Mathematics 133 – Intensive Calculus for Science 1
Sample Exam II – October 28, 2005

I. The following graph shows *the derivative* $y = f'(x)$ for some function $f(x)$.

A) (15) Using the information here, construct a "qualitative" plot of $y = f''(x)$.
B) (10) Over which intervals is f increasing?
C) (5) Is f' continuous at $x = 1$? Why or why not? What happens on the graph $y = f(x)$ at $x = 1$?

II.
A) (10) The function $H(t)$ gives the number of hours of daylight t days after the start of the year in Worcester. At $t = 304$ days (October 31 in a non-leap year), $H'(304) = -0.083$. Give the meaning of this equation as a sentence, using appropriate units.
B) (10) The table below gives the position s (in miles) of a freight train moving along a straight line track as a function of time t (in hours).

t	.5	1	1.5	2	2.5
s	10	25	42	50	55

Estimate the train's instantaneous velocity at $t = 1.5$ hours as closely as you can from this information.

III. (15) Using the limit definition, find $f'(x)$ for $f(x) = 1/x$.

IV. Find derivatives of each of the following functions by applying the appropriate "short-cut" derivative rules:

A) (10) $f(x) = 5x^7 - \frac{3}{\sqrt{x}} - 4^{2x}$

B) (10) $g(x) = (x^2 + 1)^{12} 2^x$

C) (10) $h(x) = \frac{x^2}{e^x - 1}$

V. (5) Say whether the following statement is true or false, and explain your reasoning: If the time interval is short enough, then we expect the average velocity of a car over the interval will be close to its instantaneous velocity at any time in the interval.