1.1 WHEN AND WHERE

When: Monday, December 16th at 5:30pm
Where: DSC 164 (our usual room)

1.2 WHAT WILL BE ON THE FINAL

The final will be approximately 20 questions, with 60% of the questions coming from previous material (Chapters 2-4) and 40% coming from material since Exam #4 (Section 4.8 & Chapter 5). Specifically, the test should have the following (approximate) breakdown:

- Chapter 2 | Limits & Continuity - 4 questions
- Chapter 3 | Differentiation - 4 questions
- Chapter 4 | Applications of Differentiation - 4 questions
- Chapter 5 | Integration - 8 questions

1.3 HOW TO STUDY

The best thing to do to study for a math test is do lots of problems. I would make three recommendations:

(1) Try to do the problems on your old tests, especially those that you got wrong the first time around.

(2) Do the practice finals. While these are a bit longer and more difficult than the actually final will be, if you can understand these problems you should do well on the final.

(3) Ask questions if you’re really stuck. Don’t hesitate to stop by my office hours or email me with questions.
2.1 ONE-SIDED & TWO-SIDED LIMITS

(a) Know how the how one-sided and two sided limits are related, specifically that the two-sided limit at a point exists if and only if the left and right-hand limits at the point exist and are equal.

(b) Know how to determine the one-sided or two-sided limit of a function at a given point from either a table of values or the graph of the function near the point.

2.2 LIMITS AT INFINITY

(a) Be able to determine the limit of a rational function (a function of the form \(\frac{P(x)}{Q(x)}\), where \(P(x)\) and \(Q(x)\) are polynomials) as the variable approaches \(\pm \infty\).

2.3 LIMIT RULES

(a) Know the limit rules (See pp. 65, 91).

(b) Know how to use the Sandwich Theorem for both limits at real numbers and at \(\pm \infty\).

2.4 CONTINUITY

(a) Know what it means for a function to be left and right continuous at a point.

(b) Know and be able to use the continuity test (See p. 105) to determine if a function is continuous at a given point.

(c) Know the properties of continuous functions (See p. 107).

(d) Be able to determine the removable discontinuities of a given function.
DIFFERENTIATION

3.1 THE DERIVATIVE

(a) Be able to state the limit definition of the derivative of a function.

(b) Know the how to take the derivative a function. Specifically, be comfortable with:

(i) The Generalized Power Rule

(ii) The Sum & Difference Rule

(iii) The Product Rule

(iv) The Quotient Rule

(v) The Chain Rule

(vi) The Rules for Trigonometric Functions

(vii) The Rule for Exponential Functions

(viii) The Rule for Logarithmic Functions

3.2 THE GRAPH OF THE DERIVATIVE

(a) Be able to identify the graph of the derivative of a function from the graph of the function.

(b) Be able to determine the points at which a function is not differentiable by looking at its graph.

(c) Be able to determine the equation of the line tangent to the graph of function at a given point.
APPLICATIONS OF DERIVATIVES

4.1 INCREASING, DECREASING & LOCAL EXTREMA

(a) Know what critical points are and be able to determine them.

(b) Be able to determine the intervals on which a function is increasing and decreasing using either the first derivative of the function or its graph.

(c) Be able to determine the local extrema of a function by using its first derivative or by looking at its graph.

4.2 ABSOLUTE EXTREMA

(a) Know the relationship between absolute extrema and local extrema.

(b) Be able to determine the absolute extrema of a function by using its first derivative or by looking at its graph.

4.3 MEAN & EXTREME VALUE THEOREMS

(a) Be comfortable applying the Extreme Value Theorem (EVT) and Mean Value Theorem (MVT).

4.4 CONCAVITY

(a) Be able to determine the intervals on which a function $f$ is concave up and concave down using either $f''$ or the graph of $f'$ or $f''$.

(c) Be able to determine the inflection points of a function by using its second derivative or by looking at the graph of its first derivative.

4.5 APPLIED OPTIMIZATION

(a) Be able to solve basic optimization problems.
5.1 THE INDEFINITE INTEGRAL
(a) Understand what the indefinite integral of a function is.
(b) Know the integration rules and general antiderivatives given in section 4.8 and be able to use them.
(c) Know how to solve initial value problems.

5.2 THE DEFINITE INTEGRAL
(a) Be sure you understand the difference between the indefinite integral of a function and the definite integral of the function over an interval.
(b) Know and feel comfortable using the properties of definite integrals given in section 5.3, i.e. order of integration, zero width integral, constant multiple rule, etc...
(c) Understand what the definite integral of a function over an interval is telling you in terms of area between the graph and the \( x \)-axis.
(d) Be able to determine the definite integral of a function over an interval given the graph of the function over that interval (a graph with a simple shape whose area can be determined).

5.3 THE FUNDAMENTAL THEOREM OF CALCULUS
(a) Know both parts of the statement of the Fundamental Theorem of Calculus.
(b) Be able to determine the derivative of a function defined in terms of a definite integral using the FTC part 1, i.e. be able to determine the derivative of \( f(x) \), when

\[
f(x) = \int_{g(x)}^{a} h(t) \, dt
\]

(c) Be able to use the FTC part 2 to determine the definite integral of a function over an interval.
5.4 SUBSTITUTION

(a) Know how to use u-substitution to determine the indefinite integral of a function when the integration formulas from section 4.8 do not apply.

(b) Know how to use u-substitution to determine the definite integral of a function over a given interval.

5.5 AREA BETWEEN CURVES

(a) Be able to determine the area between two curves over a specified interval.