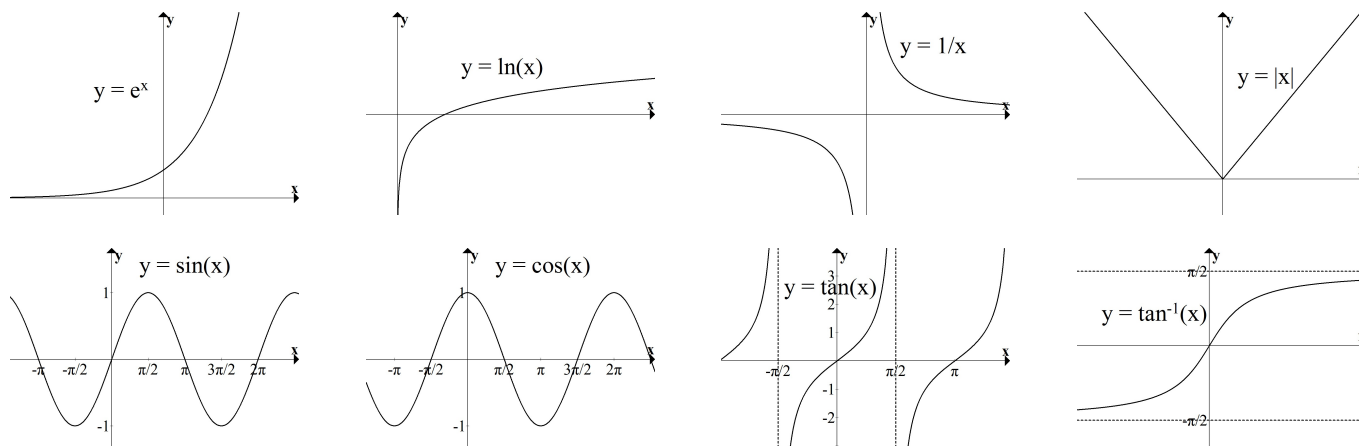# Functions and Limits Review

In order to do well in this course and before we can understand limits, we must know our basic functions. Here is a quick visual review of graphs of some functions that students sometimes forget:

On the exams, you are allowed to use what you see in these graphs. For example, by looking at the graphs you immediately know all of the following:

$\lim\limits_{x \to -\infty} e^x = 0$	$\lim\limits_{x \to \infty} e^x = \infty$	$\lim\limits_{x \to 0^+} \ln(x) = -\infty$	$\lim\limits_{x \to \infty} \ln(x) = \infty$
$\lim\limits_{x \to -\infty} \dfrac{1}{x} = 0$	$\lim\limits_{x \to 0^-} \dfrac{1}{x} = -\infty$	$\lim\limits_{x \to 0^+} \dfrac{1}{x} = \infty$	$\lim\limits_{x \to \infty} \dfrac{1}{x} = 0$
$\lim\limits_{x \to \frac{\pi}{2}^-} \tan(x) = \infty$	$\lim\limits_{x \to -\frac{\pi}{2}^+} \tan(x) = -\infty$	$\lim\limits_{x \to \infty} \tan^{-1}(x) = \dfrac{\pi}{2}$	$\lim\limits_{x \to -\infty} \tan^{-1}(x) = -\dfrac{\pi}{2}$

One Special Note:

We will make use of the particular fact $\lim\limits_{x \to 0} \dfrac{\sin(x)}{x} = 1$ (if x is in radians!).

A proof of this fact is posted on my course website and is in the book. The variable x is not important, what this says is that $\lim\limits_{BLAH \to 0} \dfrac{\sin(BLAH)}{BLAH} = 1$. So for example: $\lim\limits_{x \to 0} \dfrac{\sin(10x)}{10x} = 1$ and $\lim\limits_{x \to 0} \dfrac{\sin(31x)}{31x} = 1$.

Now if the denominator does not match the numerator, then we can do a bit of rearranging of fractions to make them match.
For example: $\lim\limits_{x \to 0} \dfrac{\sin(5x)}{x} = \lim\limits_{x \to 0} \dfrac{\sin(5x)}{x} \dfrac{5}{5} = \lim\limits_{x \to 0} 5 \dfrac{\sin(5x)}{5x} = 5 \cdot 1 = 5.$

Practice, practice, practice!:
Using the facts above along with the limit strategies discussed in class and summarized in my other review sheets, go practice your limit methods. There is a compilation of old final problems posted online, check them out. Also look at old midterm exams. Besides the departmental old exam archive, I also maintain my own archive of many old exams by me and other instructors I know, check out many, many, many old exams. You need to expose yourself to lots of different problems!