Physics 121MA/Math 122PH
Fall 2001 Project 3 Name _____

Instructions: We encourage you to work with others in your assigned group on this project. You should write your solution neatly using complete sentences that incorporate all symbolic mathematical expressions into the grammatical structure. Include enough detail to allow a fellow student to reconstruct your work, but you need not show every algebraic or arithmetic step. It is important that you do your own writing, even if you have worked out the details with other people. All graphs should be done carefully on graph paper or drawn by a computer. This project is due at the beginning of class on Friday, September 21.

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1. A particle moving in the xy-plane has an acceleration given by the function

$$\vec{a}(t) = \left(\frac{1}{8}e^{\sqrt{t}} - 1\right)\hat{\imath} + 4\sqrt{t}\,\hat{\jmath}$$

with output in m/s^2 for input in s. It is known that at time $t = 1.00$ s the particle's velocity and position are

$$\vec{v}(t = 1.00 \text{ s}) = (-2.50\,\hat{\imath} + 2.00\,\hat{\jmath}) \text{ m/s and}$$

$$\vec{r}(t = 1.00 \text{ s}) = -15\,\hat{\jmath} \text{ m}.$$

   (a) Find the velocity as a function of time.

   (b) Find the change in velocity $\Delta\vec{v}$ and change in position $\Delta\vec{r}$ from the beginning to the end of the interval t : [1.00 s, 4.00 s].

   (c) Give the best representation you can for the position $\vec{r}(t)$ for the time interval t : [1.00 s, 4.00 s].

2. For each of the following, make an argument that the given function is not integrable for the given interval. Base your argument on the definition of integrable that is given in terms of limits and Riemann sums.

   (a) $f(x) = \begin{cases} 0 & \text{for } x = 0 \\ \frac{1}{x} & \text{for } 0 < x \leq 1 \end{cases}$ with domain $[0, 1]$

   (b) $f(x) = \begin{cases} 0 & \text{if } x \text{ is rational} \\ 1 & \text{if } x \text{ is irrational} \end{cases}$ with domain $[0, 1]$