Math242 Lab 1
Exponents and Logs
Due: 1/31/11

This lab is intended to demonstrate some of the uses of wxMaxima. Please don’t hesitate to ask the TA if you have trouble getting Maxima to work – some of the input functions are very picky about how they work.

It was mentioned in class that $e$ can be expressed by the following limit:

$$\lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n$$

We will use Maxima to investigate this claim.

Start by inputting the following function (you may simply copy+paste into Maxima, then hit shift+enter):

$$f(n) := \left(1 + \frac{1}{n}\right)^n$$

1) What is the value of function $f$ when $n = 1$ (simply input $f(1)$)? What is the value of the function when $n = 3$?

2) What is the value of the function when $n = 10$? Express your answer as a decimal by right-clicking on the output line where it reads $(o%##)$ and selecting “To Float”. Alternatively, you may input $f(10.0)$.

3) To see that $f$ actually does approach $e$ as $n$ approaches infinity, it’s useful to look at the graph. Hit the “Plot 2d...” button (or use the pull-down menu “plot”). As the expression, use $f(x)$ (Note: not $f(n)$). Change the $x$-limits to graph between $x = 1$ and $x = 300$. Leave the $y$-limits as the default (Maxima will scale the graph automatically). Hit “Ok”.

Sketch the graph (you can do this by hand – I don’t need huge detail, but do label your axes).

4) How well does $f$ approximate $e$ when $n = 1000$? Input $%e = f(1000)$ (note that $%e$ is the call for $e$ in Maxima). Express your answer as a decimal.

5a) Use Maxima to take the derivative of the following function: $y = \sqrt{(x^2 + 1)(x - 1)^2}$

The proper input is: $f(x) := \sqrt{(x^2+1) * (x-1)^2}$

Use the “Diff...” button or the “Calculus” pull-down menu. Your expression should just be $f(x)$.

b) Take the derivative by hand (Suggestion: Try logarithmic differentiation).