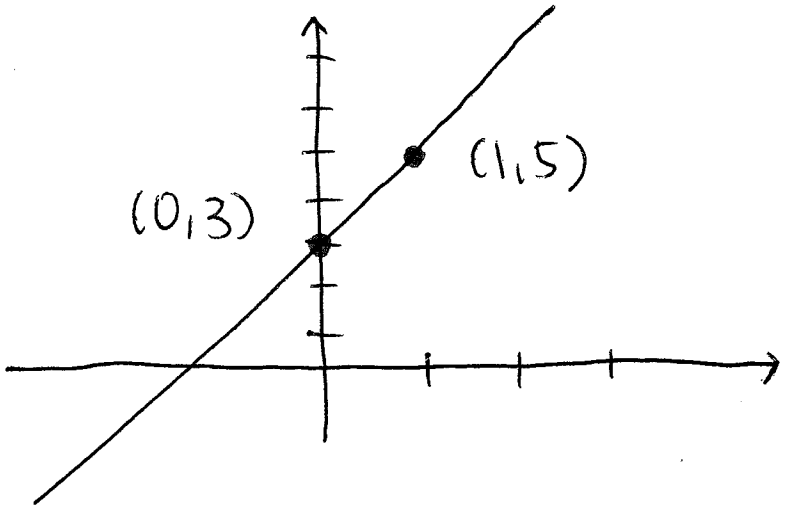
MATH 213
HOW to graph without a calculator

As you've already seen, this semester we will do some very soft-core graphing. Here is everything you need to know!

Lines: to graph a line, you only need 2 points.

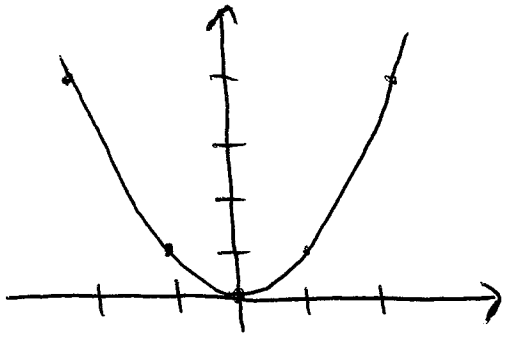
example: $y = 2x + 3$

if $x = 0$, $y = 3$
$x = 1$, $y = 5$

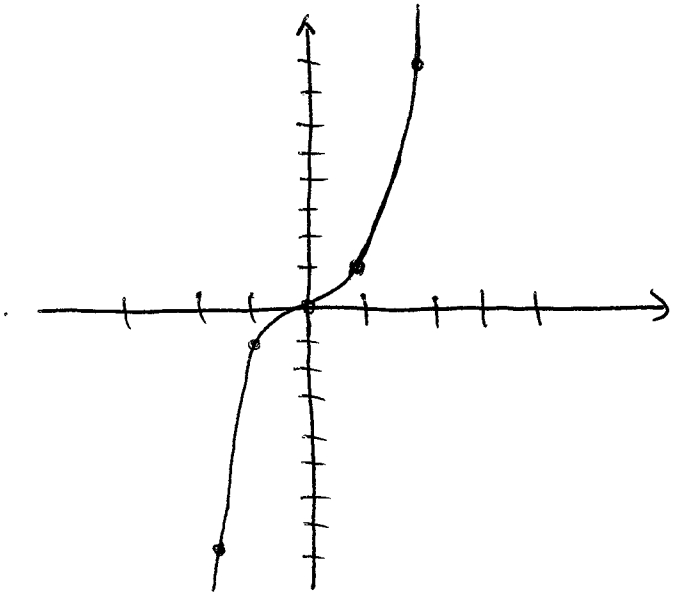


Other polynomials

x^2 looks like this:

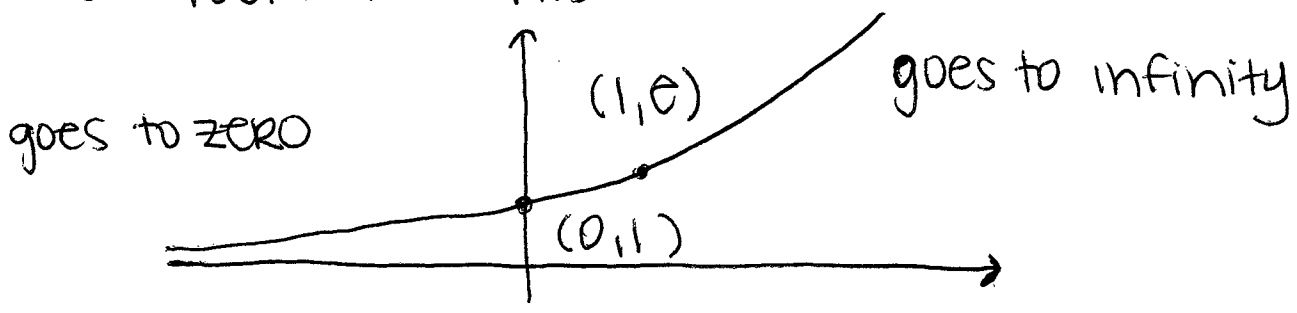


x^3 looks like this:

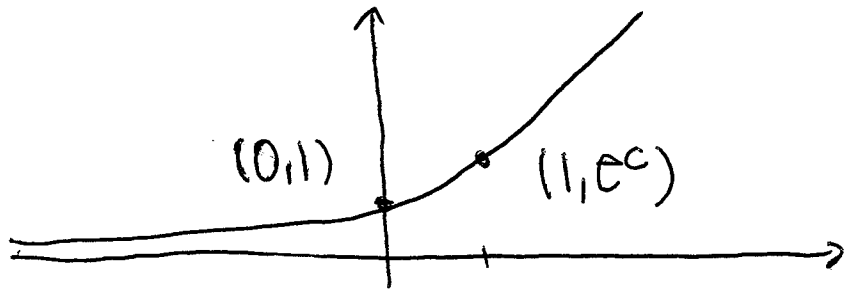


Exponentials

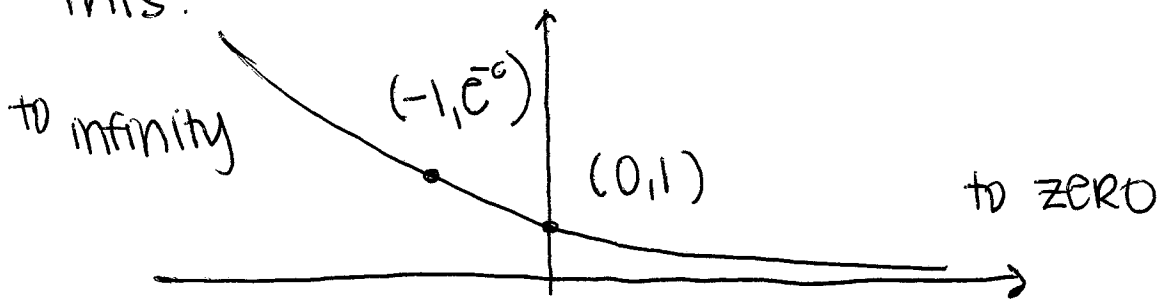
e^x looks like this:



FOR any number $c>0$, e^{cx} looks like this:

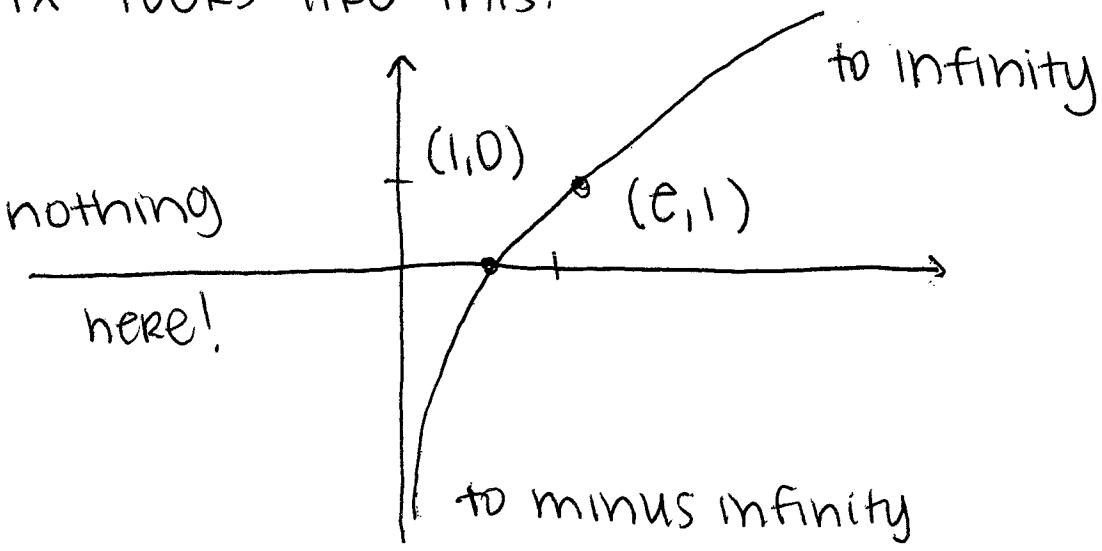


FOR any number $c<0$, e^{cx} looks like this:



Logarithm

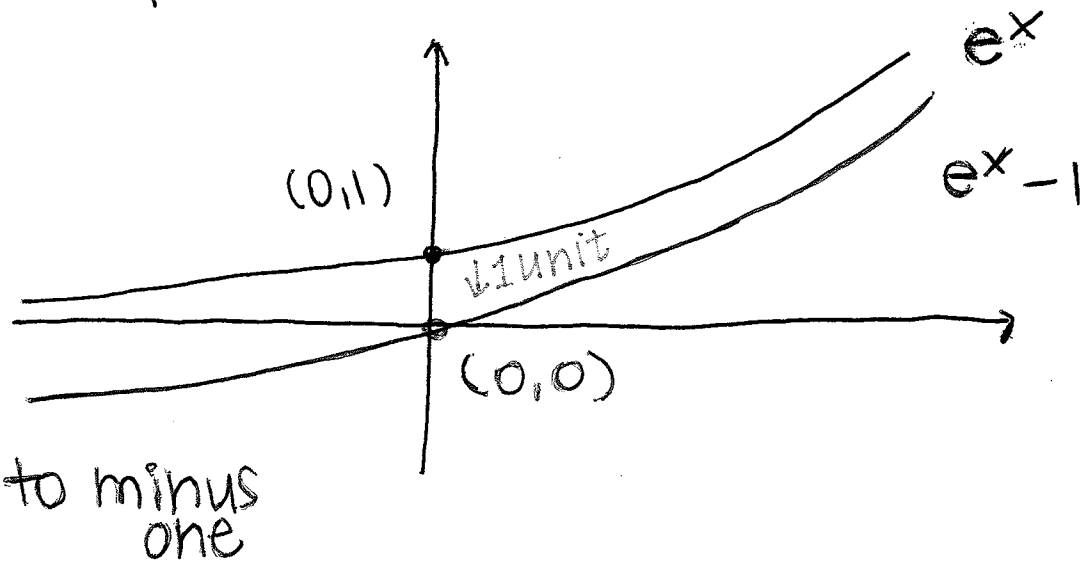
$\ln x$ looks like this:



Moving around

- up and down: adding a (positive) number to a function will move it up by that much. subtracting a (positive) number from a function will move it down by that much.

example: $e^x - 1$

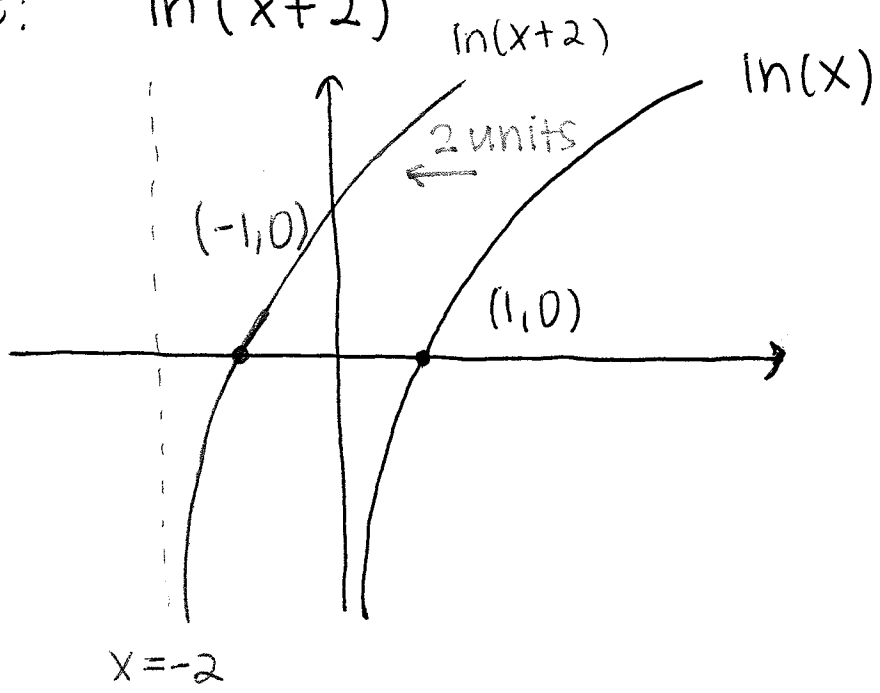


to minus one

- left and right: adding a (positive) number to x (inside the function) will move it to the left by that much. subtracting a (positive) number from x will move it to the right by that much.

(Note that this might be the opposite of what you thought.)

example: $\ln(x+2)$

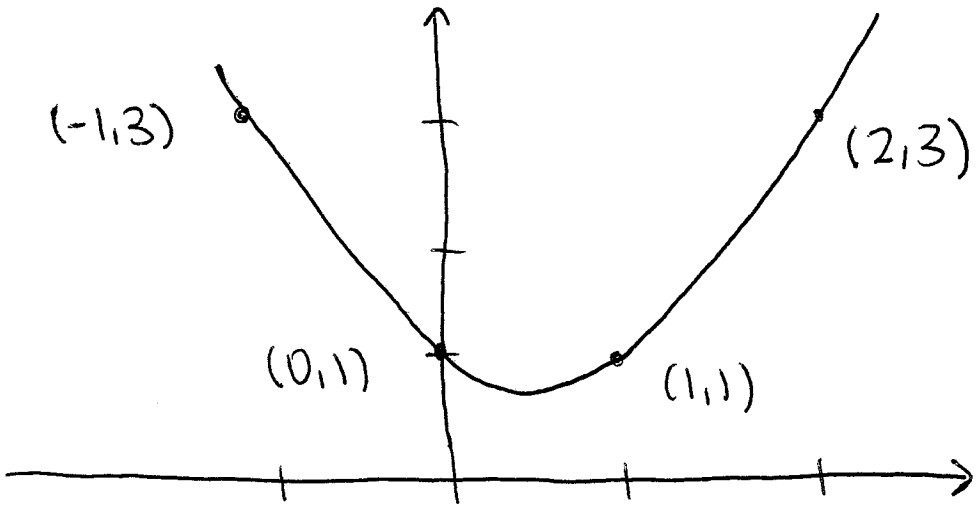


What to do when you are stuck

- plot a few points
- draw the best line you can between them

example: graph x^2-x+1 on the interval $[-1, 2]$

$x=-1$: $(-1)^2-(-1)+1=3$
$x=0$: $(0)^2-(0)+1=1$
$x=1$: $(1)^2-(1)+1=1$
$x=2$: $(2)^2-(2)+1=3$



The only tricky part is figuring out if the graph touches the x-axis between 0 and 1. To find out, I solve

$$0 = x^2 - x + 1$$

using the quadratic formula

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

So here I have $\frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(1)}}{2(1)}$

$$= \frac{1 \pm \sqrt{-3}}{2}$$

Since $\sqrt{-3}$ is not real, the graph does not touch the x-axis.