Mathematics 2934-010 Name (please print) _____

Quiz 3

September 29, 2011

Instructions: Give concise answers, but clearly indicate your reasoning.

I. (15) For the vector-valued function $\vec{r}(t) = \cos(t^2)\vec{\imath} + \sin(t^2)\vec{\jmath}$, the velocity is $\vec{v}(t) = -2t\sin(t^2)\vec{\imath} + 2t\cos(t^2)\vec{\jmath}$, and the acceleration is $\vec{a}(t) = (-2\sin(t^2) - 4t^2\cos(t^2))\vec{\imath} + (2\cos(t^2) - 4t^2\sin(t^2))\vec{\jmath}$.

(a) Draw a large graph showing the curve traced out by the function for $0 \le t \le \sqrt{\pi}$.

(b) On your graph, draw the velocity vectors for $t = 1/2$ and $t = 1$ (remember that 1 radian is a little less than $\pi/3$ radians, that is, a little less than 60 degrees).

(c) Calculate the speed.

(d) Calculate the unit tangent vector $\vec{T}(t)$.

(e) Calculate the length of $\dfrac{d\vec{T}(t)}{dt}$. How is it related to the speed? Why?

(f) Calculate the tangential component of acceleration.

II. (5) At time $t = 0$, a particle is located at $(0, 1)$ and is not moving. Starting at time $t = 0$, it moves with acceleration $\vec{a}(t) = 12t^2\,\vec{\imath} - 12t\,\vec{\jmath}$. Where is it located at time $t = 1$?