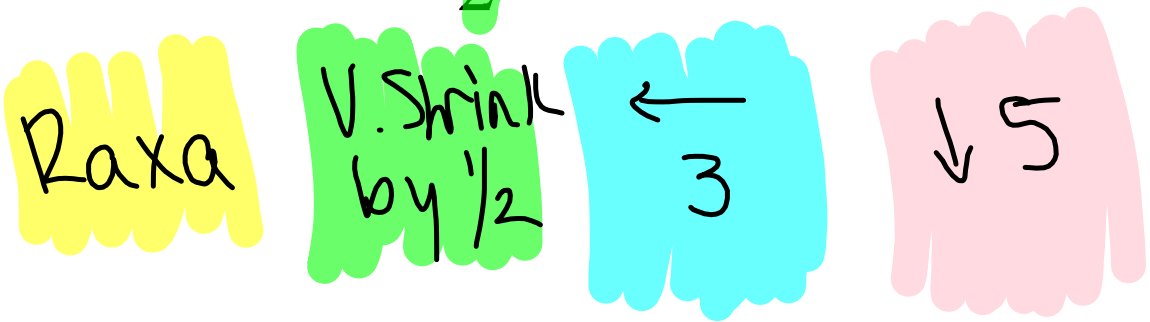
Algebra 2 - Unit 3.4 Graphing Functions

- Memorize the parent functions for the following
  - > Quadratic
  - > Cubic
  - > Square Root
  - > Cube Root
  - > Logarithm (growth and decay)
  - > Exponential (growth and decay)
- Graph transformations of the functions above.

Refresher: Identify the transformations of

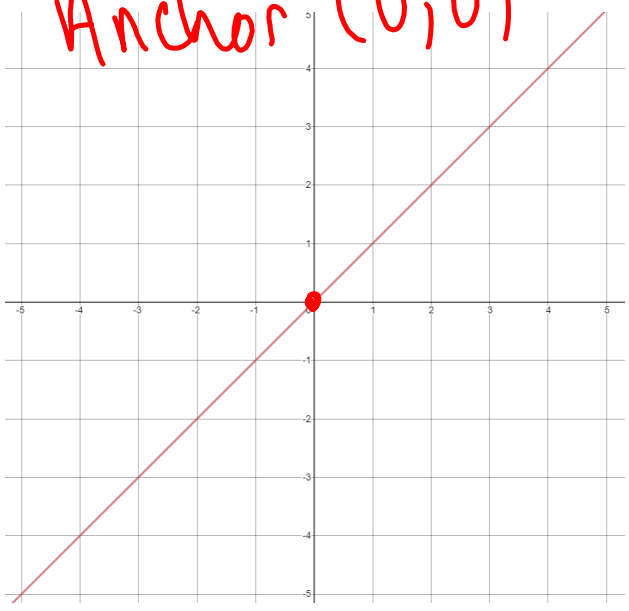
$$y = -\frac{1}{2}(x+3)^2 - 5$$



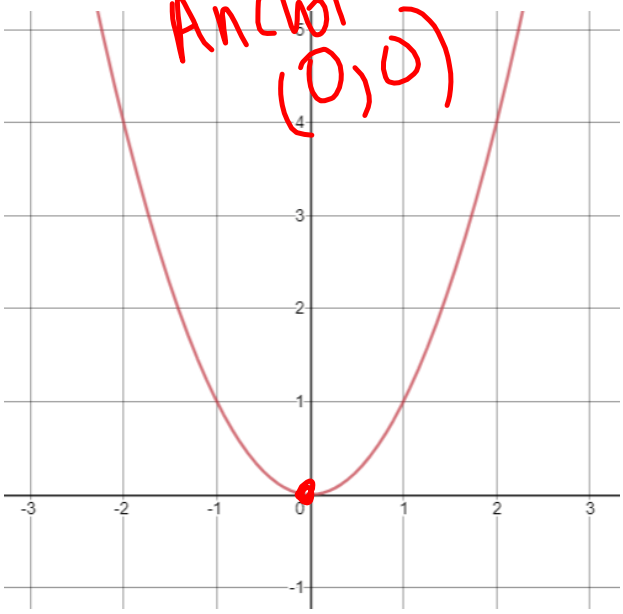
Parent Functions: In order to do transformations you have to start from somewhere. How can you move a graph "up 5" if you don't know where it was before you moved it? The baseline shape of a function is known as a parent function, and it is what gets transformed.

Each function has a parent and you will have to have all of them memorized. There will be 9 parent functions in all, make room to have them all next to each other in your notes.

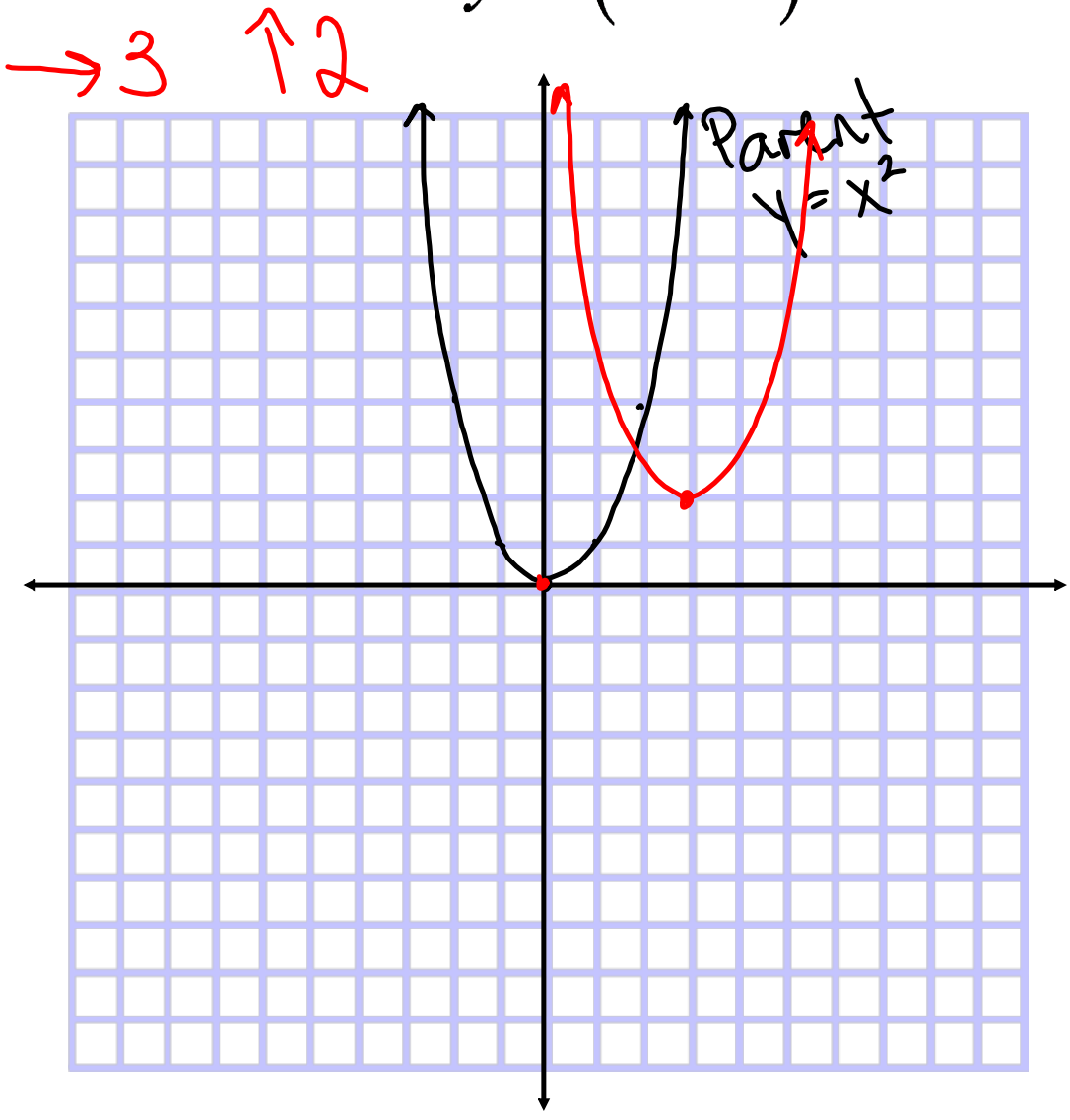
Linear: $y = x$



Quadratic: $y = x^2$

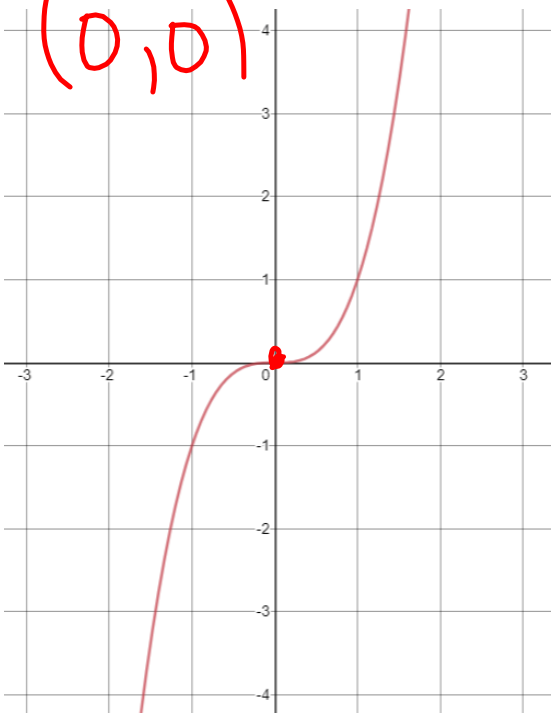


Example: Graph $y = (x-3)^2 + 2$

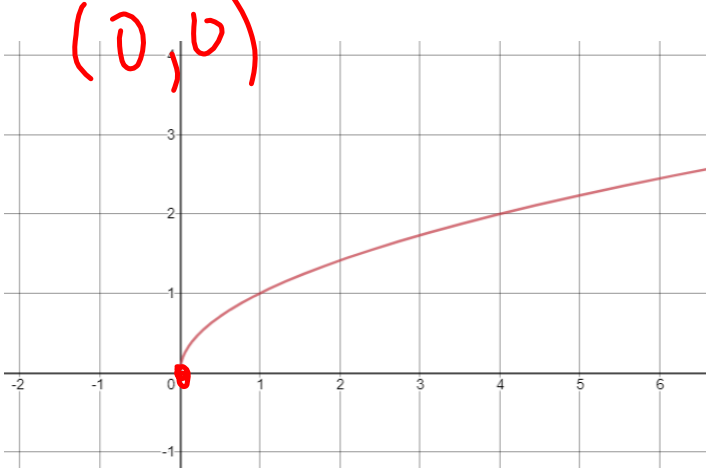


More Parent Functions:

Cubic: $y = x^3$



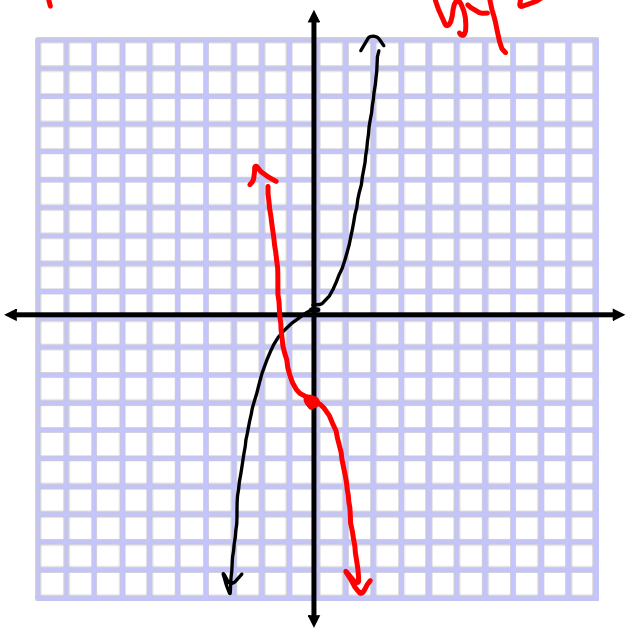
Square Root: $y = \sqrt{x}$



Examples: Graph...

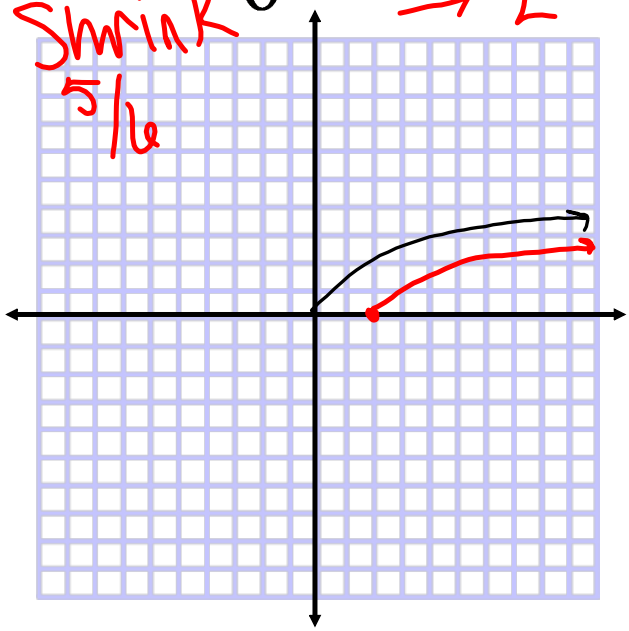
$y = -2x^3 - 3$

Reflect \/ Stretch by 2 ↓3

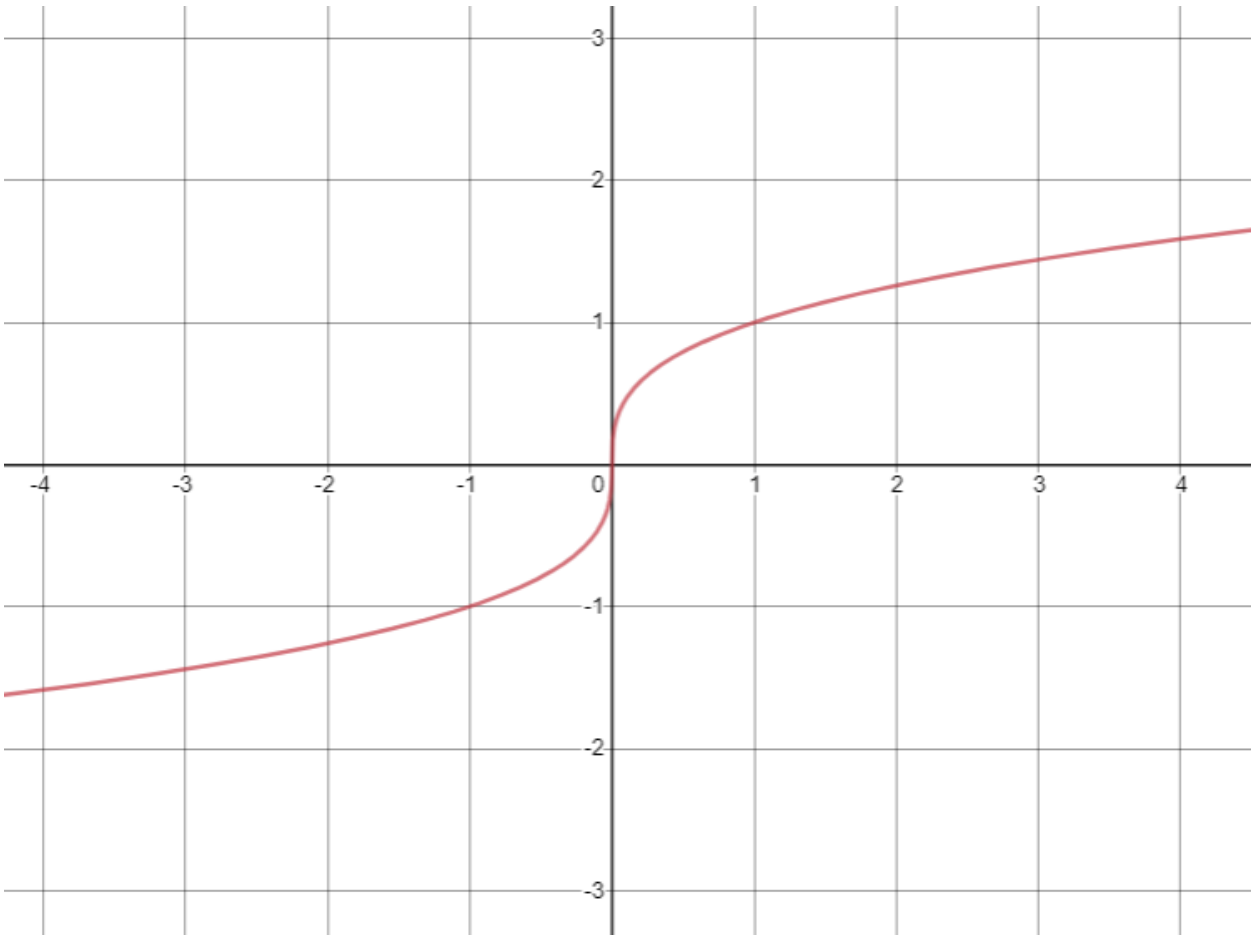


$y = \frac{5}{6}\sqrt{x-2}$

Shrink 5/6 → 2



Cube Root: $y = \sqrt[3]{x}$

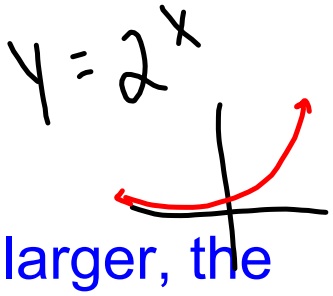


Asymptotes:

Logs and Exponentials have "Asymptotes". These are invisible lines that the functions will not touch. When graphing transformations the asymptotes will need to be moved, just like the parent function.

Let's look at the exponential functions. $y = b^x$

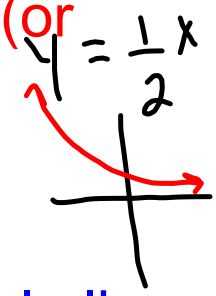
Exponential Growth : Base > 1



https://www.desmos.com/calculator/1wvuft9p4o

Notice that as the base is getting larger, the graph is getting steeper.

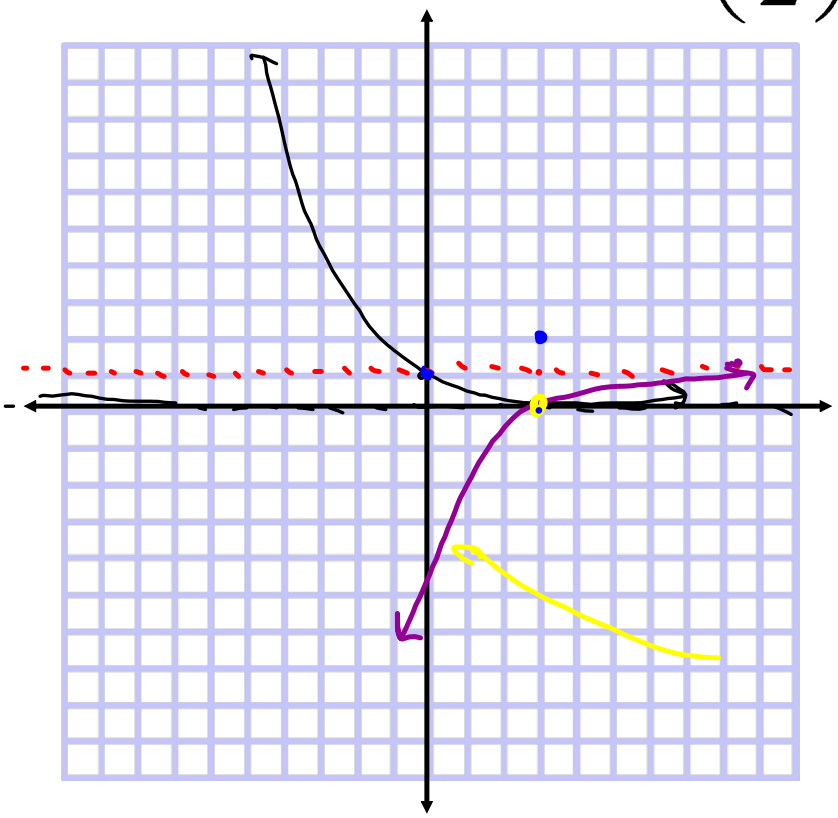
Exponential Decay : Base is a Fraction (or decimal) smaller than 1



https://www.desmos.com/calculator/chqy5xg28a

In both of these cases, there is an invisible line on the x-axis. The graphs will not touch the x-axis or go below it. This line (y=0) is known as a horizontal asymptote.

Example: Graph $y = -\left(\frac{1}{2}\right)^{x-3} + 1$



Raxa

→ 3

↑ 1

Stretches and Shrinking for Exponential Functions:

All functions have "Anchor Points" that are used to move around when doing tranformations. Usually these points are unaffected by stretching and shrinking (See link 1). But exponential functions are special, their anchor point moves when the graph is stretched. (see link 2)

Link 1: https://www.desmos.com/calculator/f0gvsl3q0b

Link 2: https://www.desmos.com/calculator/oqx6iqefot

Simple way to graph: After stating the transformations, graph the function as if it was NOT stretched/shrank. Then move the anchor point up or down so that it is exactly *x* units away from the asymptote, where *x* is the stretch factor.

The link below will show what happens as you change the stretch factor on the function below. (move a slider around)

https://www.desmos.com/calculator/yy0msxybty

$$y = 5^{x+2} - 3$$

Logarithms: These have the same quirk that exponential functions do. They have an asymptote, and they look different depending on if their base is >1 or a fraction.

Vertical Asymptote at x=0

- Examples of logs when the base is >1

https://www.desmos.com/calculator/evyztywrkr

Examples of logs when the base is <1

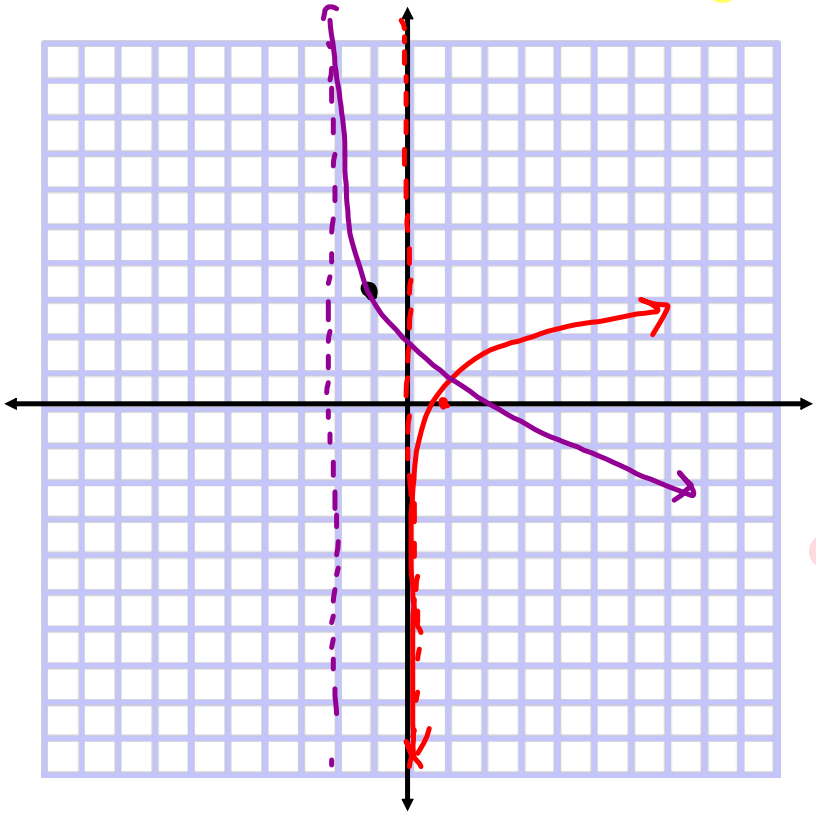
https://www.desmos.com/calculator/qy4bvxplu0

Link for sliding the base to whatever you want.

https://www.desmos.com/calculator/3urzryot63

Graphing an Example:

$$y = -2\log_2(x+4)+3$$



$y = \log_2 x$

Raxa

V. Stretch 2

← 2

↑ 3

https://www.desmos.com/calculator/xiknc52uoj

Homework: U3.4 Worksheet