Calculus 101 Midterm 2
Review List, Prof. Donnay

You will be allowed one side of a 3 x 5 index card on which you can write notes for the midterm. As part of what you write, you can include formulas for area and volume that you might need in a related rates problem (ex. Volume of sphere, cylinder, cone.)

The following are the topics we have covered and that could be on the test:

S3.3: Differentiation formulas: Product, quotient.
S.3.5: Chain Rule:

Take the derivative of the following functions. You do not have to simplify.
- \( f(x) = (3x^5 - 4x^2 + 2x - 5)^8 \)
- \( f(x) = (4x^2 + 3x)(9x^7 - 6x^4 + 3x) \)
- \( f(x) = (4x^2 + 3x) / (9x^7 - 6x^4 + 3x) \)
- \( f(x) = (4x^2 + 3x)^2 (9x^7 - 6x^4 + 3x)^3 \)
- \( f(x) = (4x^2 + 3x)^3 / (9x^7 - 6x^4 + 3x)^2 \)

S3.4: Trig review, Derivatives of Trig functions.
- you should know by heart the derivatives of \( \sin(x) \), \( \cos(x) \), \( \tan(x) \). With this derivatives, you should be able to derive the formula for the derivative of \( \sec(x) \), \( \csc(x) \), \( \cot(x) \).

Take the derivative of:
- \( f(x) = \sin(3x) \)
- \( f(x) = \cos^2(7x) \)
- \( f(x) = \sin(2x) \cos(3x) \)
- \( f(x) = \tan(x^2) \)

Summary: you should be able to take the derivative of a variety of formulas and functions in which several rules might be used in one problem.

3.7: Rates of change in physical problems.
3.8: Related rates. (This is an application of the Chain Rule).
3.9: Linear Approximations: be able to write the linear approximation function \( L(x) \) for a function \( f(x) \) based at a point \( x_0 \). Use the linear approximation to estimate the value of \( f(x) \) for \( x \) near \( x_0 \). There will not be problems involving differentials on this midterm.

S. 4.1 Max/Min of Function (Extreme value Theorem: A continuous function on a closed interval attains its absolute max and min).
- Understand the difference between a local min/max and an absolute max/min.
- Be able to find the local and absolute max/min from a graph
- Be able to find the absolute max/min of a function on a closed interval (find critical points, compare value of function at critical points to value of function and endpoints).

S. 4.3: Graphing Functions.
- Be able to graph a function using the first and second derivatives.
- Determine when a function is increasing or decreasing.
- Find critical points of function. Determine if critical points are local max/min by using the 1st Derivative Test or by using the 2nd Derivative Test.
- Determine when the function is concave up or concave down.
- Determine points of inflection.
- Put all this information together to give a detailed graph of a function.

4.2 Mean Value Theorem
- Understand what the Theorem says (I will write out the Theorem on the test if there is a question about it) so that you can find a point c that satisfies the statement of the Theorem.
- From a graph, be able to draw a tangent line whose slope f’© matches the slope of the secant line between (a, f(a)) and (b, f(b)).

of functions are continuous: (make a list)