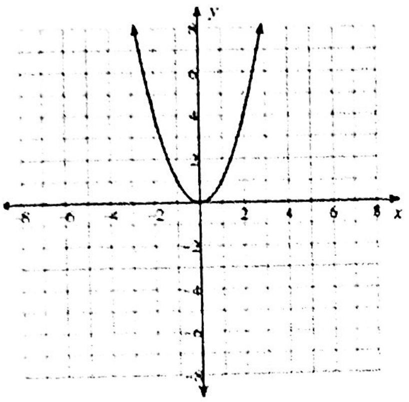
7.1 Graphing Transformations

Though an equation may look complicated and make you not want to graph it, the way the equation is structured actually makes it much easier to graph.

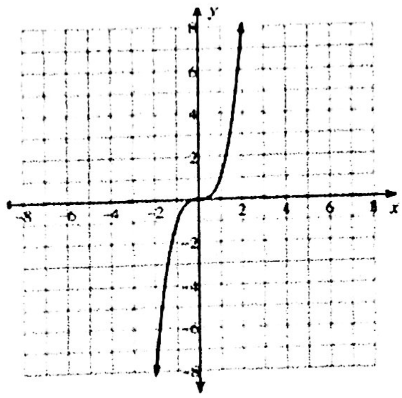
Use the graphs below to see if you can figure out what the different pieces of the equation structure do to the parent graph. Write your predictions when you are finished.

Parent graphs: * All parent graphs start at (0,0) and go through (1,1)

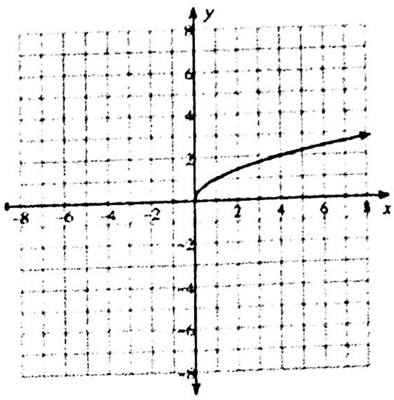
$y = x^2$



$y = x^3$

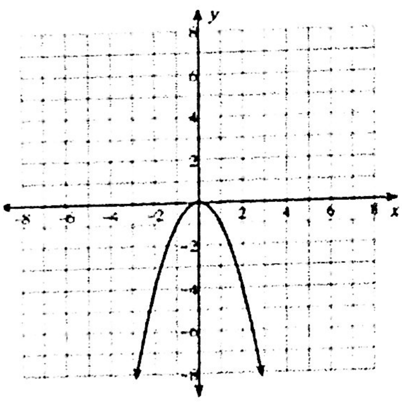


$y = \sqrt{x}$

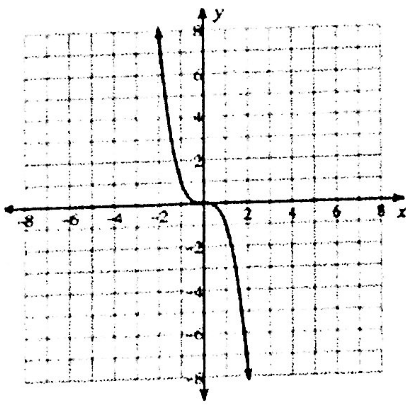


Negative out front: Flips over x-axis

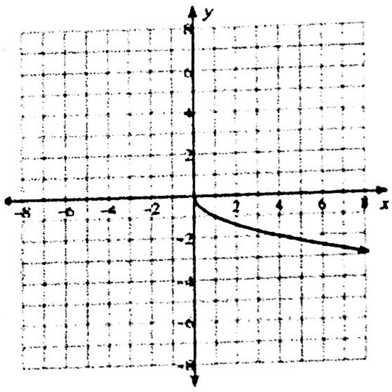
$y = -x^2$



$y = -x^3$

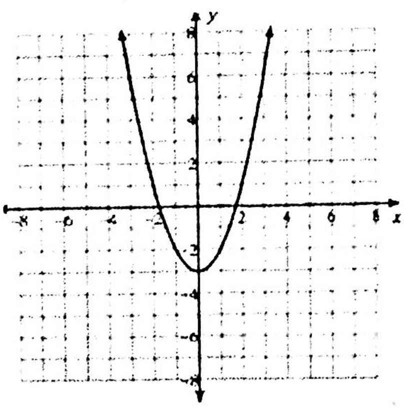


$y = -\sqrt{x}$

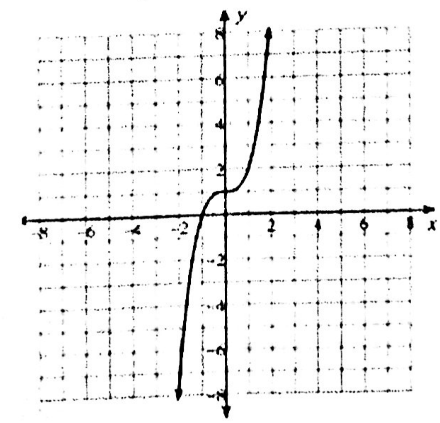


Constant at end: Moves up/down

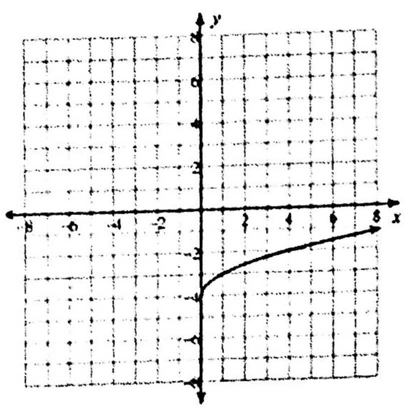
$y = x^2 - 3$



$y = x^3 + 1$



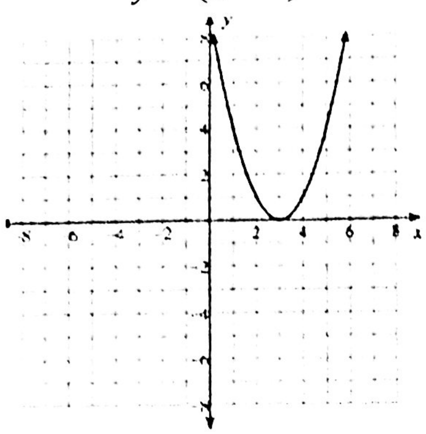
$y = \sqrt{x} - 4$



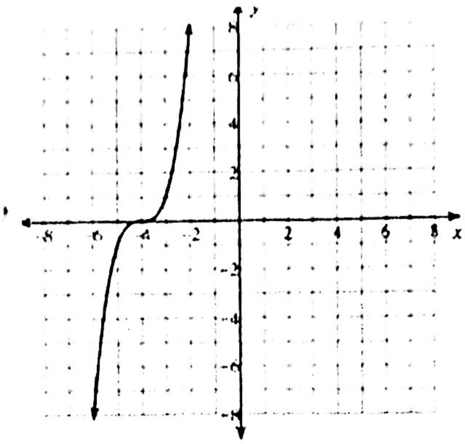
Constant added/subtracted from x: Moves left/right

• left: +
• right: −

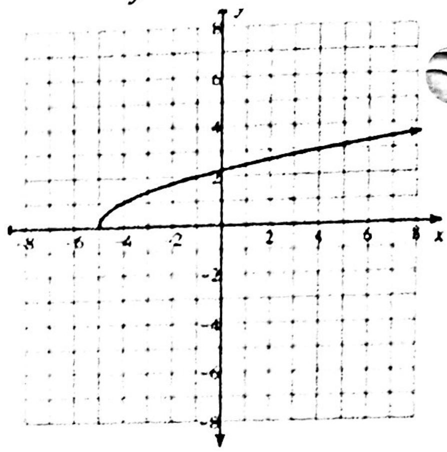
$y = (x-3)^2$



$y = (x+4)^3$

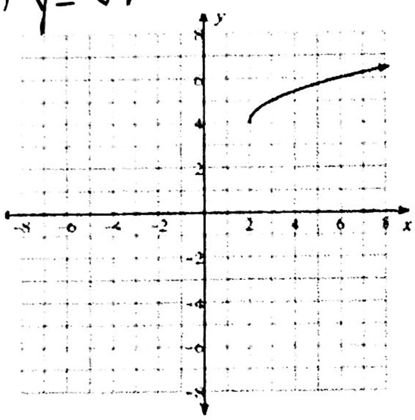


$y = \sqrt{x+5}$

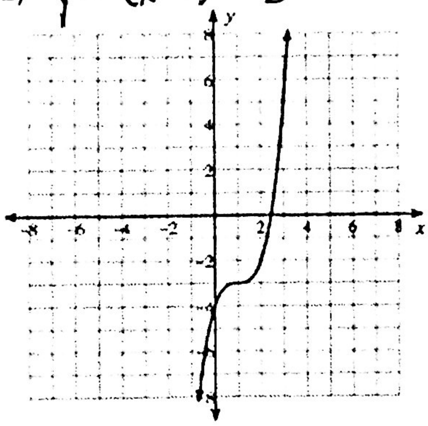


Use your ideas to write the equations of the following graphs:

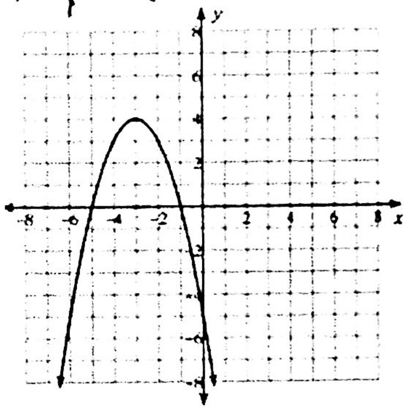
1) $y = \sqrt{x-2} + 4$



2) $y = (x-1)^3 - 3$



3) $y = -(x+3)^2 + 4$



The operation that is actually happening to x (squaring, absolute value, square rooting, etc.) determines the shape of your parent graph. Everything else tells you how the parent graph is transformed. Below are **some** examples of how equations can be structured:

$y = a\|x-h\| + k$	$y = a(x-h)^2 + k$
$y = a(x-h)^3 + k$	$y = a\sqrt[3]{x-h} + k$

No matter what kind of equation you have, in this form, all graphs will transform the same way.

$$y = -a\sqrt{x-h} + k$$

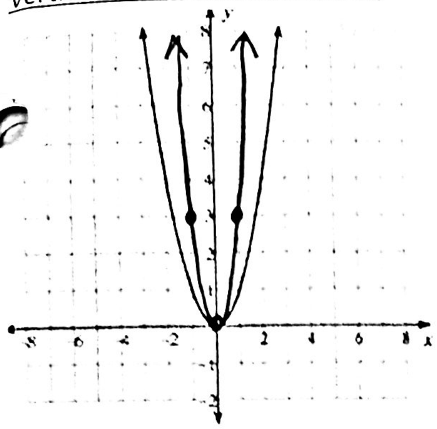
Reflection over x-axis

Vertical stretch/compression

Horizontal shift
+: left
−: right

Vertical shift

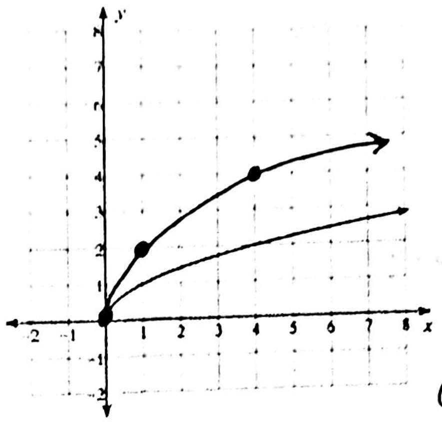
Vertical Stretch/Compression



$y = 3x^2$

x	y
-2	12
-1	3
0	0
1	3
2	12

Parent: $y = x^2$

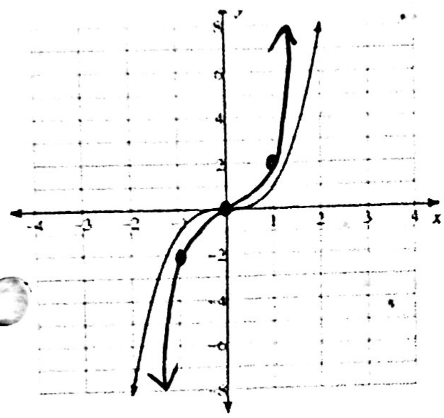


$y = 2\sqrt{x}$

x	y
0	0
1	2
4	4
9	6

(I just chose x's that have nice square roots)

Parent: $y = \sqrt{x}$



$y = 2x^3$

x	y
-2	-16
-1	-2
0	0
1	2
2	16

Parent: $y = x^3$

How to tell if a function has been vertically stretched or compressed:

If the graph does not go over 1 up 1 from the starting point, then it has been vertically stretched/compressed.

From your starting point, go over 1 & up however many until you hit the graph. This amount is the a-value.

1) Write an equation based off of the parent function for the given transformations.

a. Parent function: $y = x^3$
Reflection over the x-axis
Horizontal shift right 2
Vertical shift down 6

$\boxed{y = -(x-2)^3 - 6}$

b. Parent function: $y = |x|$
Reflection over the x-axis
Vertical compression of 1/3
Vertical shift up 1

$\boxed{y = -\frac{1}{3}|x| + 1}$

c. Parent function: $y = x^2$
Vertical stretch of 4
Horizontal shift left 3

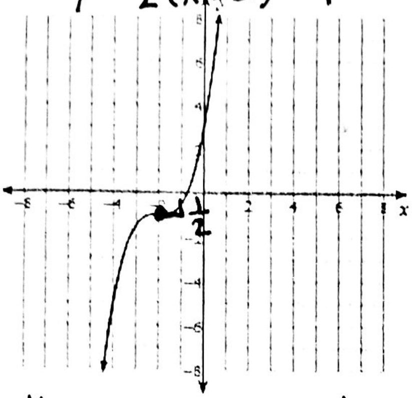
$\boxed{y = 4(x+3)^2}$

d. Parent function: $y = \sqrt{x}$
Reflection over the x-axis
Vertical shift up 3

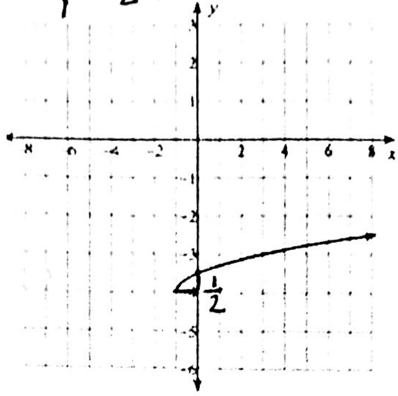
$\boxed{y = -\sqrt{x} + 3}$

2) Write the equation for each graph below.

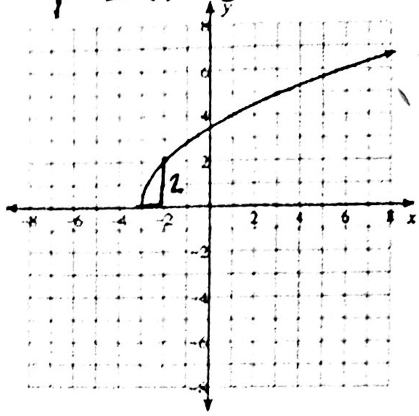
a. $y = \frac{1}{2}(x+2)^3 - 1$



b. $y = \frac{1}{2}\sqrt{x+1} - 4$



c. $y = 2\sqrt{x+3}$

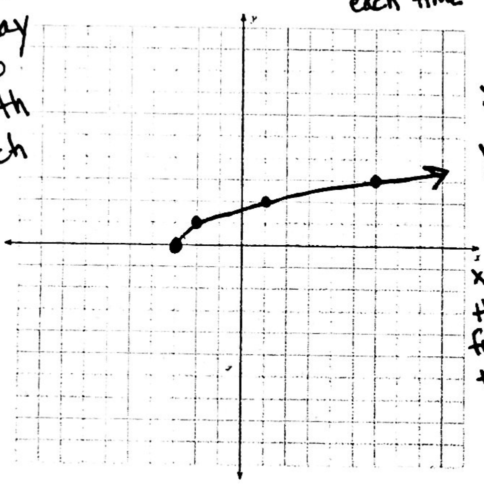


Ms. Lambert's order to look at things:
1) Determine parent graph 2) Is it reflected? 3) Vertical/horizontal shift of starting point 4) Vertical stretch/compression

3) Graph the equations below.

a. $y = \sqrt{x+3}$ $a=1$ y goes up 1 each time

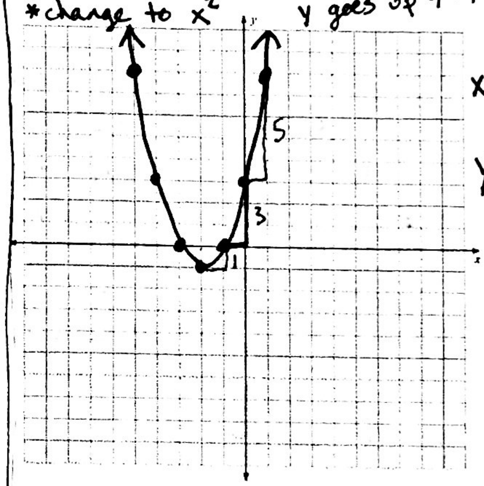
The quickest way to graph is to know the growth pattern of each parent graph.



$\sqrt{x}$
x: 1, 3, 5
y: a-value

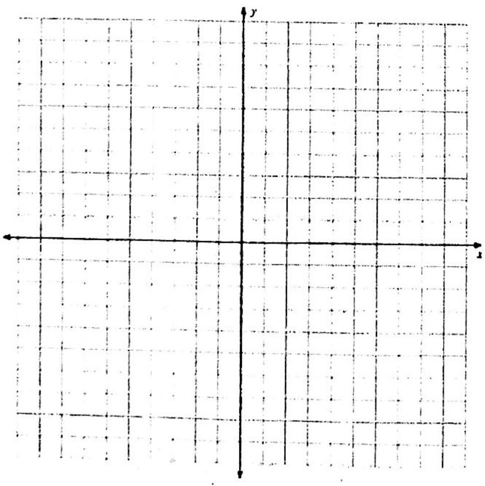
x goes over 1, then over 3 from there, then over 5

b. $y = (x+2)^2 - 1$ $a=1$ y goes up 1, 3, 5
*change to x^2

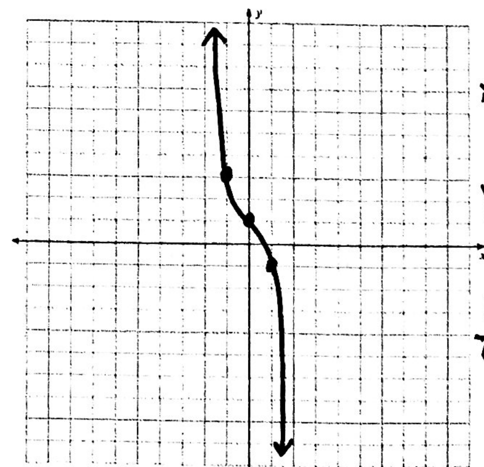


x^2
x: over 1 each time
y: 1a, 3a, 5a

c. $y = \frac{1}{2}\sqrt{x+2} - 1$



d. $y = -2x^3 + 1$ $a=-2$ y goes down 2, then down 14



x^3
x: over 1 each time
y: 1a, 7a

$a=-2$
$1a = 1(-2) = -2$
$7a = 7(-2) = -14$

Because x^3 grows so quickly, a lot of the time we'll only be able to graph 3 points