Department of Mathematics
The Ohio State University

Autumn Quarter 2005
H. Lehr

Math 151A : Calculus and Analytic Geometry I
Midterm Exam #2 (November 2, 2005)

Name: _____

Social Security Number: _____

Recitation Instructor: _____ Recitation Hour: _____

Please read each problem carefully, and indicate answers as directed. Your solutions **must** be supported by calculations or explanations, unless specified otherwise. *No points will be given for answers that are not accompanied by, or are not consistent with, supporting work. Partial credit can be earned for steps that make reasonable progress towards a solution.*

CHOOSE FOUR OF THE FIVE PROBLEMS. INDICATE BELOW WHICH PROBLEMS YOU INTEND TO HAVE GRADED BY MARKING AN X THROUGH THE NUMBER THAT YOU DO NOT WANT.

Problem #	Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	
Total	40	

1. Let $h(x) = 3^x - 4x$.

   (a) [6 points] Find the equation of the tangent line to $f(x)$ at $x = 1$.

   (b) [4 points] Is there a value of x at which the tangent to f is a horizontal line?

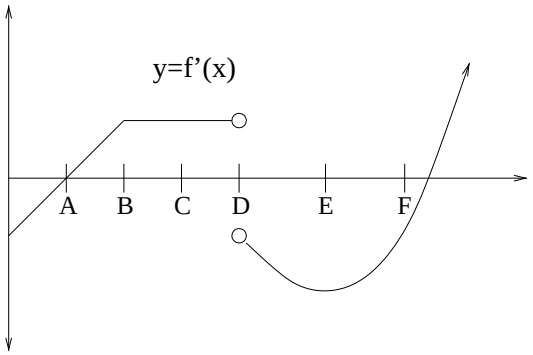
2. Suppose that $P(m)$ is the productivity of a small family farm (measured in bushels of produce) given that they have applied m tons of fertilizer to their fields. After several years of collecting data, they noticed that the productivity seems to follow the formula $P(m) = -4m^2 + 16m$.

   (a) [4 points] Use the definition of the derivative (no shortcuts!) to compute $P'(m)$.

   (b) [4 points] Compute and explain what $P'(1)$ and $P'(3)$ mean in practical terms.

   (c) [2 points] Is there an amount of fertilizer that gives a maximum productivity?

3. Below is a graph of $f'(x)$ [NOTE! the graph is of f' not f!]. For each of the following multiple choice questions, circle the one correct answer. The choice DNE means that the indicated quantity does not exist. The choice NEI means that you are not given enough information to be able to conclude that any of the other answers must be true.



[YOU DO NOT NEED TO GIVE EXPLANATIONS FOR THIS PROBLEM]

(a) Is $f'(x)$ differentiable at $x = D$? Yes No NEI

(b) $f(x)$ at $x = E$: is increasing is decreasing is constant DNE NEI

(c) $f''(F)$: is positive is negative is zero DNE NEI

(d) Which is larger? $f(B)$ $f(C)$ they are equal NEI

(e) Is $f(x)$ continuous at $x = E$? Yes No NEI

(f) f'' on the interval (A,B): is increasing is decreasing is constant DNE NEI

(g) $f(A)$: is positive is negative is zero DNE NEI

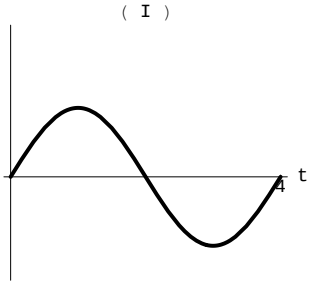
(h) Which is larger? $f''(A)$ $f''(E)$ they are equal NEI

(i) Is $f(x)$ differentiable at $x = D$? Yes No NEI

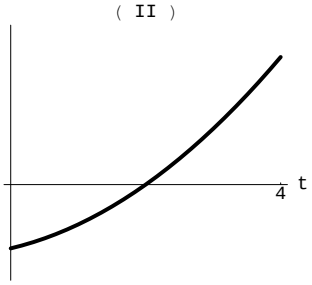
(j) $f''(B)$: is positive is negative is zero DNE NEI

4. Each of the graphs below represent the position of a particle as a function of time, with $0 \leq t \leq 4$. During this time, which particle:

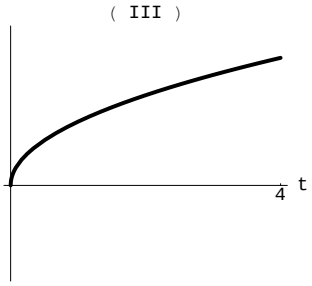
(I)



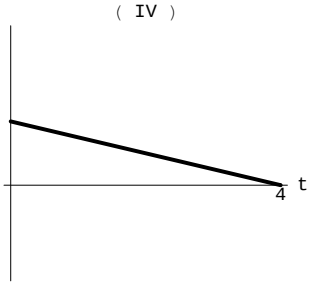
(II)



(III)



(IV)



(a) [2 points] Has constant velocity?

(b) [2 points] Is always decelerating?

(c) [2 points] Has the largest velocity at $t = 2$?

(d) [4 points] Has zero acceleration at $t = 2$ (There are two functions that satisfy this one)

5. Let f be defined as below, with a being a constant.

$$f(x) = \begin{cases} ax + 9 & \text{if } x > 1 \\ 3 & \text{if } x = 1 \\ 2\sqrt{x} & \text{if } x < 1 \end{cases}$$

(a) [3 points] Evaluate the left handed limit of f as $x \to 1^-$

(b) [3 points] Evaluate the right handed limit of f as $x \to 1^+$

(c) [2 points] Is there a value of a that makes the $\lim_{x \to 1} f(x)$ exist?

(d) [2 points] Is there a value of a that makes f continuous at $x = 1$?