Warm - Up

Draw a graph with the following characteristics:

Quiz on Friday

Maximums at (-3,4) and (2,2)

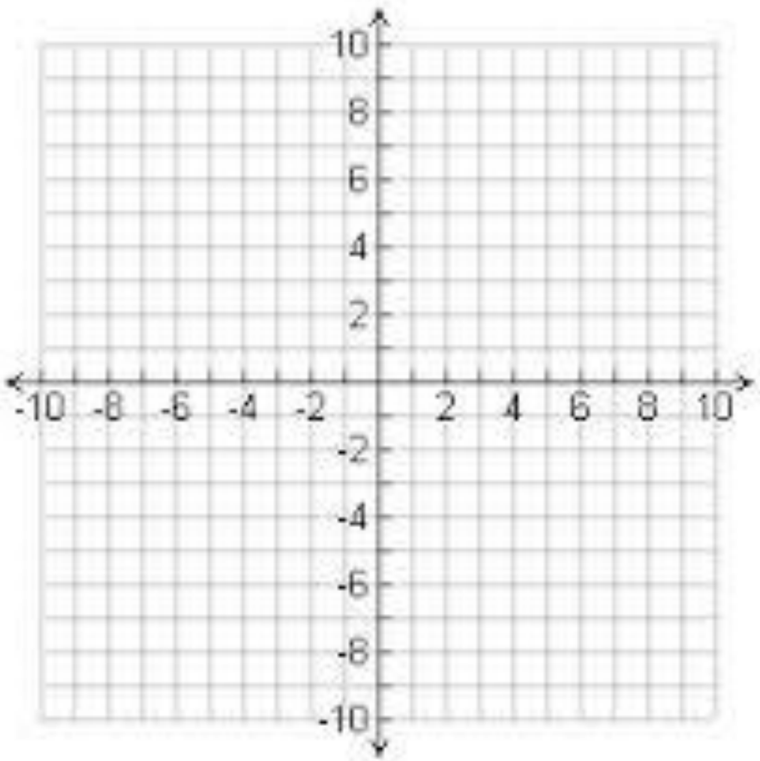
Minimum at (-1,-3)

X intercepts at (-4,0), (-2,0) and (1,0)

Y intercept at (0,-2)

Increasing Intervals $(-\infty, -3)\ and\ (-1,2)$

Decreasing Intervals (-3.-1) and $(2, \infty)$



HINT: plot points first then connect the dots.

Homework Questions?

Quiz on Friday

So far…

Define and identify the following for a given function

- Domain/Range
- Maximum /Minimums
- Increasing/Decreasing Intervals
- Vertexes
- Intercepts, x and y

Objectives for today

Define and identify the End Behavior for a function

Define Parent Functions and be able to associate the graph of a parent function with the correct name and function notation.

Determine the characteristics of Parent Functions.

Domain and Range

Remember this from yesterday?

A ***FUNCTION*** is a relation in which each element of the **domain** corresponds with exactly one element of the **range**.

Domain	Range
Input	Output
x	y

Domain and **Range** are intervals.

Domain is the interval(s) of **X values** for which there is a corresponding Y value.

Range is the interval(s) of **Y values** for which the there is a corresponding X value.

Functions

Look at the x axis.

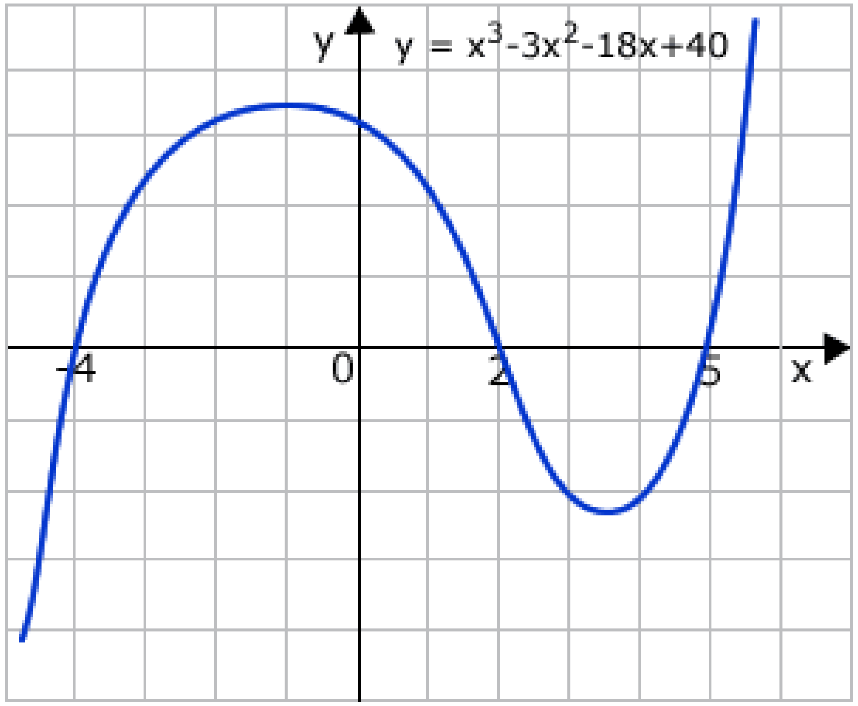
Lets look at Domain first

Remember if there is no dot at the far ends of the graph then it goes on forever in that direction.

Work from left to right. (or smallest numbers to largest numbers)

Where is the first x value that has a corresponding y value?

Since we don't have one the we say the domain interval starts at $-\infty$.



Functions

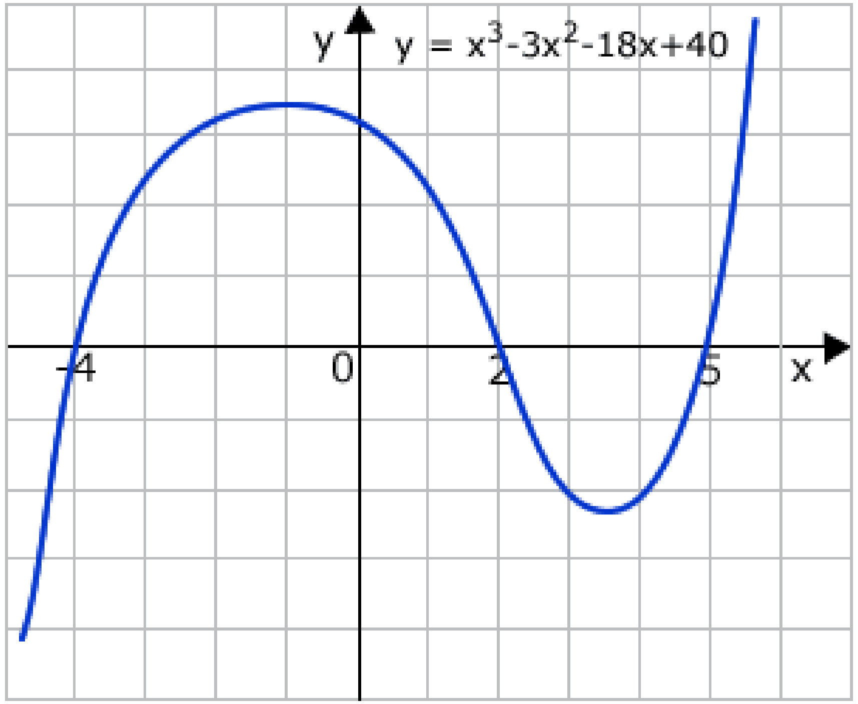
Look at the x axis.

Lets look at Domain first

Continue tracing from left to right. (or smallest numbers to largest numbers)

Where is the last x value that has a corresponding y value?

Since we don't have one, the function goes on forever off to the left. We say the domain interval ends at ∞.



So the domain for this function is $(-\infty, \infty)$

Range

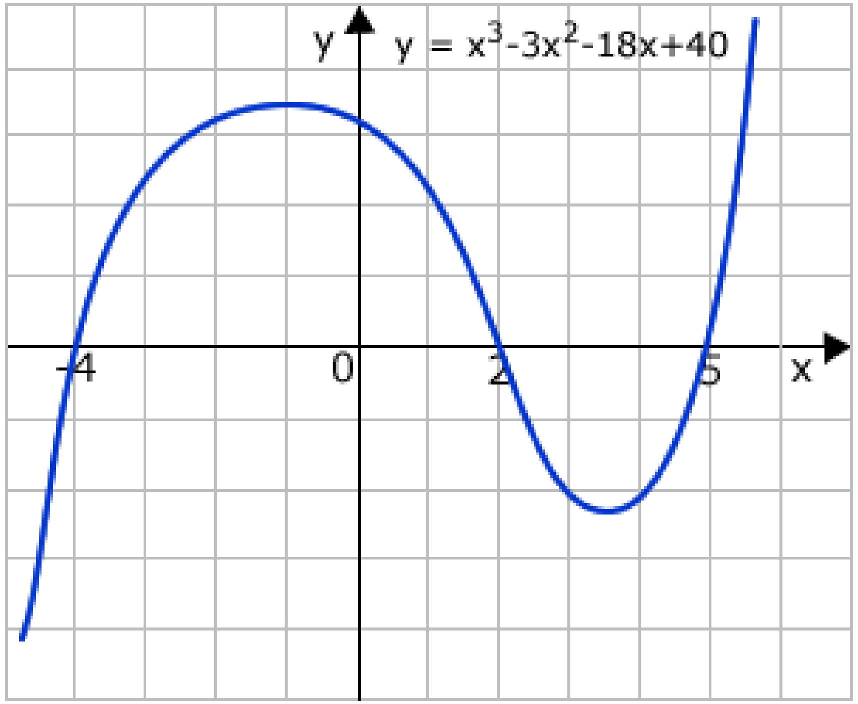
Look at the y axis.

No dot at the end of the line. What does that mean? ☺

Work from bottom to top. (or smallest numbers to largest numbers)

Where is the first y value that has a corresponding x value?

Since we don't have one, we say the range interval starts at $-\infty$.



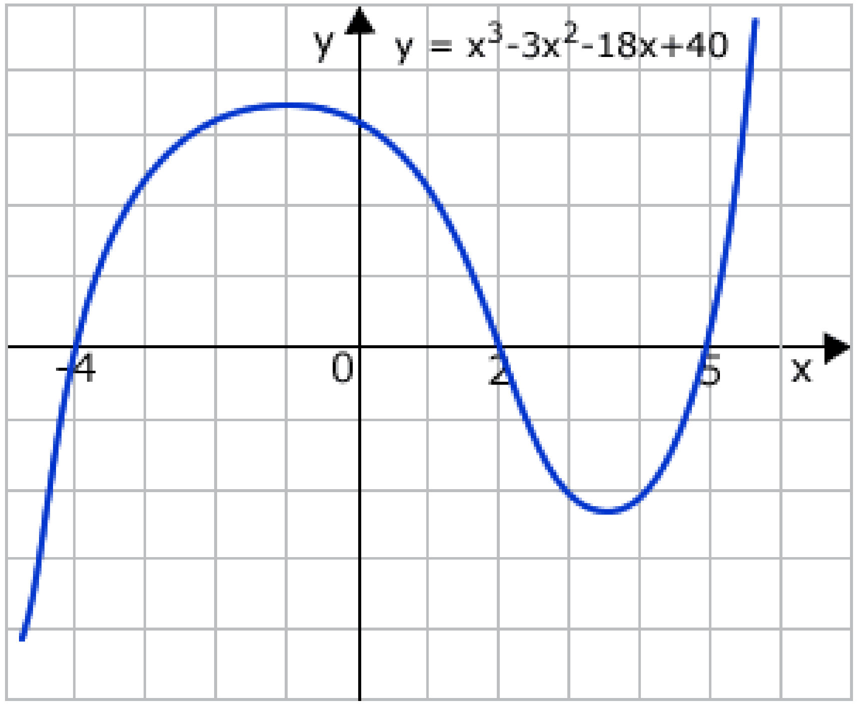
Range

Look at the y axis.

Continue tracing from top to bottom.

Where is the last y value that has a corresponding x value?

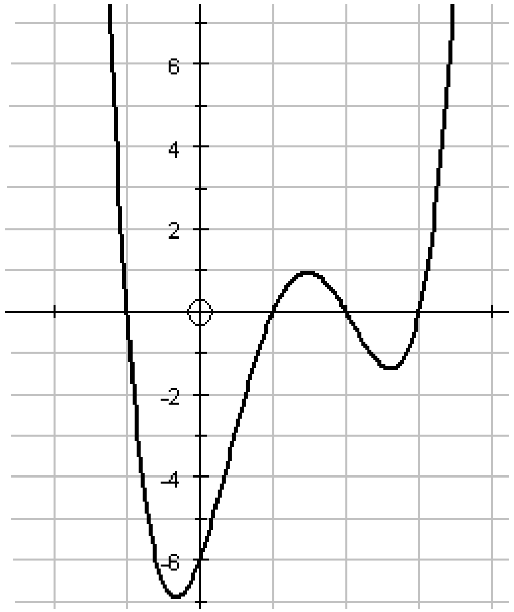
Since we don't have one, the function goes on forever. We say the range interval ends at ∞.



So the range of this function is $(-\infty, \infty)$

End Behavior

End behavior describes what goes on at the far ends of the graph.



It's written in the following format

$$x \to \infty, y \to something$$
$$x \to -\infty, y \to something$$

And we say

as $x \ approaches \ positive \ \infty, y \ approaches \ something$

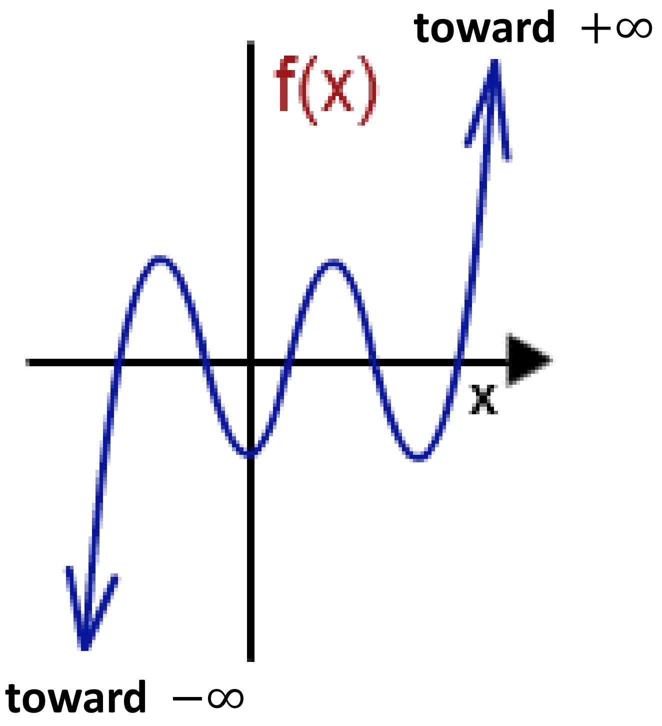
as $x \ approaches \ negative \ \infty, y \ approaches \ something$

End Behavior

First, look at the far Ends of the graph. There will always be two ends. ☺

If the end is pointing up,
it's going toward $+\infty$

If the end is pointing down,
it's going toward $-\infty$

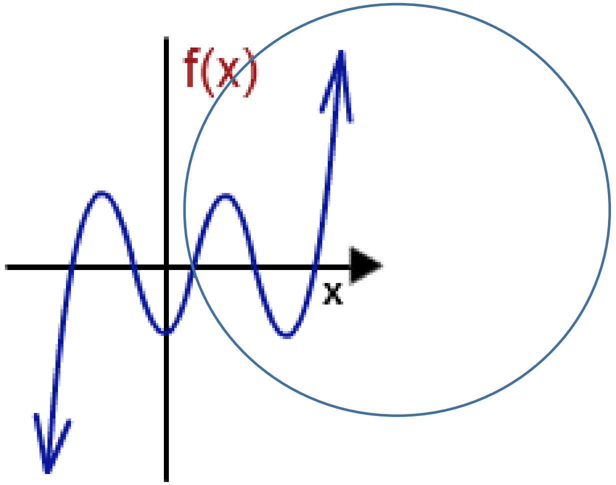


End Behavior

Next, start at the origin and look to the RIGHT. Is the graph pointing up or down? Depending on which way it's pointing…

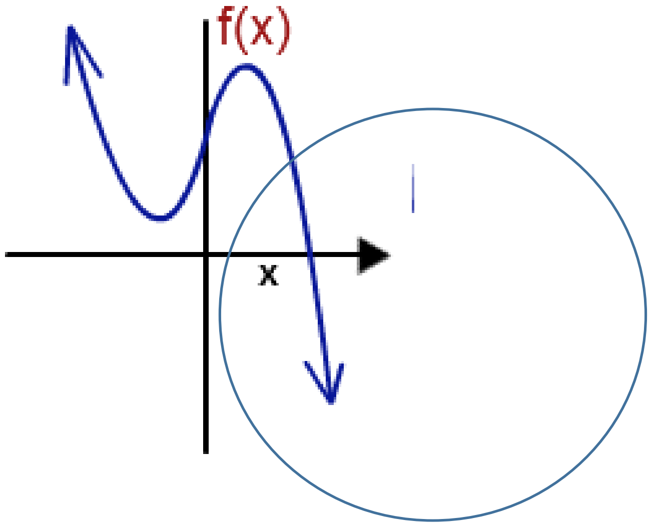
Up: As x approaches positive infinity y approaches positive infinity. We write

$$x \to \infty, y \to \infty$$



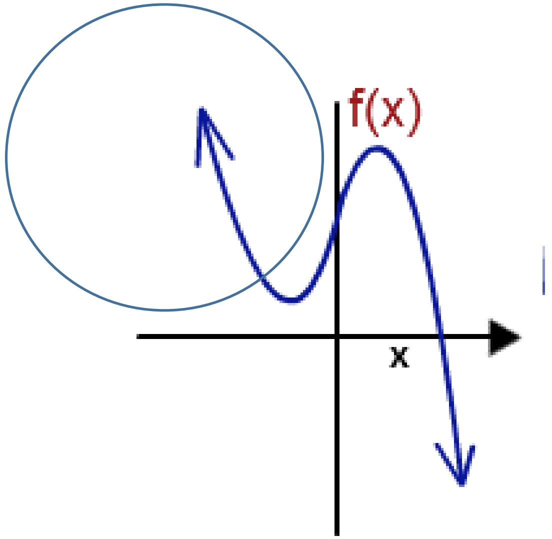
Down: As x approaches positive infinity y approaches negative infinity. We write

$$x \to \infty, y \to -\infty$$



End Behavior

Next, start at the origin and look to the LEFT. Is the graph pointing up or down? Depending on which way it's pointing…

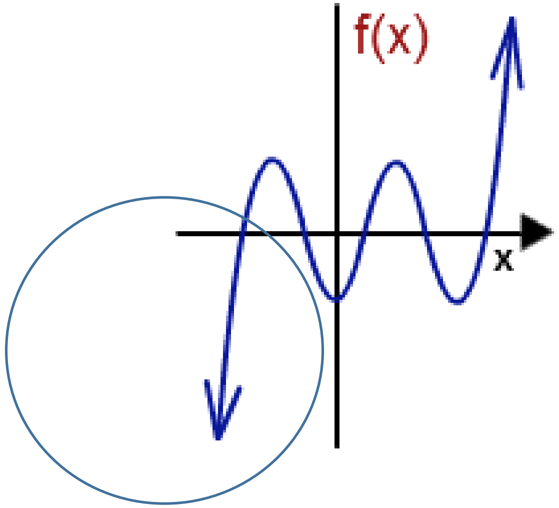


Up: As x approaches negative infinity y approaches positive infinity. We write

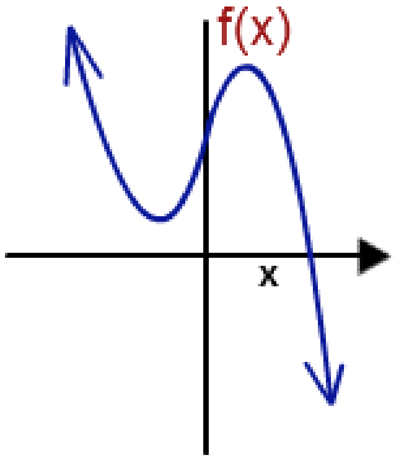
$$x \to -\infty, y \to \infty$$

Down: As x approaches negative infinity y approaches negative infinity. We write

$$x \to -\infty, y \to -\infty$$



Now let's put it together



We see
As x approaches positive infinity y approaches negative infinity.
As x approaches negative infinity y approaches positive infinity.

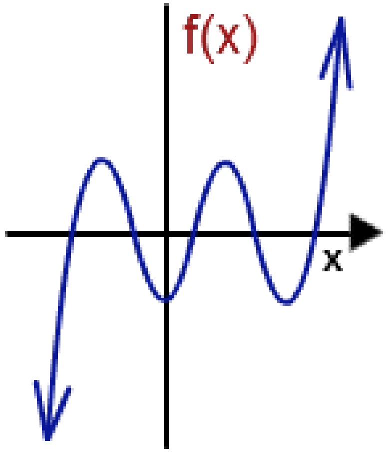
We write
$x \to \infty, y \to -\infty$
$x \to -\infty, y \to \infty$

Now let's put it together

We see

As x approaches positive infinity y approaches positive infinity.

As x approaches negative infinity y approaches negative infinity.



We write

$x \to \infty, y \to \infty$

$x \to -\infty, y \to -\infty$

Functions

Wow! That's a lot.

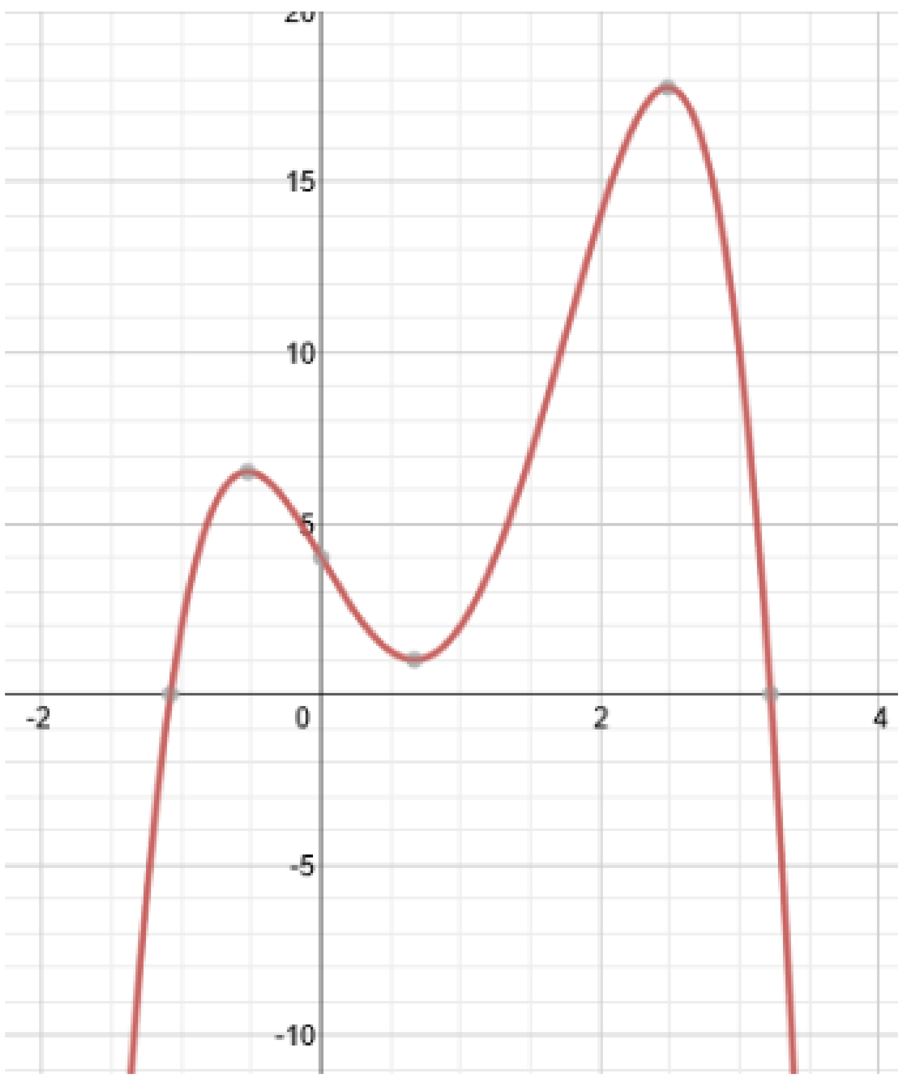
Finish the table from the previous example.

Identify the following	
Maximum(s)	(1.1,12)
Minimum(s)	(3.5,-2)
Increasing Intervals	$(-\infty, 1.1)$ (3.5,∞)
Decreasing Intervals	(1.1,3.5)
x Intercepts	(0,0), (3,0), (4,0)
y intercepts	(0,0)
Domain	
Range	
End Behavior	

Wow! That's a lot.

Finish the table from the previous example.

Identify the following	
Maximum(s)	$(-0.5, 6)$, (2.5, 18)
Minimum(s)	(0.6, 1)
Increasing Intervals	$(-\infty, -0.5)$, $(0.6, 2.5)$
Decreasing Intervals	$(-0.5, 0.6)$ $(2.5, \infty)$
x Intercepts	(-1, 0), (3.25,0)
y intercepts	none
Domain	
Range	
End Behavior	



Parent Functions

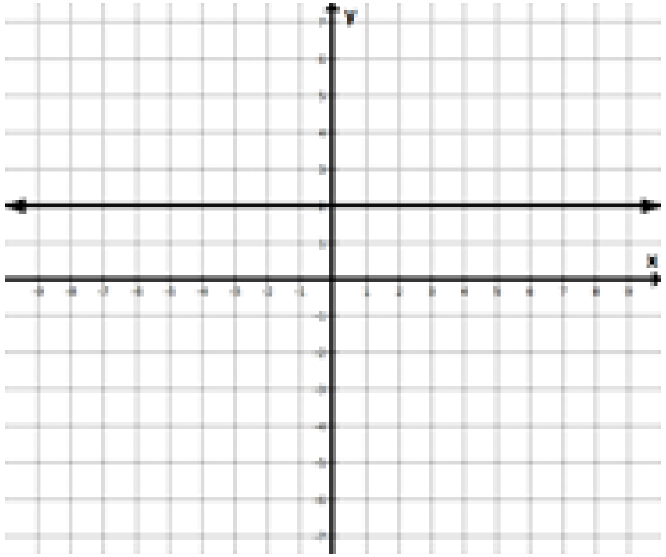
Introducing PARENT FUNCTIONS!

Parent functions are the simplest form of families of functions.

Function	Parent Function
$g(x) = 2x^2 + 4$	$f(x) = x^2$
$g(x) = x - 7$	$f(x) = x$
$g(x) = \frac{1}{3}(x - 7)^3 - 1$	$f(x) = x^3$
$g(x) = \lvert x + 4 \rvert$	$f(x) = \lvert \mathrm{x} \rvert$

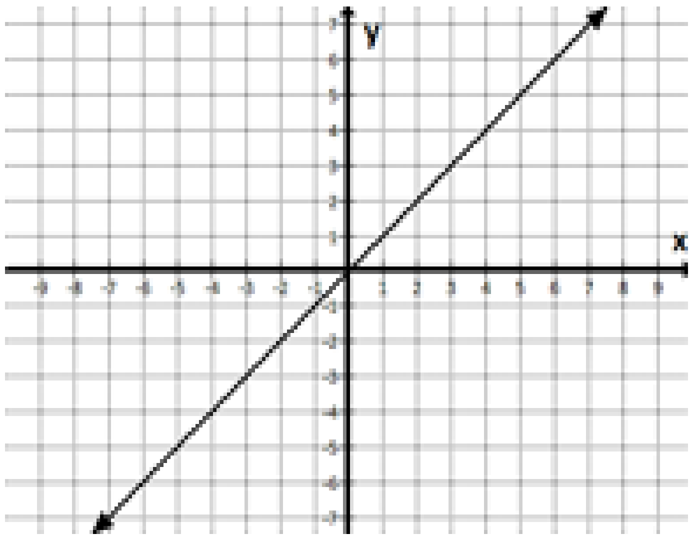
Parent Functions

Constant, f(x) = C



Domain ________		**Range** ________
End Behavior		
$as\ x \to -\infty, y \to$		$as\ x \to \infty, y \to$
Critical Points		
Vertex	**X intercepts**	**Y intercepts**

Linear, f(x)=x

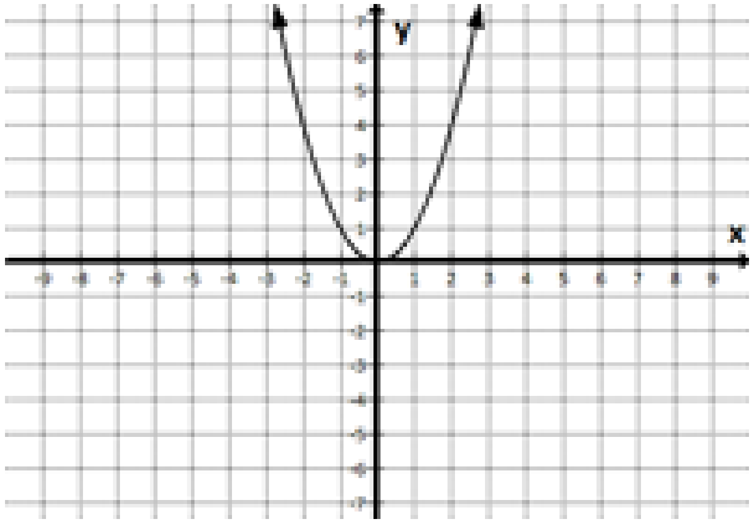


Domain ______________	**Range** ______
End Behavior	
$as\ x \to -\infty, y \to$	$as\ x \to \infty, y \to$

Critical Points		
Vertex	**X intercepts**	**Y intercepts**

Parent Functions

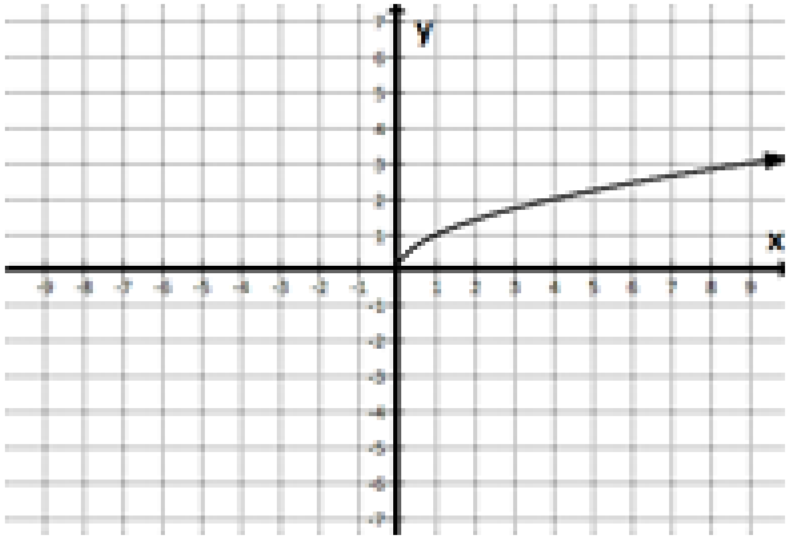
Quadratic, $f(x)=x^2$



Domain ______	**Range** ______	
End Behavior		
$as\ x \to -\infty, y \to$	$as\ x \to \infty, y \to$	
Critical Points		
Vertex	**X intercepts**	**Y intercepts**

Parent Functions

Radical (Square Root), f(x)=



Domain		**Range**
End Behavior		
$as\ x \rightarrow -\infty, y \rightarrow$		$as\ x \rightarrow \infty, y \rightarrow$
Critical Points		
Vertex	**X intercepts**	**Y intercepts**

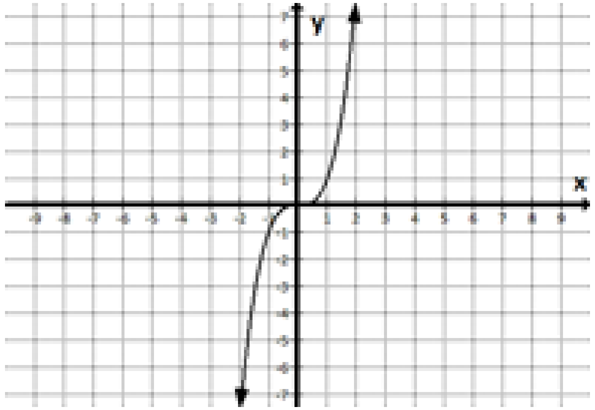
Work with a partner to complete the next five parent functions.

If you're feeling confident complete the last function, Rational.

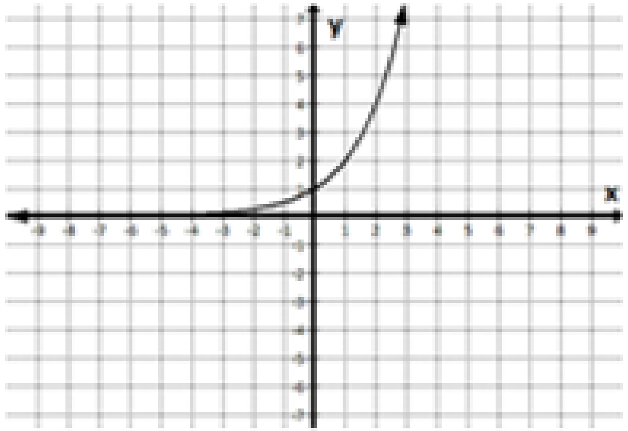
We'll do that one together as a class.

Parent Functions

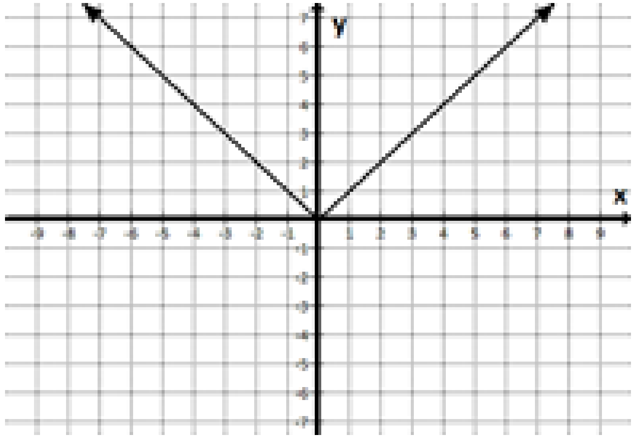
Cubic, $f(x)=x^3$



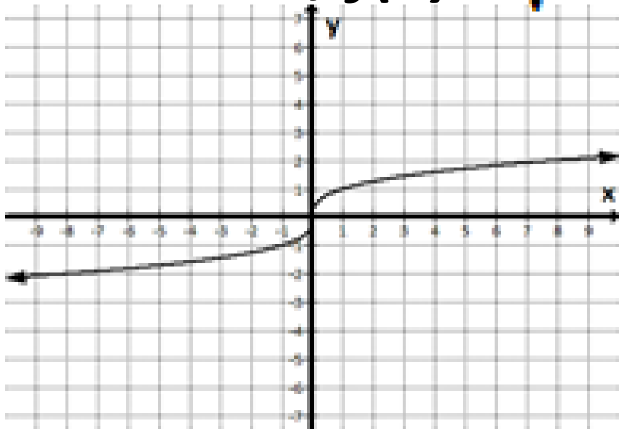
Exponential, $f(x)=b^x$, $b>1$



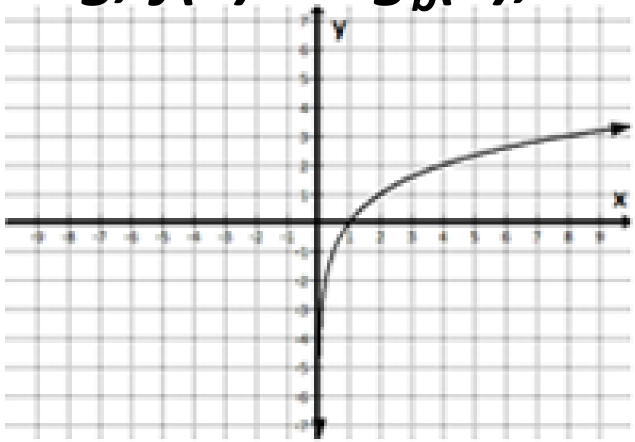
Absolute Value, $f(x)=|x|$



Cube Root, $f(x)=\sqrt[3]{x}$

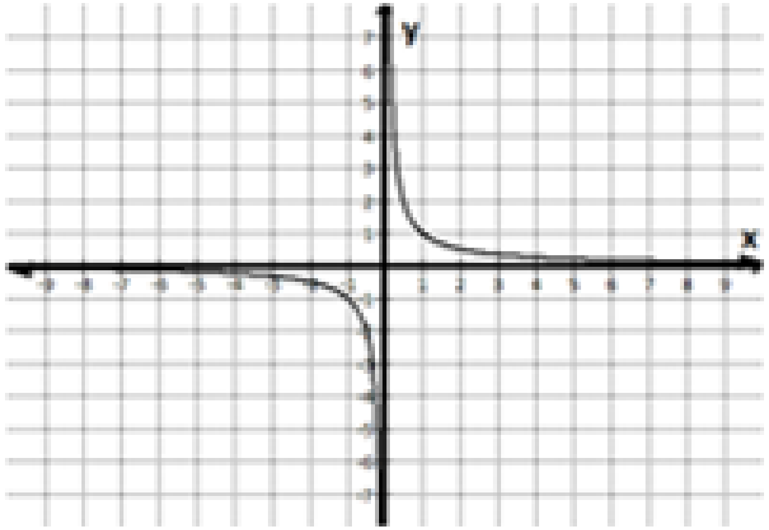


Log, $f(x)=\log_b(x)$, $b>1$



Parent Functions

Rational, Inverse, Reciprocal, f(x)= $\frac{1}{x}$

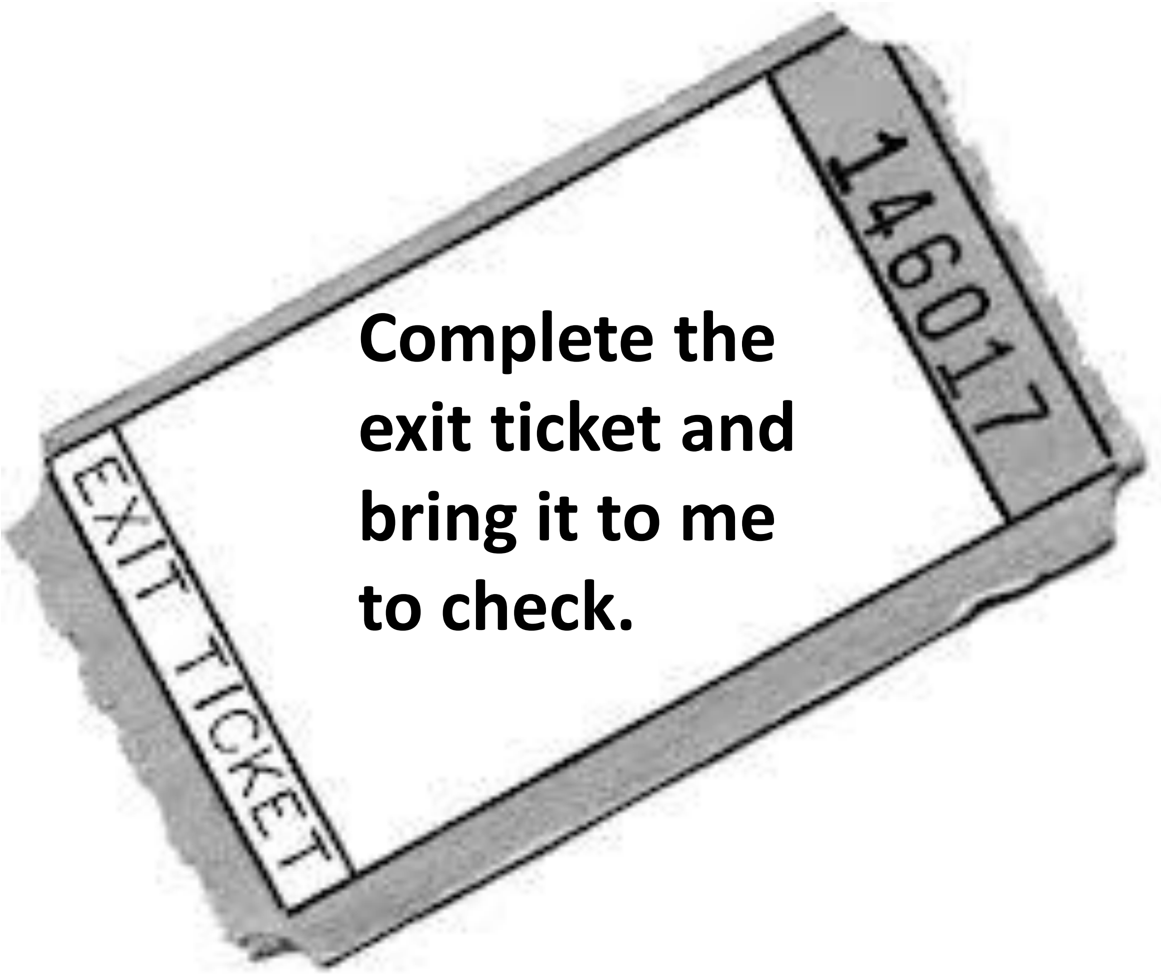


Domain		**Range**
End Behavior		
$as\ x \to -\infty, y \to$		$as\ x \to \infty, y \to$
Critical Points		
Vertex	**X intercepts**	**Y intercepts**

What's different about this graph?

Functions

Did we meet our objectives?



Complete the exit ticket and bring it to me to check.