Today's Objectives

- Write **possible polynomial definitions from given mathematical characteristics** and describe **the end behavior** using limit statements and sentence frames.
- Success Criteria
  - □ Define end behavior
  - □ Write limit statements.
- **Vocabulary:** term, degree, coefficient, monomial, binomial, trinomial, polynomial

Ex: Graphing Transformations of Monomial Functions

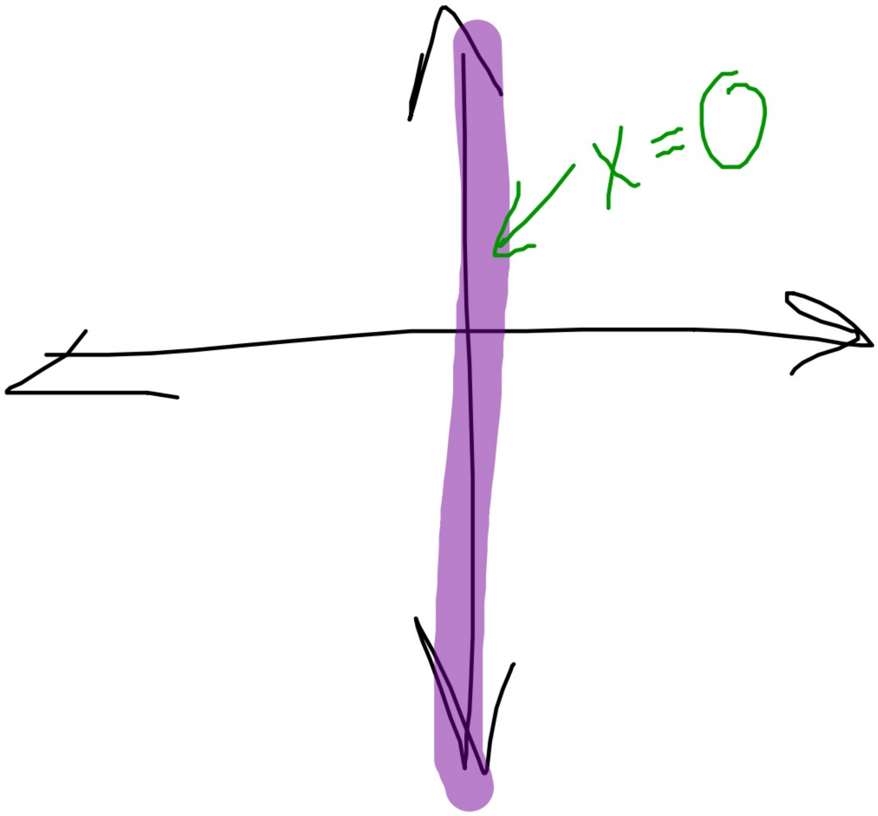
Describe how to transform the graph of an appropriate monomial function $f(x) = -x^4$ into the graph of $h(x) = -(x+2)^4 + 5$. Sketch $h(x)$ and compute the y-intercept.

LO: The leading coefficient of h(x) is -1. The degree of the monomial function is 4. A monomial function is a special case of a polynomial function. I recognize this is a monomial function because it has exactly one term and the prefix mono means one. You can obtain the the graph of h(x) by shifting f(x) 2 units left and 5 units up.

$h(0) = -(0+2)^4 + 5$ $\quad (0, -11) \leftarrow$ y-intercept

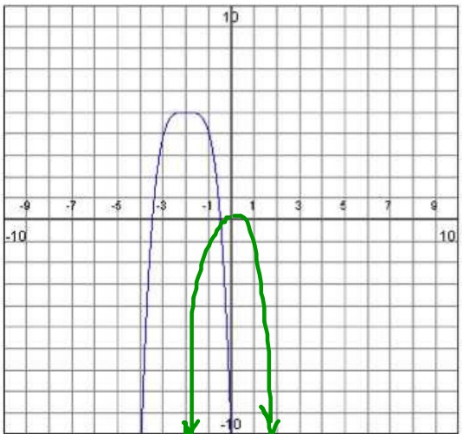
$-16 + 5$

$= -11$

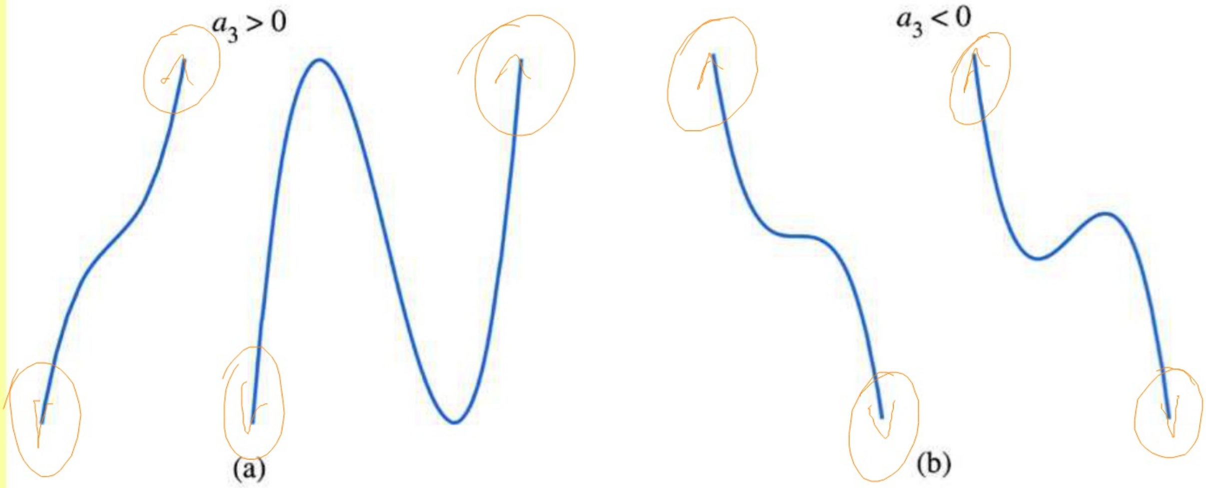

x = 0

Example **Graphing Transformations of Monomial Functions**

You can obtain the graph of $h(x) = -(x+2)^4 + 5$ by shifting the graph of $f(x) = -x^4$ two units to the left, and five units up. The y-intercept of $h(x)$ is $h(0) = -\left(2\right)^4 + 5 = -11$.



Cubic Functions: Basic Graph Shapes



Use a graphing calculator to explore how a_3 effects the graph of these third degree polynomials.

leading coefficient (+)

$$y_1 = 4x^3 - 28.23x + 1$$

$$y_2 = 15x^3 + 7.567x - 20$$

$$y_2 = .2x^3 - 3.6x - 13.67676$$

A. What do these functions have in common?

B. Explain how the functions behave when x is larger then 100?

C. Explain how the functions behave when x is smaller then -100?

Use a graphing calculator to explore how a_3 effects the graph of these third degree polynomials. leading coefficient $\ominus$

$$y_1 = \boxed{-8}x^3 + 2x + 1$$

$$y_2 = \boxed{-1.67675}x^3 + 7.567x - 20$$

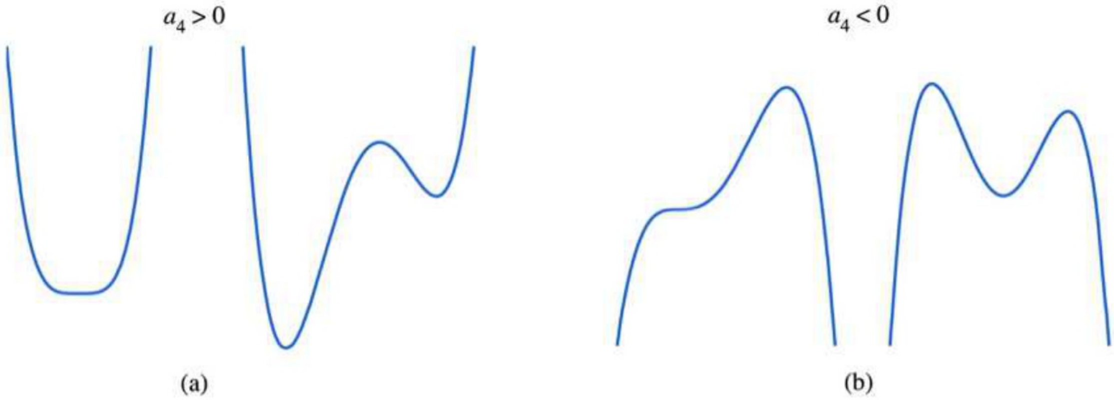
$$y_2 = \boxed{-.3452}x^3 - 3.6x - .67676$$

A. What do these functions have in common?

B. Explain how the functions behave when x is larger then 100?

C. Explain how the functions behave when x is smaller then -100?

Quartic Function



Use a graphing calculator to explore how a_4 effects the graph of these fourth degree polynomials.

quartic

$$y_1 = 5x^4 + 4x^3 - 28.23x + 1$$

$$y_2 = 17x^4 + 7.567x - 20$$

$$y_2 = 184x^4 + .2x^3 - 3.6x - 13.67676$$

A. What do these functions have in common?

B. Explain how the functions behave when x is larger then 100?

C. Explain how the functions behave when x is smaller then -100?

Use a graphing calculator to explore how a_4 effects the graph of these fourth degree polynomials.

$$y_1 = -0.5x^4 + 4x^3 - 28.23x + 1$$

$$y_2 = -1.337x^4 + 7.567x - 20$$

$$y_2 = -184x^4 + .2x^3 - 3.6x - 13.67676$$

A. What do these functions have in common?
B. Explain how the functions behave when x is larger then 100?
C. Explain how the functions behave when x is smaller then -100?

Leading Term Test for Polynomial End Behavior

For any polynomial function $f(x) = a_n x^n + \ldots + a_1 x + a_0$,

right

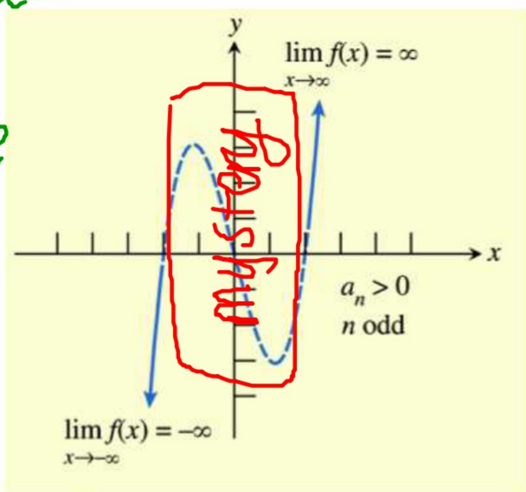
the limits $\lim_{x \to \infty} f(x)$ and $\lim_{x \to -\infty} f(x)$ are determined by the

left

degree n of the polynomial

and its leading coefficient a_n:

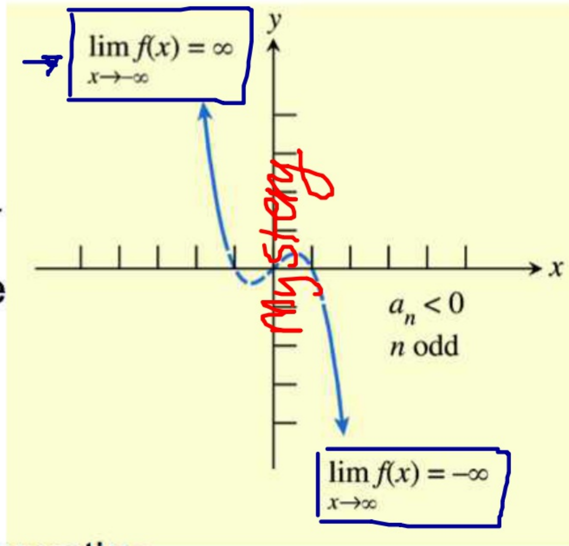
The leading coefficient is positive
because a_n > 0.
This polynomial has odd degree
because n is odd.
Examples of odd numbers
Include 15, 17, and
1.



Find two monomials with these properties.

Leading Term Test for Polynomial End Behavior

For any polynomial function $f(x) = a_n x^n + \ldots + a_1 x + a_0$, the limits $\lim_{x\to\infty} f(x)$ and $\lim_{x\to-\infty} f(x)$ are determined by the degree n of the polynomial and its leading coefficient a_n:

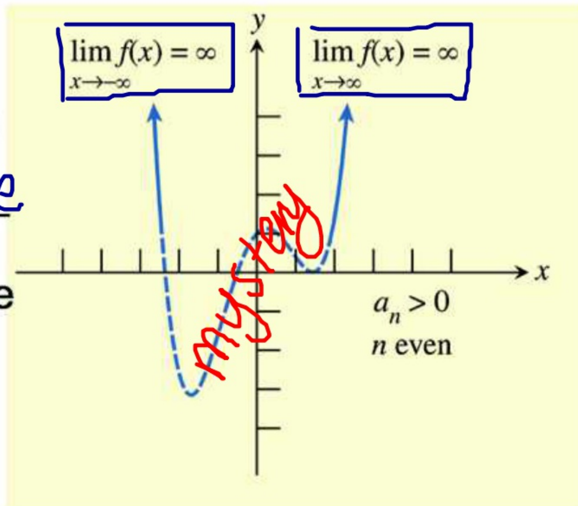


The leading coefficient is negative because a_n < 0.
This polynomial has odd degree because n is odd.
Examples of odd numbers Include 3, 5, and 1.

Find two binomials with these properties.

Leading Term Test for Polynomial End Behavior

For any polynomial function $f(x) = a_n x^n + \ldots + a_1 x + a_0$, the limits $\lim_{x\to\infty} f(x)$ and $\lim_{x\to-\infty} f(x)$ are determined by the degree n of the polynomial and its leading coefficient a_n:

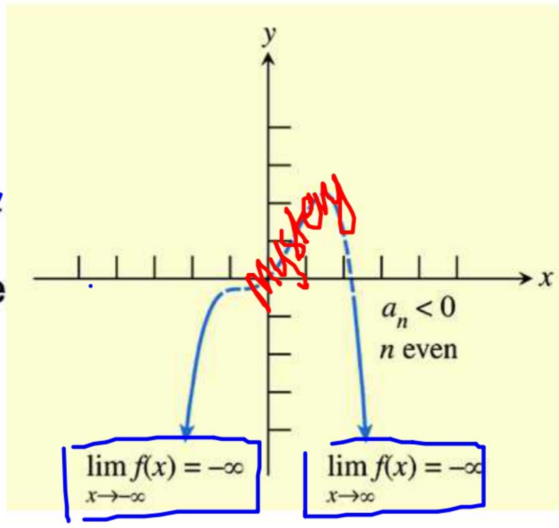


The leading coefficient is positive because a_n > 0.
This polynomial has even degree because n is even.
Examples of even numbers Include 2, 4, and 6.

Find two trinomials with these properties.

Leading Term Test for Polynomial End Behavior

For any polynomial function $f(x) = a_n x^n + \ldots + a_1 x + a_0$, the limits $\lim_{x\to\infty} f(x)$ and $\lim_{x\to-\infty} f(x)$ are determined by the degree n of the polynomial and its leading coefficient a_n:



The leading coefficient is negative because a_n < 0.
This polynomial has even degree because n is even.
Examples of even numbers Include 8, 10, and 24.

Find two 4-term polynomials with these properties.