Polynomials of Higher Degree

A polynomial function is a function in the form $f(x) = a_n x^n + a_{n-1}x^{n-1} + \cdots + a_1 x^1 + a_0$ where $a \neq 0$ and the coefficients are real numbers.

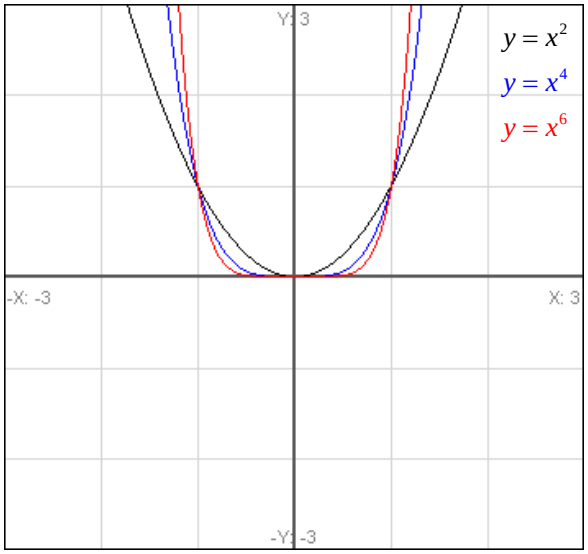
$$f(x) = x^5 - 2x^4 + 3x^3 + 5x^2 - x + 1$$

$$f(x) = -x^6 + 1$$

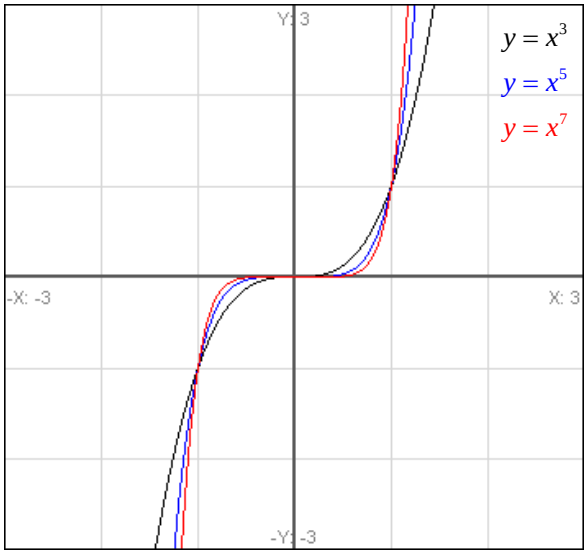
$$f(x) = \frac{1}{2}(x+1)^4$$

Power Functions

$y = ax^n$ (n is even)

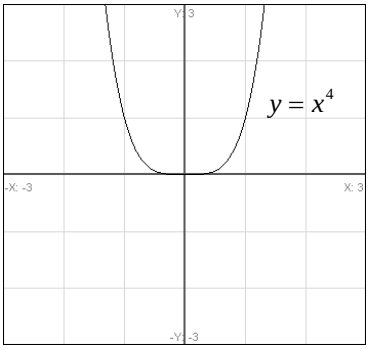


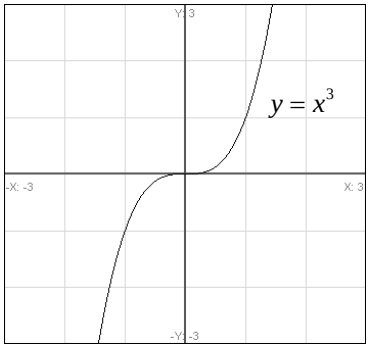
$y = ax^n$ (n is odd)



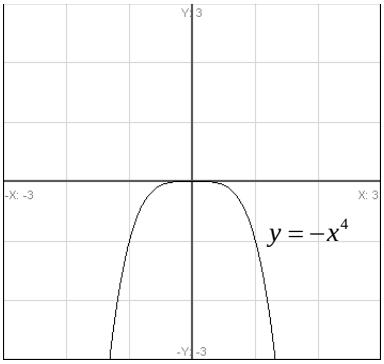
Transformations of Power Functions

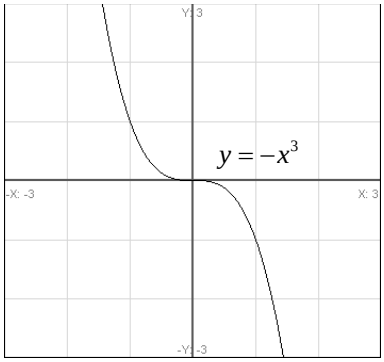
$a > 0$





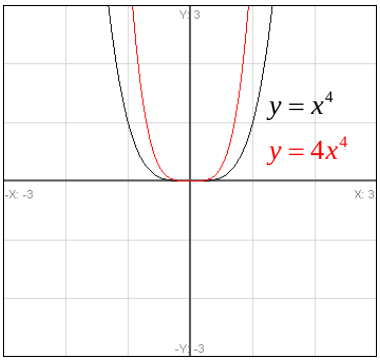
$a < 0$

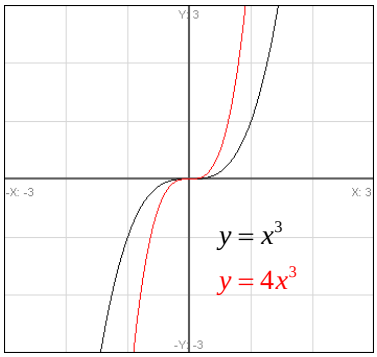




$|a| > 1$

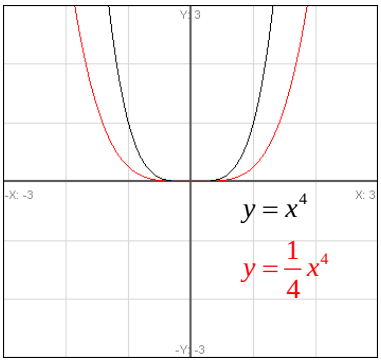
Slimmer

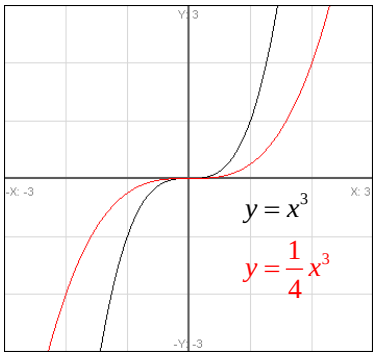




$0 < |a| < 1$

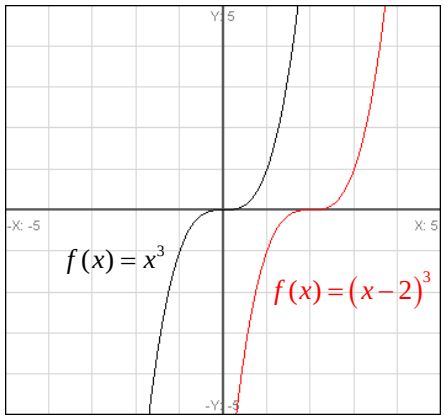
Wider





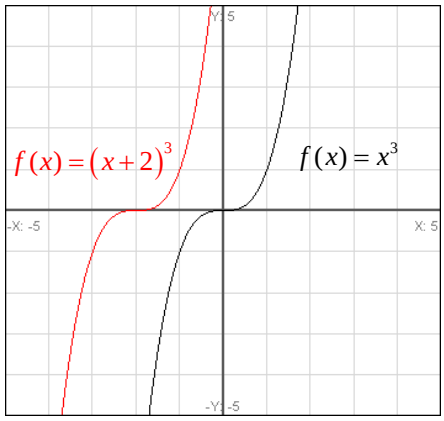
$f(x) = (x - h)^n$

Shift graph h units to the right



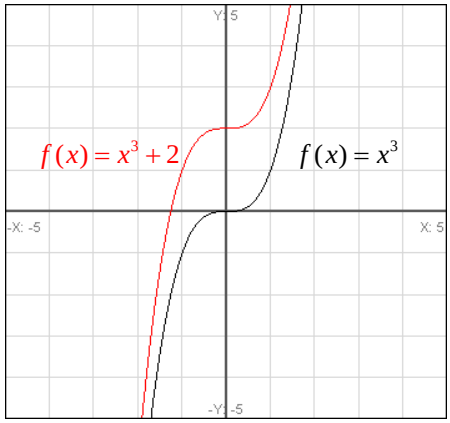
$f(x)=(x+h)^n$

Shift graph h units to the left



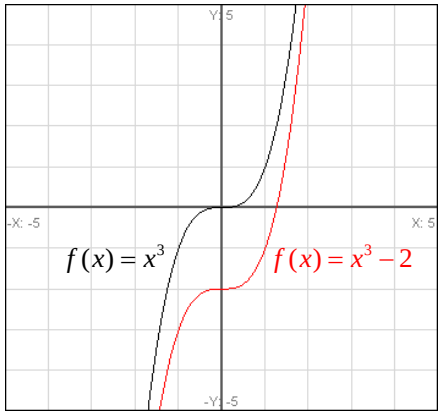
$f(x)=x^n+k$

Shift graph k units up



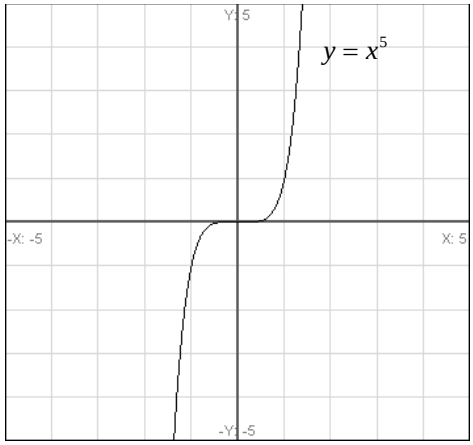
$f(x)=x^n-k$

Shift graph k units down

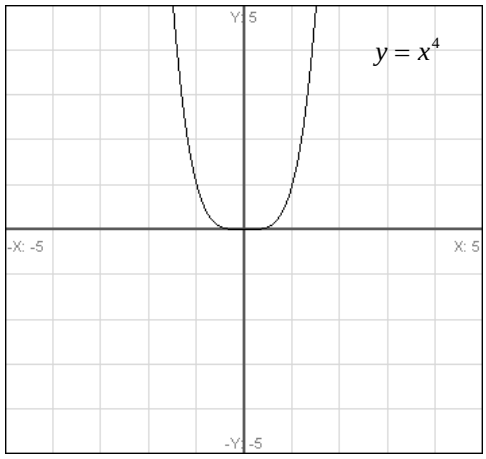


Directions: Sketch a graph of each of the power functions.

1. $f(x) = -(x+1)^5$



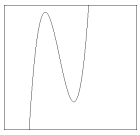
2. $f(x) = 1 - \frac{1}{2}x^4$



<u>To Determine the Right and Left Hand Behavior</u> - Look at the sign and the degree of the leading coefficient

Degree is Odd

Leading Coefficient > 0

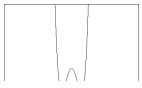


$f(x) = x^3 + 3x^2 - 2x - 3$

Leading Coefficient < 0

$f(x) = -x^3 - 3x^2 + 2x + 3$

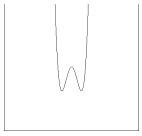
Leading Coefficient > 0



$f(x) = .5x^4 - 3x^2$

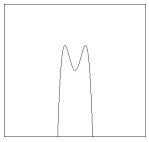
Degree is Even

Leading Coefficient > 0



$f(x) = .5x^4 - 3x^2$

Leading Coefficient < 0



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

Directions: Determine the right and left hand behavior of the graph of the polynomial function.

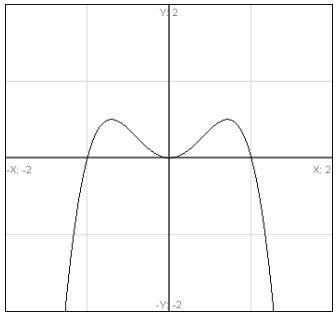
3. $f(x) = 2x^5 - 3x + 7$

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

<u>To Determine the *x*-intercepts/zeros</u> - set the polynomial equal to zero and factor

Graph crosses the *x*-intercept, multiplicity is odd

Graph touches the *x*-intercept, multiplicity is even



$f(x) = -2x^4 + 2x^2$

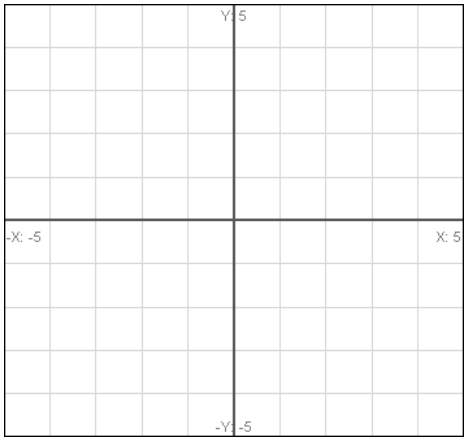
Directions: Sketch the graph of each polynomial function. Determine the degree, right and left hand behavior and the zeros of the function.

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

Degree:

Right/Left Hand Behavior:

Zeros:



6. $f(x) = 3x^3 - 15x^2 + 18x$

Degree:

Right/Left Hand Behavior:

Zeros: