Exam 3 Calculus 1 12/5/2003

Each problem is worth 10 points. Show adequate justification for full credit. Please circle all answers and keep your work as legible as possible.

1. Given the following table of data on the velocity (in feet per second) of the space shuttle t seconds after liftoff, give a low and a high estimate of the height of the shuttle after ten seconds. Explain why you think one estimate is high and the other low.

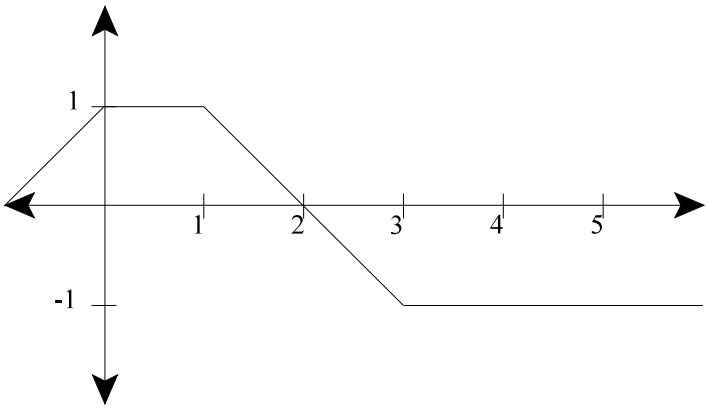
t	v(t)
0	0
2	33
4	68
6	108
8	147
10	185

2. Find $\int \left(x^2 + \frac{1}{x} + \frac{1}{x^4} \right) dx$.

3. Given the graph of g(x) shown at right, what are:

(a) $\int_0^1 g(x)\,dx$

(b) $\int_0^5 g(x)\,dx$



4. If $F(x) = \int_3^x \sqrt{1+t^3}\,dt$, what is $F'(x)$?

5. Find an antiderivative $F(x)$ of the function $f(x) = 6x^2 - 3$ for which $F(0) = 4$.

6. What is the **average value** of the function $g(x) = \sin x$ on the interval from $x = 0$ to $x = \pi$?

7. Jake is a calculus student at a large university and he's frustrated. Jake says "This sucks so bad. Math is supposed to just be numbers, and our sucky book keeps asking things with words. I'm an engineering student, I'm not supposed to have to be able to read. So anyway, there's this question about this metal rod, and it's, like, bigger at one end than the other, so like more kilograms, right? And we're supposed to say what it means to do an integral of it from zero to two. What kind of crap is that? I just wanna work out an answer, not understand it. This touchy-feelie crap just pisses me off."

Explain clearly for Jake what the integral of a density function might tell us about a metal rod **and why**.

8. If $\int_0^b x^2\,dx = 2$, what is the exact value of b?

9. Jon's sink has developed a drip. Ten days ago it was dripping at a rate of one gallon each day. Now it's dripping two gallons per day. Assuming that the rate of the dripping has increased linearly, how much water has dripped over the last ten days?

10. We worked out in class that if a car is traveling 88 ft/sec and brakes (with constant deceleration) to a stop in 4 seconds, then it travels 176 feet while coming to a stop.
(a) If instead the initial velocity is 110, but still can decelerate at 22 feet/sec^2, how far will the car travel before coming to a stop?

(b) If we just know that the car is traveling v_0 feet/sec when the brakes are first applied, but still can decelerate at 22 feet/sec^2, what distance (in terms of v_0) will it travel while coming to a stop?

Extra Credit (5 points possible):

Evaluate $\lim_{x\to 3}\left(\frac{x}{x-3}\int_3^x \frac{\sin t}{t}\,dt\right)$.