Math 231, Section U1
Exam 1 Checklist
Sections 6.1-7.1 (excluding 6.5)

Introduction
This is an outline of material I expect you to know for Exam 1. Details are omitted, but it should give you a good idea of what to concentrate on. Problems from the quizzes, examples in class and the problems from the homework should also give you a good idea of what material will be covered on the test. To prepare for the test, you should get lots of practice and be sure you understand why you are doing what you are doing! Get help ASAP if you need it. (Obviously, you also are expected to know prerequisite material from Geometry, Algebra, Trig and Calculus I, such as the trig identities, algebra techniques, common antiderivative rules and the Fundamental Theorem of Calculus.)

Section 6.1: Review of Formulas and Techniques
Know:

- the common antiderivative formulas
- how to do substitution
- how to do a definite integral by substitution
- how to complete the square in order to make an integral easier.

Section 6.2: Integration by Parts
Know:

- the integration by parts formula (formula 2.1) and HOW TO DERIVE IT from the product rule
- how to use the integration by parts formula
- how to do problems where you must apply IBP multiple times (e.g. Example 2.4)
- how to do problems "with a twist" like the one in Example 2.5
- how to do a definite integral via IBP (Example 2.7)
- what a reduction formula is, and how to use it (you need NOT memorize any specific reduction formulas)

Section 6.3: Trigonometric Techniques of Integration
Know:

- trig identities (pythagorean, half angle, $\sin 2x = 2\sin x \cos x$ etc) and how to use them to do

- integrals of the form $\int \sin^m x \cos^n x \; dx$, $\int \tan^m x \sec^n x \; dx$ and $\int \cot^m x \csc^n x \; dx$
- how to integrate $\int \sec^3 x \; dx$ (start with integration by parts, you need NOT memorize the reduction formula we proved on HW 3)
- how to integrate $\int \sec x \; dx$ (and by extension $\int \csc x \; dx$)
- how to do trigonometric substitution, INCLUDING what interval to pick for the θ and WHY
- how to put your answers in terms of the original variable at the end of a trig substitution problem (reference triangles or algebraic methods)
- how to do definite integrals via trig substitution

Section 6.4: Integration of Rational Functions Using Partial Fractions
Know:

- how to find the partial fractions decomposition of a rational function where the degree of the numerator is less than the degree of the denominator
- how to use polynomial long division (or some other polynomial division technique) in the case that the degree of the numerator qreater than or equal to than the degree of the denominator
- how to integrate the terms of the resulting partial fractions decomposition (often you must use substitution, or complete the square or do other algebra...look at examples!)
- There is a brief summary of integration techniques at the end of this section. Given an arbitrary integral, the goal is to be able to recognize which technique(s) might lead to a solution, because on the exam I may not tell you which technique to use. Practice, Practice, Practice!

Section 6.6: Improper Integrals
Know:

- how to tell if an integrand is continuous on a given interval
- the several different kinds of improper integrals (with discontinuities in the middle, and/or on either end of the interval, and where one or both of the limits of integration is ∞) and how to recognize them
- how to calculate an improper integral, and what it means for an improper integral to diverge, what it means for an improper integral to converge
- specifically, Definitions 6.1, 6.2, 6.3 and 6.4 (you don't need know them word for word, but you must be able to remember/paraphrase and USE these definitions)
- What the Comparison Test is (Theorem 6.1, this one, you should memorize) and how to use it!

Section 7.1: Modeling with Differential Equations
Know:

- what a differential equation is
- how to find the general solution of simple differential equations like $y' = 3$, and how to find a specific solution given an initial condition
- how to find the general solution to the differential equation $y' = ky$ (k here is called the growth constant if it is > 0, and the decay constant if it is < 0)
- how to find a specific solution to the differential equation $y' = ky$ given an initial condition
- what is exponential growth, what is exponential decay, what do the associated differential equations look like and what is the general form of a function with exponential growth/decay
- how to PROVE that the general solution to $y' = ky$ has the form $y(t) = Ae^{kt}$
- what is meant by half-life, doubling time and compound interest, and how to calculate them
- how to do the suggested word problems