STUDENT NAME: ______________________________

Test 1

Calculus III - MA 227 7B

February 05, 2007

Time : 50 min

Instructions

This test consists of two parts.

In Part I, your answer must be correct. No partial credit will be given. For credit to be awarded in this part you **MUST** show your work. Write your answer in the space indicated. There are 5 questions in this part, each worth 3 points, for a total of 15 points.

In Part II, give a complete answer to the question in the space provided. In this part partial credit may be awarded. There are 4 questions in this part. Question 6 is worth 5 points and Questions 7 through 9 are each worth 10 points, for a total of 35 points.

You may use the back of the pages if the space next to questions is insufficient. The back pages may also be used for scratch work. However clearly indicate so if you are using it for scratch. **Leave all test sheets stapled**.

Do NOT write in this box

Part I	________
Question 6	________
Question 7	________
Question 8	________
Question 9	________
Total	________

STUDENT NAME: ____

Part I

Write your answers in the place indicated

Question 1. Find the values of x such that the vectors $\langle 3, 2, x\rangle$ and $\langle 2x, 4, x\rangle$ are orthogonal.

Answer: ______________________

. . . .

Question 2. Find a vector orthogonal to both $\langle 2, 0, -3\rangle$ and $\langle -1, 4, 2\rangle$.

Answer: ______________________

STUDENT NAME: ____

Question 3. Find scalar equation of the plane passing through $P(1, 1, -1)$ and parallel to the YZ-plane.

Answer: ________________________

....

Question 4. The trajectories of two particles traveling through space are given by

$$\vec{r_1}(t) = \left\langle t^2, 7t - 12, t^2 \right\rangle \qquad \vec{r_2}(t) = \left\langle 4t - 3, t^2, 5t - 6 \right\rangle$$

The particles will collide if they occupy *the same position at the same time.* Do the given particles collide?

Answer: ________________________

STUDENT NAME:

Question 5. The vector equation of a *straight* line L parallel to a vector $\vec{v}$ passing through point P_0 with a position vector $\vec{r}_0$ is

$$\vec{r}(t) = \vec{r}_0 + t\vec{v}$$

Find the curvature $\kappa(t)$. Are you surprised by the result?

Answer: ______________________

STUDENT NAME:

Part II

Answer in the space provided

Question 6. Find the scalar equation of the plane passing through the points $(1, 0, 1), (2, 2, 1)$ and $(3, -1, 2)$.

(5 points)

Question 7. A particle is moving on a curve described by the equation

$$\vec{r}(t) \quad = \quad \langle \cos(t), \sin(t), t \rangle$$

- Find the velocity $\vec{v}(t)$ and acceleration $\vec{a}(t)$ of the particle.

  (2 points)
- Find the unit tangent vector $\vec{T}(t)$ and the principal normal vector $\vec{N}(t)$ to the given curve.

  (4 points)
- Find the tangential $(a_T(t))$ and normal $(a_N(t))$ acceleration of the particle.

  (4 points)

STUDENT NAME:

Question 8. Find the curvature of $\vec{r}(t) = \left\langle e^t \cos(t), e^t \sin(t), t \right\rangle$ at the point $(1, 0, 0)$. You can leave your answer as a radical *i.e.* in the form $\sqrt{\frac{29}{\sqrt{57}}}$.

STUDENT NAME:

Question 9. Evaluate the following:

- $$\lim_{t\to 0^+} \left\langle \cos(t), \frac{1}{t}\sin(2t), t\ln(t) \right\rangle$$

  (5 points)

- $$\frac{d}{dt}\left\langle e^{t^2}, \sin(\cos(t)), \int_0^t \sin(u)du \right\rangle$$

  (5 points)