Midterm 2 Study Guide

This is meant to be a representative sampling of the key concepts you will need to know, and it is not meant to be exhaustive. You should make sure that you are comfortable with all practice problems and homework assignments.

1. Problems involving exponential growth/decay.
2. How do we find the half-time/doubling-time?
3. What are all the different indeterminate forms? Explain why they are indeterminate (for instance can you provide two simple examples of 0/0 forms that have different limits?)
4. What does L'Hopital's rule say? What are the conditions for its application?
5. How do we bring other indeterminate forms to a form that can use L'Hopital's?
6. Use L'Hopital's.
7. Growth notation (double less-than) for comparing behavior of functions as $x \to \infty$.
8. Define the inverse trigonometric functions by appropriately restricting the domain and range of trigonometric functions to where they are one-to-one and onto.
9. Derivatives of inverse trigonometric functions ($\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, $\sec^{-1}$). Focus especially on sine and tangent.
10. Using the triangle to find things like $\cos(\sin^{-1}(0.3))$.
11. Definitions of hyperbolic functions. Derivatives of hyperbolic functions.
12. Integration by parts, examples, when to use it.

   - Also study cases where you have to add a "times 1" term to integrate. Examples are the integrals of $\ln(x)$ and $\tan^{-1}(x)$.

13. Trigonometric integrals:

   - $\int \sin^n(x) \cos^m(x) dx$ for various values of n, m
     - Easy cases if at least one of n, m is odd
   - $\int \sec^n(x) \tan^m(x) dx$ for various values of n, m
     - Easy cases if m is odd, or if n is even.

14. Know how to compute the reduction formulas for trigonometric integrals.

Formulas you need to know:

1. Double angle formulas ($\cos(2x)$, $\sin(2x)$). Using them to handle the sin/cos integral when both n and m are even.
2. Basic trig relations (sin/cos, tan/sec).
3. Integral of $\sec x$. Integral of $\tan x$.
4. Derivatives of inverse trigonometric functions.

More theoretical questions (I will ask you some of these):

1. Know how to use the rule for the derivative of the inverse to find out the formulas for the derivatives of the inverse trigonometric functions.
2. Demonstrate how the rule for integration by parts comes from the product rule for derivatives.
3. Know how to compute the reduction formulas for trigonometric integrals.