Your Name

Your Signature

Student ID #

Your TA's name

Your Quiz Section Label and Time

Problem	Points	Possible
1		10
2		7
3		19
4		14
Total		50

- No books allowed.
- You may use a scientific calculator and one $8\frac{1}{2} \times 11$ sheet of notes.
- Do not share notes.
- In order to receive credit, you must show your work and explain your reasoning (except on the "short answer" questions).
- **Place a box around YOUR FINAL ANSWER to each question.**
- If you need more room, use the backs of the pages and indicate to the grader where to find your work.
- Raise your hand if you have a question or need more paper.

Don't open the test until everyone has a copy and the start of the test is announced.

GOOD LUCK!

1. (10 **points**) Let $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$ be three nonzero coplanar vectors (that is, they lie in the same plane) in $\mathbf{R}^3$, and assume that no two of them are parallel. Let $\mathbf{v} = \mathbf{a} \times (\mathbf{b} \times \mathbf{c})$. For each of the following statements determine whether it is True (**T**) or False (**F**).
No explanation of answers is needed for this problem. Be sure to explain your answers on other problems!

   (a) $\mathbf{v}$ is the zero vector. **T** **F**

   (b) $\mathbf{v} = (\mathbf{b} \times \mathbf{c}) \times \mathbf{a}$ **T** **F**

   (c) $\mathbf{v} \cdot (\mathbf{b} \times \mathbf{c}) = 0$. **T** **F**

   (d) $\mathbf{v}$ is perpendicular to the plane containing vectors $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$. **T** **F**

   (e) $\mathbf{v}$ is parallel to the plane containing vectors $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$. **T** **F**

2. (7 **points**) Write an equation of the plane that contains the line $\mathbf{r}(t) = \langle -2+t, 3-2t, t \rangle$ and is perpendicular to the plane $x + y - 2z = 1$.

3. (19 = 2 + 5 + 7 + 5 **points**) Consider the curve $\mathbf{r}(t) = \langle -e^t, e^t \sin t, e^t \cos t \rangle$.

   (a) Show that this curve lies on the cone $x^2 = y^2 + z^2$.

   (b) Find parametric equations for the tangent line to this curve at the point $(-1, 0, 1)$.

   (c) Find the curvature of this curve at the point $(-1, 0, 1)$.

   (d) Find the length of the portion of this curve between the points $(-1, 0, 1)$ and $(-e^{\pi/2}, e^{\pi/2}, 0)$.

4. (14 = 6+4+4 **points**) Consider the following two curves: one is represented by the Cartesian equation $x + y = 2$, and another one by the polar equation $r = \cos\theta - \sin\theta$.

   (a) Find the slope of the tangent line to the second curve at the point corresponding to $\theta = \pi/4$.

   (b) Find a polar equation for the first curve.

   (c) Find the points of intersection of these two curves, if any. Show your work!