Fall 2004 Calculus I, sections 4, 5, 6, Courant Institute of Mathematical Sciences, NYU.

Homework 8, due November 7

Self check (not to hand in, answers are in the back of the book):

Section 5.5: 1, 3, 5, 9, 11.

Section 5.6: 3, 5, 13, 19, 25, 35, 39.

In all integrals, check the result by differentiation. The answer is incomplete without this.

To hand in:

Section 5.5: 2, 8, 16, 30.

Section 5.6: 4, 8, 14 (do 13 first), 20, 30, 36, 42

In all integrals, check the result by differentiation. The answer is incomplete without this.

More problems (to hand in)

Problem: After the fiasco at this year's Super Bowl half-time show, people started phoning in complaints[1]. The number of calls per minute had the form $r(t) = \dfrac{1}{(a+bt)^2}$. They received 100 calls in the first minute, which, within the accuracy of this model, is the same as saying that the call rate at time $t = 0$ was 100 calls/minute. At minute 60, the call rate was down to 25 calls/minute. Estimate the total number of calls they received.

Hints: If the number of calls per minute were constant, we could calculate the number of calls received between time $t = 0$ and time $t = T$ by multiplying the rate (calls per minute) by the time elapsed (number of minutes). Here, the rate is changing, so we have to integrate to get the number of calls from the rate of calls.

To find the antiderivative of $1/(a + bt)^2$, try differentiating $1/(a + bt)$ and see how you have to correct this to get $1/(a + bt)^2$. You can estimate the number of calls received between time $t = 0$ and time $t = T$ by

$$\int_0^T r(t)dt.$$

To estimate the total number of calls received, you take a limit. Note that the limit will be a simpler number than the integral to time T. Also, it seems to be a little simpler to perform the integral with the general constants a and b and plug their values in after taking the limit. The values of a and b can be determined from the given call rates at $t = 0$ and $t = 60$.

[1] This part is true, but the quantitative part is somewhat fictionalized