Chapter 13 Assignment:

Chapter 13 describes various transformations of equations we've been working with. Look over the chapter. However, I found the descriptions to be horrible boring. I find the best way to get a feel for an equation and its transformations is to plug it into a graphing program like Geogebra or Desmos, throw a slider onto it, and see what happens when you fiddle with it. It's a bit like learning to play a sport or a musical instrument. You can read about it all you want, but you don't learn much until you do it. Playing with these graphing programs is about as close as you can get to "doing it."

My preferred free graphing program/calculator is Geogebra. You can also download a stand-alone application for work off-line if you poke around that web site. Slider controls are a little more obvious in this program.

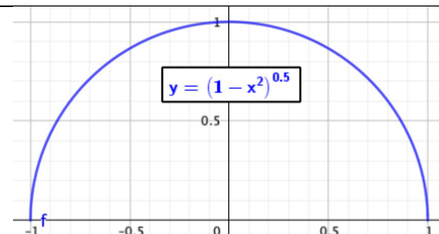
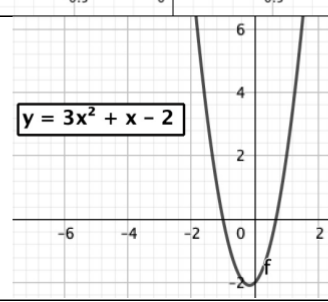
Another free graphing application is Desmos. If you put an "a" in the equation it will give you a slider to work with automatically. I'm not sure how to change its parameters, but you probably can if you dig deeper into the program.

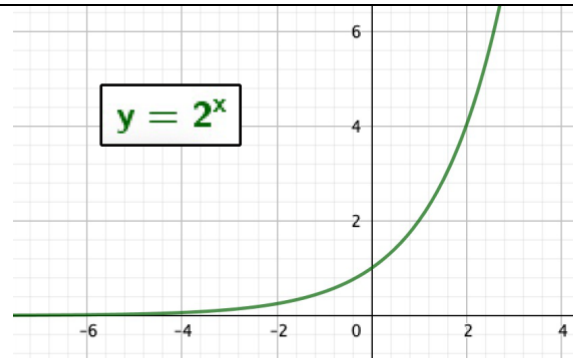
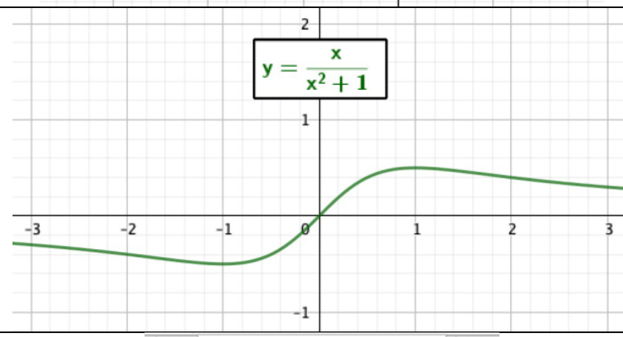
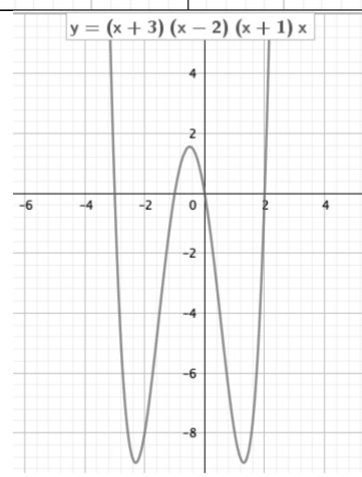
Assignment:

Using either Geogebra, Desmos (or another comparable graphing program) I want you to plug in the following functions, with a slider (set to -2 to 2 with 0.1 increments), and play around with each transformation: Reflection, Shifting, and Dilation. The conditions for these transformations are described on pp. 174-177 [Tables 13.1-13.3]

Here is a video showing you what I want. Ch13-TranslationsVideo

I'd like you to transform each of the following functions in a graphing program. There are 6 transformations, listed below.

	Here's what the base function looks like.
1) The Semicircle: $y = \sqrt{1 - x^2}$	
2) The Quadratic: $y = 3x^2 + x - 2$	

3) The Exponential: $y = 2^x$ [Set your slider to -5 and 5 with increments of 0.1 for this one.] This one is a bit weird visually, particularly when shifting horizontally, but the shift is working... it just looks like something more complicated is happening. If you put in a reference graph (i.e. $y = 2^x$) along with the shifting graph you'll see that it is just shifting left and right, nothing fancier.	
4) The Rational: $y = \frac{x}{x^2+1}$	
5) Make up a function which has at least 3 bumps on it. The easiest way to make bumpy functions is to just randomly do this: $y = (x \pm ?)(x \pm ?)(x \pm ?)(x \pm ?)$. This will produce 3 bumps unless you are unlucky and choose some very particular numbers for the question marks. To the right is an example. Do a different one than the one shown here.	

The Transformations: Do each of these 6 translations to each function listed above.

s.1) Shifting vertically: Simply add to the entire function. Basically adding to y.
s.2) Shifting horizontally: Simply add to the x's only.

d.1) Dilation vertically (squashed or stretched taller): Multiply the y by some number. If the number is between 0 and 1 it will be squashed, and if the number is greater than 1 it will be stretched taller.
d.2) Dilation horizontally (fatter or thinner): Multiply the x's by some positive number. If the number is between 0 and 1 it will get fatter. If the number is greater than 1 it will get thinner.

r.1) Reflection across x-axis: make the entire function negative.
r.2) Reflection across y-axis: Replace all x's with -x's. This will often require lots of parentheses.

Note: Whenever dealing with translations on the x's, it is a good rule-of-thumb to throw parentheses around them.
E.g. If you want to do a horizontal shift: $y = 3x^2 - 2x \rightarrow 3(x+a)^2 - 2(x+a)$.
E.g. If you want to do a horizontal dilation: $\rightarrow 3(ax)^2 - 2(ax)$
E.g. If you want to flip across the y-axis: $\rightarrow 3(-x)^2 - 2(-x)$

I don't need to see any of this stuff except for #5.

Turn in a presentation of all 6 transformations that you do to your function for #5. Either draw them out or take screen shots, or make an animation. Be creative in your presentation. Please keep files under 10 MB. As usual, provide enough prose to make it stand alone as a demonstration of transforming your particular polynomial.

Exercise #2

Recall the equation of a circle. $r^2 = (x-h)^2 + (y-k)^2$

If k = h = 0, solve for y. Simple as that. Solve for y. Notice that it is the equation for #1 (above) for a circle with radius of 1.