In this document, we'll give an overview of some of the graphs of common functions we should know. This is not comprehensive coverage of all you need to know about graphing, but it will get you most of the way there.

Parent Graphs

A parent function is a basic member within a type of function. For instance, the parent function for quadratics is $f(x) = x^2$. Every other quadratic function is a variation (scaling, shift, reflection—these are called transformations) on the parent, $f(x) = x^2$. We can, therefore, leverage this to graph any quadratic by just knowing the parent and knowing what the transformations do. Overall, this process organizes and simplifies what we need to know. For each of the following functions, be sure to know the algebraic representation, the shape of the graph, how to get a few points, and any relevant characteristics (asymptotes, names of special points/values and what they tell us): linear, absolute value, quadratic, exponential, logarithmic, sine, and cosine.

Transformations

We can change parent graphs through transformations—shifting, scaling, and reflecting. Let $f(x)$ be any function and $c > 0$. Then we have the following possible shifts:

$y = f(x) + c$	shift graph of $f(x)$ up c units
$y = f(x) - c$	shift graph of $f(x)$ down c units
$y = f(x + c)$	shift graph of $f(x)$ left c units
$y = f(x - c)$	shift graph of $f(x)$ right c units.

For scaling, we see

$y = cf(x)$	stretch $f(x)$ vertically by factor of c
$y = (1/c)f(x)$	shrink $f(x)$ vertically by factor of c
$y = f(cx)$	shrink $f(x)$ horizontally by factor of c
$y = f(x/c)$	stretch $f(x)$ horizontally by factor of c.

For reflecting, we have

$y = -f(x)$	reflect $f(x)$ about x-axis
$y = f(-x)$	reflect $f(x)$ about y-axis.

Although there appears to be lots of different rules to remember, we can easily summarize all of them:

- if there is a number inside with the x then do the opposite of what that number is doing to the x values; when there are multiple changes (scaling/reflection and a shift) to the x values then use reverse order of order of operations
- if there is a number outside away from the x then do what that number is doing to the y values; when there are multiple changes (scaling/reflection and a shift) to the y values then use order of operations

It will be helpful to understand why the above bullet points are true. Use the space below to write out the reasons why the two bullet points cover all the transformations rules.

The next several pages contain most of the problems from the Final Exam Topics document that require you to be able to graph.

Practice

1. Graph $y < -2x + 3$

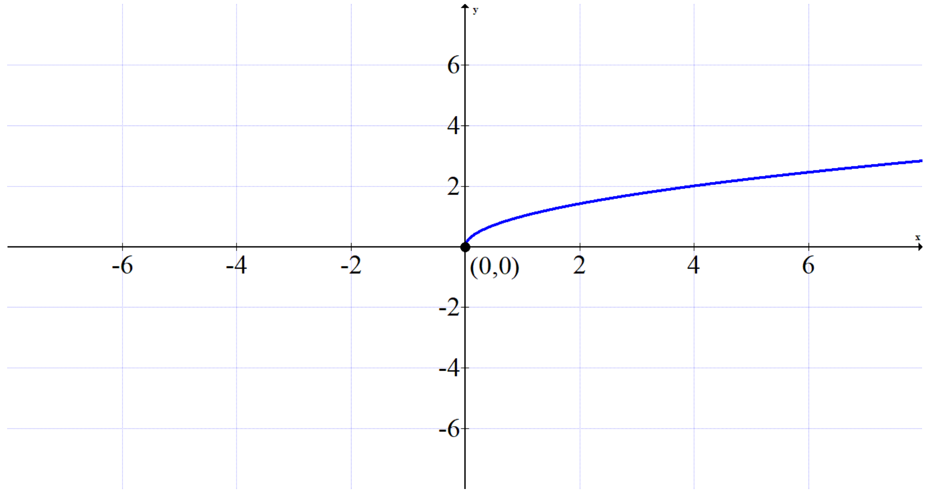
2. Graph $2x + 3y = -6$

3. Graph $y = -\frac{2}{3}x^2$

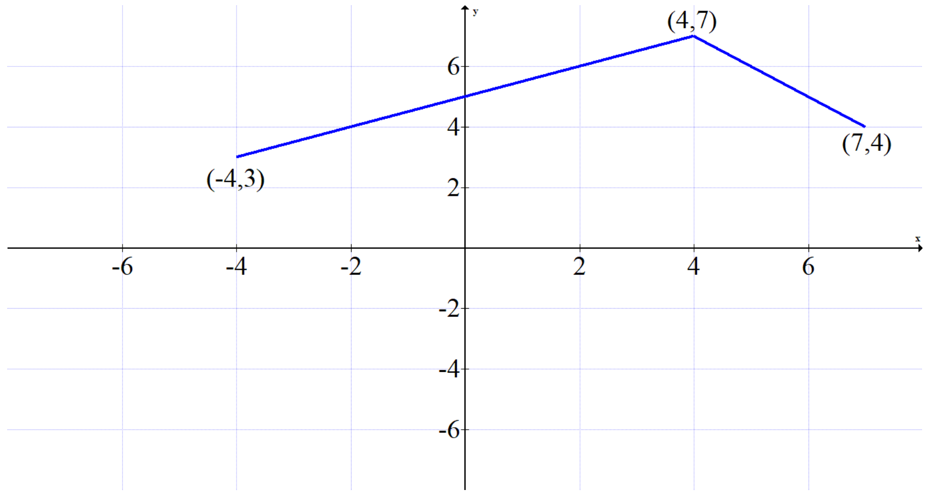
4. Graph $y = (x-2)^2 + 3$

5. Graph $y = -2|x+4| + 5$

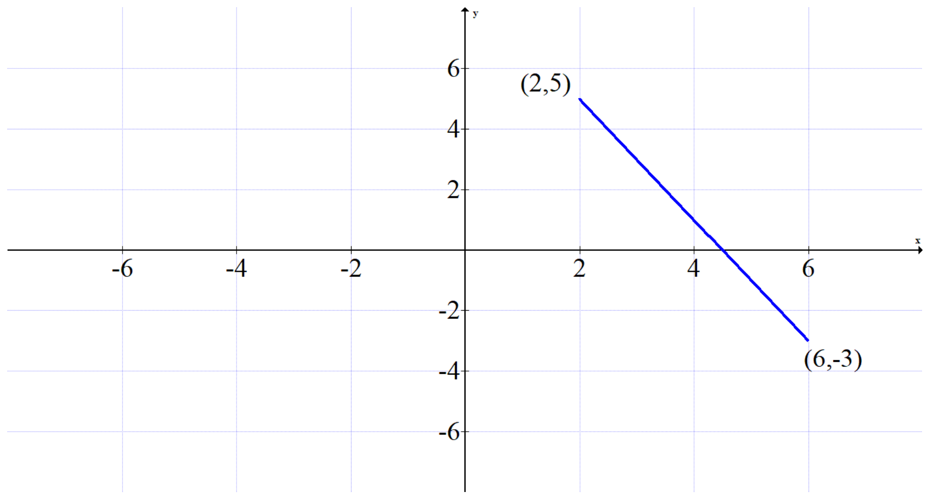
6. Below is the graph of $y = \sqrt{x}$. Translate it to make the graph of $y = \sqrt{x+3} - 1$.



7. The graph of $y = f(x)$ is shown. Draw the graph of $y = -f(x)$.

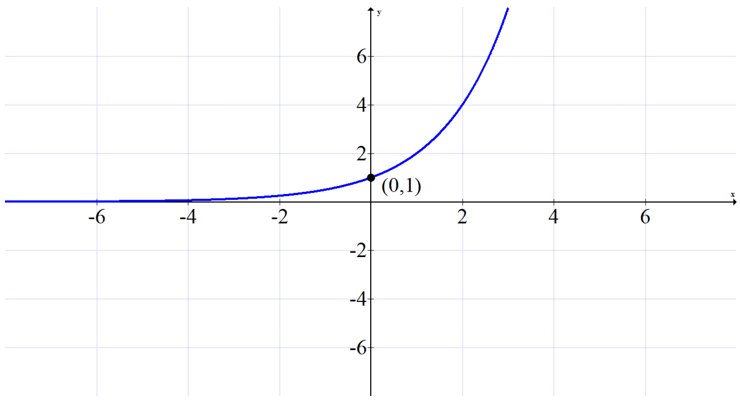


8. The graph of $y = f(x)$ is shown. Graph $y = 2f(x+3)$.

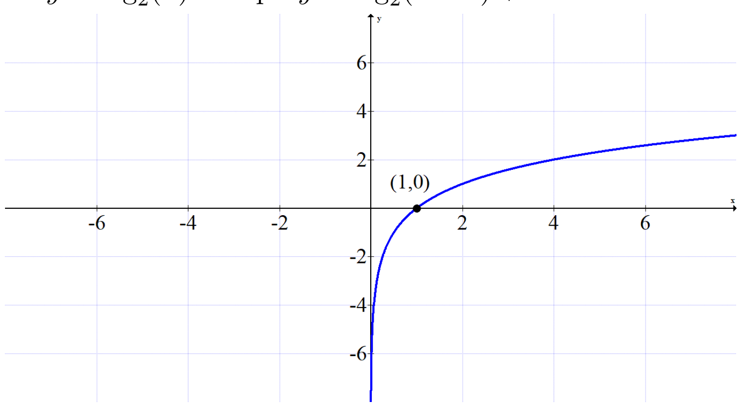


9. Classify the following graphs (line with positive/negative slope, horizontal/vertical line, parabola that opens up/down):
   (a) $f(x) = 3$
   (b) $g(x) = 8 - 2x + x^2$
   (c) $x = 2$
   (d) $h(x) = e - \pi x$
   (e) $j(x) = 8x + 3x^2 - 10$

10. Below is the graph of $y = 2^x$. Graph $y = 2^{x-4} + 1$



11. Below is the graph of $y = \log_2(x)$. Graph $y = \log_2(x - 1) + 4$



12. Graph $y = \cos\left(x - \frac{\pi}{3}\right)$

13. Graph $y = \sin\left(\frac{2}{3}x\right)$

14. Graph $y = \frac{1}{2}\cos\left(\frac{1}{2}x - \frac{\pi}{4}\right)$