Overview of the Exam

Generally speaking, the length of the exam is about 1.5 times the length of the previous exams, even though we are given double to amount of time to finish. A good way to study for the exam is to first go over your old exams, then go over the quizzes, then start the overall review.

As usual, you will not be allowed a calculator on the exam. I will also provide one page (both sides) of formulas that you may use, and so you should use them in your review to get familiar with what will be on it.

Chapter 1 Topics

- Find the domain of a function. Be able to compute the equation of a line, and be able to factor a quadratic polynomial. Use a sign chart to determine where a product or quotient is positive or negative.
- Be able to apply the rules of exponents and logarithms.
- Recall the definitions of the 6 trigonometric functions, and be able to compute them for angles on the unit circle (or equivalently, for our two special triangles).
- Understand what inverse functions are, and be able to compute them algebraically and graphically. Work with the inverse sine and tangent functions.

Overview of Calculus I

Calculus I has 4 main themes: The Limit, Continuity, the Derivative, and the Antiderivative (and FTC). The "big theorems" of Calculus I are the three "value theorems" and the Fundamental Theorem of Calculus (both parts). Additionally, we discussed how to apply the derivative to "story problems", resulting in "related rates" and optimization problems.

The Limit

1. Algebraic Methods. In particular, recall that we can "divide by a power of x", "multiply by a conjugate", l'Hospital's rule. Understand its use in finding vertical and horizontal asymptotes.
2. Understand when heuristics can be used, or when a form is indeterminant. If a form is indeterminant, know how to manipulate it to a form we can analyze- For l'Hospital's rule, we looked at the limit of $f(x) \cdot g(x)$ and $f(x)^{g(x)}$.
3. Be able to apply the limit laws.

Continuity

Check to see if a function is continuous using the definition. Understand the difference between continuity and differentiability.

The Derivative

Be able to compute f' using the definition. Be able to apply the rules of differentiation. Understand the meaning of "differentiable" and higher order derivatives.

Theorems

Understand Rolle's Theorem. Understand the three "value" theorems: Intermediate, Extreme and Mean. Be able to apply them under the right circumstances.

Main Applications

1. Understand what linearization is, and be able to compute the equation of the tangent line under different circumstances.
2. Optimization. Critical points, first and second derivative tests. Closed interval test. Be able to analyze where the first derivative is positive/negative (using "sign charts" typically).
3. Related Rates.
4. Problems involving velocity and acceleration. Find where a function is inc/dec, concave up/down.

Antiderivatives

- Know the properties of the antiderivative and some basic antiderivatives (Table 2, p 345). The exceptions are the hyperbolic sine/cosine, which we have not covered ($\sinh(x), \cosh(x)$).
- Be able to find the antiderivative both algebraically (ex 1-22, 25-48) and graphically (51-54).
- Be able to solve some physics problems using acceleration, velocity, displacement, and distance. If you need the acceleration due to gravity (9.8 m/s^2), I will provide that. (Examples 6, 7. Exercises 59-65, 69).

The Integral

- Know the definition of the definite integral, and how to compute it using right endpoints:

$$\int_a^b f(x)\,dx = \lim_{n\to\infty} \sum_{i=1}^{n} f(x_i^*)\Delta x = \lim_{n\to\infty} \sum_{n=1}^{\infty} f\left(a + i\frac{b-a}{n}\right)\,\frac{b-a}{n}$$

  This defines the definite integral as "the area under a curve" (or net area, if f is sometimes negative).
- Properties of the definite integral (starts p 379). I won't ask you these specifically, but you should be able to use these in evaluating the integral.
- Given a definite integral, write the appropriate Riemann sum.
- Given a Riemann sum, be able to convert it to a definite integral.
- Evaluate the definite integral graphically or using geometry.
- Know the Fundamental Theorem of Calculus, both parts. In particular,
  - Be able to apply the FTC to evaluate the derivative, and to evaluate definite integrals.
  - Be able to differentiate an integral with functions as bounds.
- Understand the difference in notation:

$$\int f(x)\,dx \qquad \int_a^x f(t)\,dt \qquad \int_a^b f(x)\,dx$$

- The integral as antiderivative (the indefinite integral, the FTC)
  - Integrate using the table (that we've memorized)
  - Simplify first, then integrate.