Pledge:

2/15/2010 MATH361 Calculus III Name:_____
Dr. Lunsford Quiz 3 (50 Points Total)

Please show all work on this quiz.

Problem I. Given the space curve $\mathbf{r}(t) = \sin(2t)\mathbf{i} + \cos(2t)\mathbf{j} + \sqrt{5}\ t\,\mathbf{k}$ please answer the following: (18 points total)

(a) Find the unit tangent vector, $\mathbf{T}(t)$, to the curve. (6 points)

(b) Find $\mathbf{T}(\pi)$. (2 points)

(c) Find the unit normal vector, $\mathbf{N}(t)$, to the curve. (5 points)

(d) Find $\mathbf{N}(\pi)$. (2 points)

(e) Find the binormal vector $\mathbf{B}(\pi)$. (3 points)

II. Suppose the space curve has the following unit tangent and unit normal vectors at the point $(-3,4,5)$:

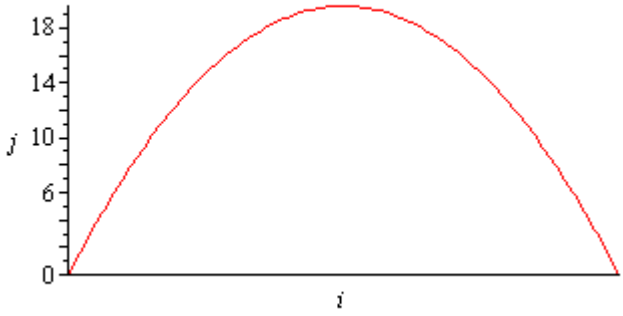
$\mathbf{T} = \left\langle \frac{1}{2}, \frac{1}{2}, \frac{\sqrt{2}}{2} \right\rangle$, $\mathbf{N} = \left\langle \frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}, 0 \right\rangle$. Please answer the following: (8 points total)

(a) Find the equation of the normal plane to the curve at the point. (4 points)

(b) Find the equation of the osculating plane to the curve at the point. (4 points)

III. A tennis ball is projected from ground level with initial velocity $\mathbf{v}(0) = 10\mathbf{i} + 19.6\mathbf{j}$ (NOTE: This should have been at t=0!) meters per second. Recall the gravity constant is $\mathbf{a}(t) = -9.8\mathbf{j}$ meters per second squared. Below you are given a graph of the position of the ball. Please answer the following: (12 points total)

(a) Find the vector equation of motion of the ball. (6 points)



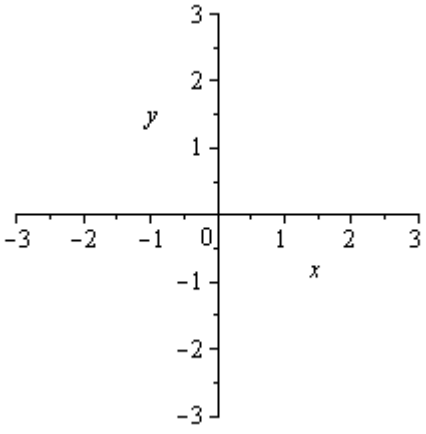
(b) At what time does the ball hit the ground? (2 points)

(c) How far does the ball travel horizontally? (2 points)

(d) What is the maximum height reached by the ball? (2 points)

IV. Given the multivariable function $f(x, y) = y - x^2$ please answer the following: (12 points total)

(a) Graph the level curves for the levels $-2, -1, 0, 1, 2$. Clearly label the curves. (6 points)



(b) Describe the graph of the function in English and attempt a three dimensional drawing of the function. (4 points)

(c) If you are on the surface of this function at the point $(1, 1, f(1,1))$ and walk in the positive x direction, will you be moving up or down the surface? (2 points)