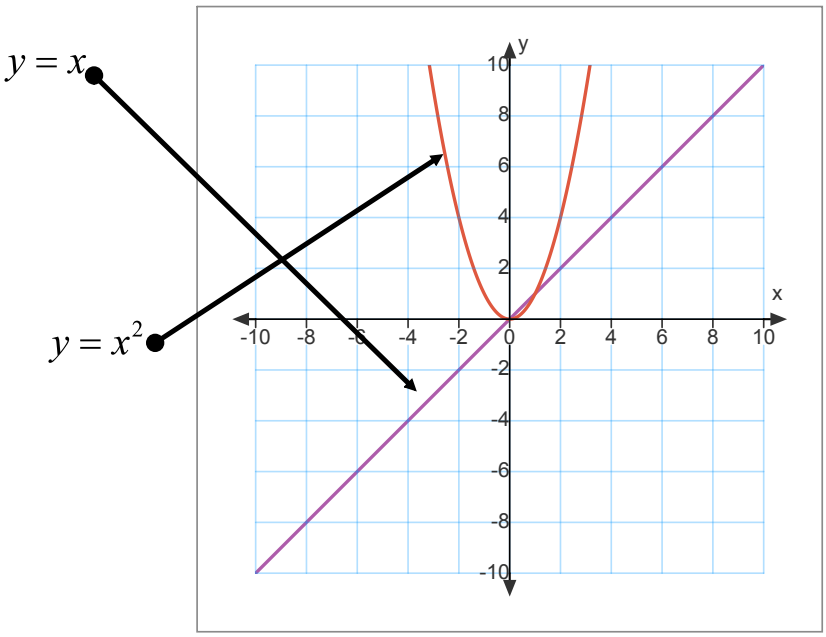
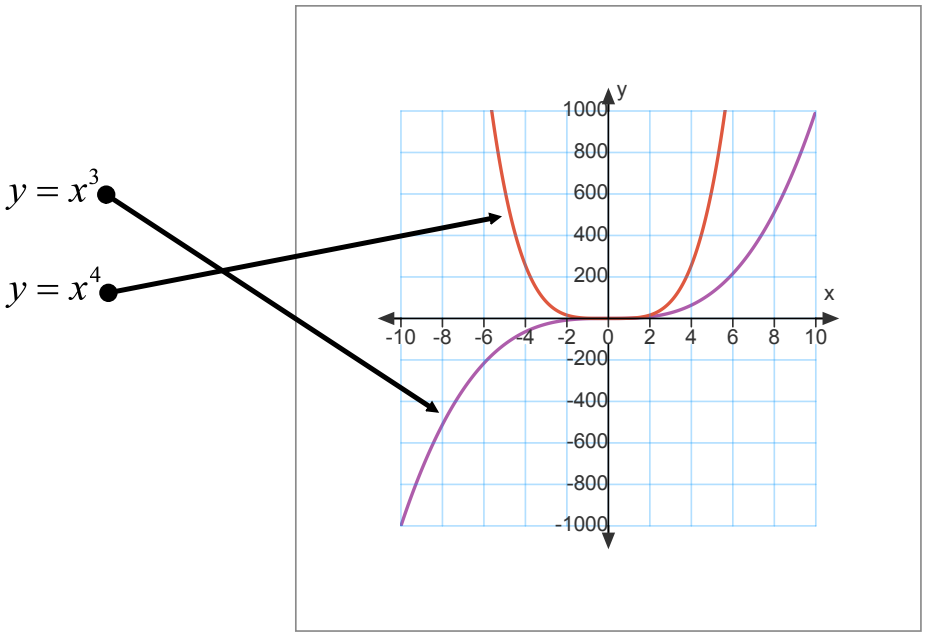
1.1: Power Functions

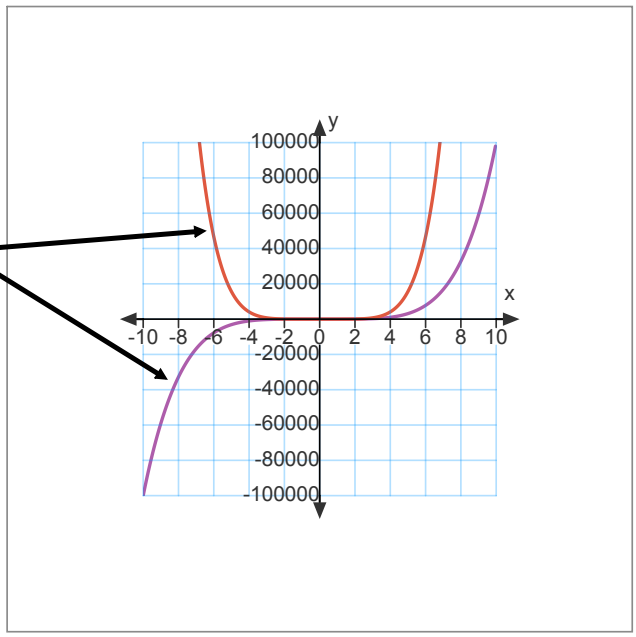
Investigate key features of the graphs of power functions




$y = x^3$
$y = x^4$
y
x
1000
800
600
400
200
-200
-400
-600
-800
-1000
-10 -8 -6 -4 -2 0 2 4 6 8 10

$y = x^5$

$y = x^6$


y
x
100000
80000
60000
40000
20000
-20000
-40000
-60000
-80000
-100000
-10 -8 -6 -4 -2 0 2 4 6 8 10

Terminology

- End Behaviour: the behaviour of the y-values as x increases (as x approaches positive infinity $x \to \infty$) and as x decreases (as x approaches negative infinity $x \to -\infty$)
- Line Symmetry: a graph has line symmetry if there is a line x=a that divides the graph into two parts such that each part is a reflection of the other in the line x = a.

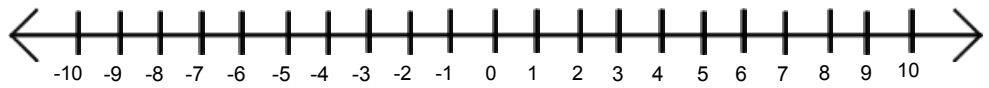
- Point Symmetry: a graph has point symmetry about a point (a, b) if each part of the graph on one side of (a,b) can be rotated 180^0 to coincide with part of the graph on the other side of (a, b).

Key Features of the Graph	$y = x^n$, n is odd	$y = x^n$, n is even
Domain	$\{x \in \mathbb{R}\}$	$\{x \in \mathbb{R}\}$
Range	$\{y \in \mathbb{R}\}$	$\{y \geq 0, y \in \mathbb{R}\}$
Symmetry	Point	line
End Behaviour	$x \to \infty, y \to \infty$ $x \to -\infty, y \to -\infty$	$x \to \infty, y \to \infty$ $x \to -\infty, y \to \infty$

Interval Notation

Sets of real numbers may be described in a variety of ways:

- as an inequality, $-3 < x \leq 5$
- in interval (or bracket) notation
- graphically on a number line



Intervals that are infinite are expressed using the symbol ∞ or $-\infty$

Square brackets indicate that the end value is included in the interval, and round brackets indicate that the end value is NOT included

A round bracket is used at infinity

Example

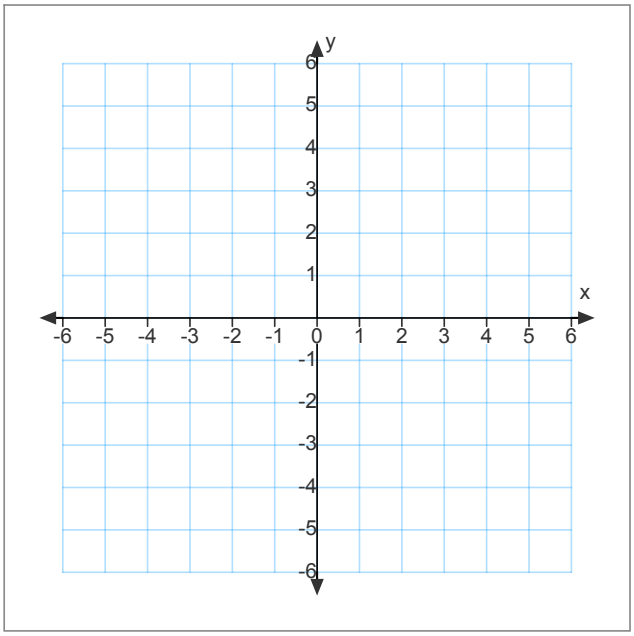
Write each function in the appropriate row of the second column of the table. Give reasons for your choices.

$y = 2x$ $y = -3x^2$

$y = 5x^6$ $y = x^7$

$y = x^{10}$ $y = -0.5x^8$

$y = -\frac{2}{5}x^9$ $y = -4x^5$



End Behaviour	Function	Reasons
Extends from quadrant 3 to quadrant 1	$y = 2x$, $y = x^7$	odd degree '+' leading co-efficient
Extends from quadrant 2 to quadrant 4	$y = -\frac{2}{5}x^9$, $y = -4x^5$	odd degree '−' leading co-eff.
Extends from quadrant 2 to quadrant 1	$y = 5x^6$, $y = x^{10}$	even degree, '+' leading co-eff.
Extends from quadrant 3 to quadrant 4	$y = -3x^2$, $y = -0.5x^8$	even degree '−' leading co-eff.

Consolidate

- Explain why the function y= 3 is a polynomial function
- How can you use a graph to tell whether the leading coefficient of a power function is positive or negative?
- How can you use a graph to tell whether the degree of a power function is even or odd?