Calculus I - Final Exam Study Guide
Fall 2011

The Final Exam is cumulative. Approximately half the final exam will cover material since the last test, and the rest will be over earlier material. Review questions on the Final Exam will be modeled after earlier exam questions.

1. Continuity and Limits from a Graph - Estimate limits from a graph. Discuss the continuity of a graph (does the limit exist? is it equal to the function? is the discontinuity removable?)
See Exam 1 page 1 and page 5, the Exam 1 study guide, section 2.2 #'s 1-4, section 2.4 #'s 1-4, and section 2.5 #'s 1-10.

2. Limits from the Formula - Compute limits of functions by algebraic manipulation (if possible) or by using l'Hopital's Rule (if it applies).
See Exam 1 page 2, study guide for Exam 1, section 2.2 #'s 11-41, section 2.6 #'s 13-21, and section 4.5 #'s 1-20.

3. Differentiation - Know the limit definition for the derivative.
See Exam 2 problem 1, study guide for Exam 2, and section 3.2 #'s 1-6.

4. Differentiation - Compute derivatives using differentiation rules (power rule, product rule, quotient rule, and chain rule), and the derivatives of trigonometric functions, exponential functions and logarithms.
See Exam 2 problems 4 and 5, the study guide for Exam 2, and (essentially) all Ch. 3 homework problems.

5. Tangent Lines - Write the equation of the tangent line to the graph of a function. Use the linearization of a function at a point (the equation of the tangent line) to approximate values of the function near by.
Exam 3 problem 2 and section 3.11 #'s 1-12.

6. Use a number line sign chart for the first and second derivative to find intervals of increase and decrease, maximum and minimum points, intervals of concavity (up and down), and inflection points.
Exam 3 problem 4, section 4.4 #'s 9-50.

7. Given the graph of a function, sketch the graph of the derivative. Given the graph of a function, sketch the graph of its anti-derivative. Given number line sign charts for the derivative of a function, sketch the function.
Exam 2 page 5.

8. Modeling and Optimization - Find an equation of one variable describing the quantity we wish to maximize or minimize. Use the derivative to find the max/min point.
Homework from section 4.6, Exam 3 problem 5, and study guide for Exam 3.

9. Related rates problems -
Exam 3 problem 1 and section 3.10 homework.
10. Integration - Compute the following integrals

\[ \int_{-1}^{1} (2x^3 - 3x + 5)\,dx \] \[ \int \left( \frac{\sqrt{x}}{2} - \frac{2}{\sqrt{x}} \right)\,dx \]

\[ \int_{-\pi}^{2\pi} -2 \cos(x)\,dx \] \[ \int \frac{x\,dx}{\sqrt{x^2 + 7}} \]

\[ \int x^3 \sin(x^4 - 5)\,dx \] \[ \int \frac{1}{x^3} \cos \left( \frac{1}{x} \right)\,dx \]

\[ \int_{-2}^{0} (2x - 3)\,dx \] \[ \int_{0}^{\pi} (\cos(x) + \sin(x))\,dx \]

\[ \int_{0}^{1} t \sqrt{t^2 + 1}\,dt \] \[ \int e^{3x} - \frac{1}{x}\,dx \]

\[ \int_{0}^{\pi} \sin(x)e^{\cos(x)}\,dx \] \[ \int \frac{x\,dx}{1 + x^2} \]

11. Find the area under the curve

(a) \( y = \sin(x)e^{\cos(x)} \) between \( x = 0 \) and \( x = \frac{\pi}{2} \).

(b) \( y = x^3 - 5x + 20 \) between \( x = -2 \) and \( x = 2 \).

12. Find the area between the curves, like in section 5.6 #’s 47-62.