 | | $x^4 - 9$ | 2 | |
| 5 | | $x^5 + 4x^3 - x^2 - 6$ | 4 | |

## Standard form of Polynomials

The **standard form of a polynomial function** arranges the terms by degree in descending numerical order.

A polynomial function $P(x)$ in standard form is

$$P(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0,$$

where $n$ is a nonnegative integer and $a_n, \ldots, a_0$ are real numbers.

$$P(x) = \underbrace{4x^3}_{\text{Cubic term}} + \underbrace{3x^2}_{\text{Quadratic term}} + \underbrace{5x}_{\text{Linear term}} - \underbrace{2}_{\text{Constant term}}$$

**Practice**: Rewrite each polynomial in standard form. Classify each polynomial by degree and number of terms.

a. $\frac{2}{3}$ b. $3x + x^4 + 1$ c. $6 - x^3$ d. $4x^5 - 8x$

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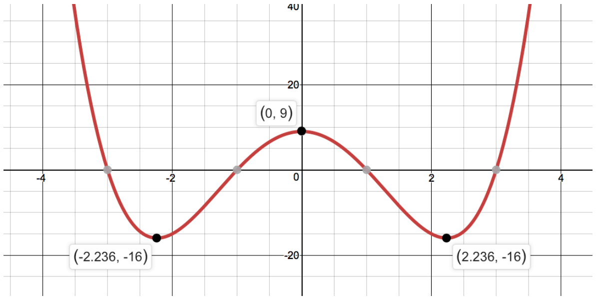
## Turning Points and End Behavior of Polynomial Functions

**Example** $y = 4x^4 + 5x^3 - x$

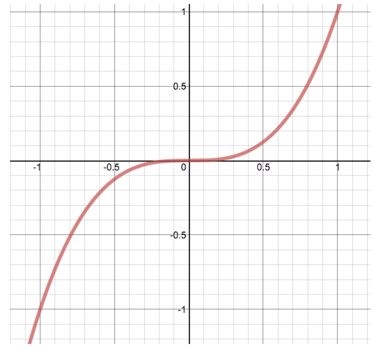



Turning Points:

End Behavior:

Increasing/Decreasing

**1.** $y = x^3$

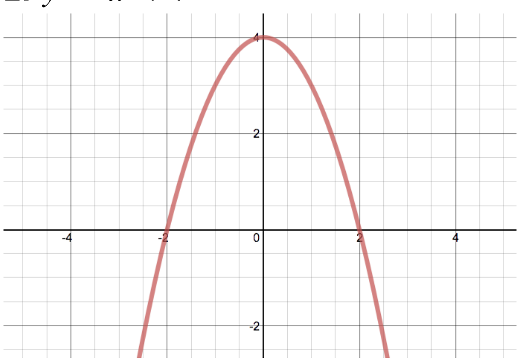


Turning Points:

End Behavior:

Increasing/Decreasing

**2.** $y = -x^2 + 4$

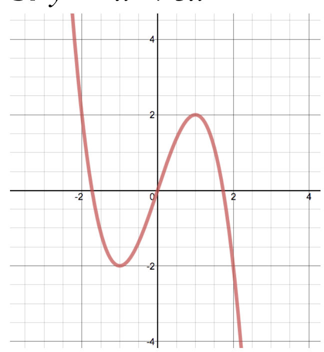


Turning Points:

End Behavior:

Increasing/Decreasing

**3.** $y = -x^3 + 3x$



Turning Points:

End Behavior:

Increasing/Decreasing

**Summarize:** How do the $a$ and the $n$ of the $ax^n$ term with the highest exponent determine graph behavior?

| | $n$ is even | $n$ is odd |
|---|---|---|
| $a > 0$ | | |
| $a < 0$ | | |

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**Practice:** Consider the leading term of each polynomial function. What is the end behavior of the graph? Check using a graphing calculator.

a. $y = 3x^3 - 3x$

b. $y = -2x^4 - 4x^3 - 8x^2 + 3$

**Practice:** Classify each polynomial by degree and by number of terms. Simplify first if necessary.

a. $4x^5 - 5x^2 + 3 - 2x^2$

b. $b(b-3)^2$

**Practice:** Determine the end behavior of the graph of each polynomial function.

**a.** $y = 3x^4 + 6x^3 - x^2 + 12$

**b.** $y = 50 - 3x^3 + 5x^2$

**c.** $y = -x + x^2 + 2$

**d.** $y = 4x^2 + 9 - 5x^4 - x^3$

**e.** $y = 12x^4 - x + 3x^7 - 1$

**f.** $y = 2x^5 + x^2 - 4$