Mathematics 136, section 2 – Advanced Placement Calculus
Review Sheet for Exam 2
October 27, 2009

General Information

The second exam for the course will be given at 7:00pm next Wednesday evening, November 4, as announced in the course syllabus. It will cover the material from Chapters 4 and 5 in the text that we have discussed starting from immediately before the first exam through and including the material from Wednesday, October 28 on the table of integrals. (This is also almost exactly the material from Problem Sets 4, 5, and 6.) There will be 4 or 5 problems, some possibly with several parts. The format will be similar to that of the first exam.

Topics to be Covered

1. Critical points, local maxima and minima, global maxima and minima on an interval. First and Second Derivative Tests. Using f' and f'' to sketch $y = f(x)$.
2. Indeterminate form limits and L'Hopital's Rule.
3. Applied optimization problems.
4. Riemann sums, the definite integral of a function over an interval $[a, b]$. The definite integral as "signed area." Be prepared to compute a Riemann sum for a particular function and a given number of subdivisions (small, of course!) Also know how to derive the exact value of a definite integral of a function $ax^2 + bx + c$ by taking the limit of the Riemann sums. The summation formulas for $\sum_{i=1}^{n} i$ and $\sum_{i=1}^{n} i^2$ will be provided.
5. The Fundamental Theorem of Calculus (know the statement of this theorem – both parts)
6. Methods of integration, including substitution, integration by parts, trigonometric substitution, partial fractions, use of the table of integrals.

Review Session

We will review for the exam in class on Tuesday, November 3.

Suggested Practice Problems

- From Review Problems for Chapter 4: 1,3,7,25,27,29,31,39,45,47,51,57,63
- From Review Problems for Chapter 5: 1,2,9-34,39,41
- From Section 5.7/15,17,21,23,25,27.

Sample Exam – Note the real exam will contain different questions, and possibly different types of questions. The actual exam will be about this length.

I. (15) In an alternate universe, the "super-attractive" force exerted by two objects of mass m_1, m_2 is *directly* proportional to the square of the distance between them: $F = Sm_1m_2r^2$, where S is a constant and r is the distance between the masses. Two 1kg masses are fixed at points $x = -1$ and $x = 3$ respectively along a straight line in this alternate universe. At what location x along that line should a third 2kg mass be placed to *minimize* the sum of the super-attractive forces exerted on it by the two unit masses?

II. (15) Evaluate $\lim_{x\to\infty}\left(1 - \frac{3}{x}\right)^x$.

III. (10) In a car moving at 90 ft/sec, the driver suddenly saw an obstacle 400 feet ahead and braked to a stop in 10 seconds. The car's velocity was recorded by a sensor in its onboard computer every two seconds:

t (sec)	0	2	4	6	8	10
$v(t)$ (ft/sec)	90	75	50	25	5	0

Can you say for sure from the information here whether the car hit the obstacle or not? Explain, using the left- and right-hand Riemann sums for $v(t)$.

IV.

A) (10) Using the definition of the definite integral (not the Evaluation Theorem), determine $\int_1^2 x^2 + 3x + 1\ dx$. (Possibly useful information:

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2} \qquad \sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}.)$$

Check your answer using the Evaluation Theorem.

B) (10) What is $\frac{d}{dx}\int_1^{x^2} \frac{\sin(t)}{t}\ dt$?

V. Methods of integration. In B,C,D you may use the table of integrals provided.

A) (10) Using integration by parts, show that

$$\int x^n \cos(ax)\ dx = \frac{x^n}{a}\sin(ax) - \frac{n}{a}\int x^{n-1}\sin(ax)\ dx.$$

B) (10) $\int \tan(\sqrt{x})/\sqrt{x}\ dx$

C) (10) $\int (3x+2)/(x^2+8x+7)\ dx$

D) (10) $\int (4-x^2)^{-3/2}\ dx$