**Mathematica  Lab II**

*(Lab report due: Wednesday, Oct 30th)*

*First read* the following sections (pp 20 – 24) of Thomas’ [An Introduction to Mathematica](http://media.pearsoncmg.com/cmg/pmmg_mml_shared/calculus/mathematica/manual/MM01.pdf).

* Built-in commands and constants
* Command options and additional plots

Submit a *printed version* of your Mathematica notebook. You may (*and are encouraged to*) work with other students and compare results, but ultimately you must submit *your own* lab results --- *not* a shared copy. On your front page (using *Mathematica*) state your name and “Mathematica Lab II” using an appropriate style, font, size and color. *Number* each problem and *restate the problem* before giving the solution. Use *Mathematica* input, not free-form input!

1. Plot the curve *y = x2 sin(1/x2)*. What happens near x = 0? What happens as

x → ∞? Justify your answers by referring to appropriate versions of your graphs. (You may wish to use *at least* two different domains to answer these questions.)

1. Let *f(x) = x4 –  x3  – 19.93 x3 + 156.567 x2 – 391.693 x + 303.242*
2. Plot y = f(x) and, using the graph, determine the *number of roots* of this polynomial. Explain how you reached this conclusion.
3. Using the NSolve command, find *all the real roots* of this polynomial.
4. Graph the curve y = |x| cos(1/x).
5. Graph the two curves y = |x| cos(1/x) and y = x/2 for *several different domains*. (Use the built-in function Abs[ ] )
6. Viewing this graph, how many solutions do you think the equation

|x| cos(1/x) = x/2 has?

1. Using NSolve, can you find a solution? What happens?
2. Using FindRoot, find 5 positive solutions.
3. Compare *logarithmic growth* with *linear growth* by plotting the two curves,

(ln x)7 and x on the same set of axes. Which function tends to infinity faster (as x → ∞)?: (ln x)7 or x?

*Note:* Be careful in choosing your domain. *Explain why your answer is correct by viewing the plot.*

1. Let *g(x) = x + 4 sin x*.
2. Find equations of the *tangent and normal lines* to *y = g(x)* at x = 4 (either by hand or using Mathematica).
3. Graph *(on the same pair of axes)* the curve y = g(x) *together with* its *tangent and normal lines* at x = 4. (You may wish to use AspectRatio→Automatic to make sure that the tangent and normal lines actually *appear to be* perpendicular.)

*If a lion could talk, we could not understand him.*

* *Ludwig Wittgenstein*

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