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. You might note that they way we weigh the exam is equal to the previous exams, unless you do better on the final exam than the lowest scoring exam- Then the final exam is weighted as an exam and a half (and the low scoring exam is weighted as half).

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

Know the definition and be able to apply it explicitly. Understand the difference between continuity and differentiability.

The Derivative

1. Know the definition and be able to compute f' using the definition. Memorize the standard table of derivatives. Understand the usual rules of differentiation (product, quotient and chain rules), with logarithmic and implicit differentiation. Be able to differentiate an inverse function.
2. 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.

Section 4.9

- 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 $\mathrm{m/s^2}$), I will provide that. (Examples 6, 7. Exercises 59-65, 69).

Appendix E

Introduced sigma notation for sums. Be able to write a sum using sigma notation, given sigma notation, write the sum. Know the formulas:

$$\sum_{i=1}^{n} 1 = n \qquad \sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

Sections 5.1, 5.2

- 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).
- For what functions are we guaranteed that the definite integral exists (as a limit)? If f is continuous, or has only a finite number of jump discontinuities. (This is Theorem 3, p 373).
- Properties 1-8 of the Integral (starts p 379). The two middle equations in the middle of p 379: I won't ask you these specifically, but you should be able to use these in evaluating the integral.
- Be able to write the Riemann sum for a definite integral, then evaluate the sum and limit (ex 21-25, 27).
- Given a Riemann sum, be able to convert it to a definite integral (ex 17-20).
- Evaluate the definite integral graphically or using geometry (ex 33-34, 51-52, 53).

Section 5.3, 5.4, 5.5

- Know the Fundamental Theorem of Calculus, both parts. Be able to apply the FTC to evaluate the derivative, and to evaluate definite integrals.
- 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.
  - u, du substitution (like 1-21 in 5.5).