Math 126, Sections A and B, Winter 2011, Midterm I

January 27, 2011

Name_____

TA/Section_____

Instructions.

- There are 4 questions. The exam is out of 40 points.
- You are allowed to use one page of notes written only on one side of the sheet in your own handwriting. **Hand in your notes with your exam paper.**
- You may use a calculator which does not graph and which is not programmable. Even if you have a calculator, give me exact answers. ($\frac{2\ln 3}{\pi}$ is exact, 0.7 is an approximation for the same number.)
- **Show your work**. If I cannot read or follow your work, I cannot grade it. You may not get full credit for a right answer if your answer is not justified by your work. If you continue at the back of a page, make a note for me. Please $\boxed{\text{BOX}}$ your final answer.

Question	points
1	
2	
3	
4	
Total	

1. Answer the following questions about the triangle with vertices $A(1, 4, 5)$, $B(1, 8, 8)$ and $C(3, 6, 5)$.

   (a) Find the angle A. (3 points)

   (b) Draw a line from the point A perpendicular to the side BC. Call the point where this line intersects BC point D. Find the coordinates of point D. (3 points)

   (c) Find the area of the triangle. (4 points)

2. The line l_1 is perpendicular to the plane $2x + 3y + z = 24$ at the point $(4, 5, 1)$. The line l_2 is the line passing through the points $(0, 2, 0)$ and $(6, 11, 3)$.

   (a) Find the vector equation for the line l_1. (4 points)

   (b) Find the vector equation for the line l_2. (4 points)

   (c) Are the two lines the same, skew, parallel or intersecting? (1 points)

3. Let C be the curve traced by the vector function $\mathbf{r}(t) = \langle 2\cos t - \sin t, \sin t, \cos t \rangle$.

   (a) Find two surfaces so that C is their intersection. Use your surfaces to sketch and describe the shape of the curve. (3 points)

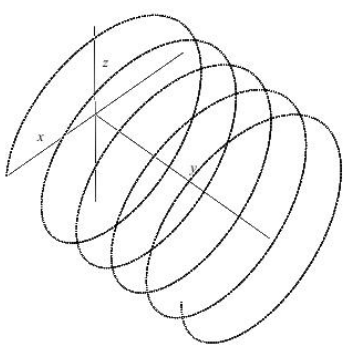
   (b) Set up an integral to find the length of the curve you have above. Do not integrate. (3 points)

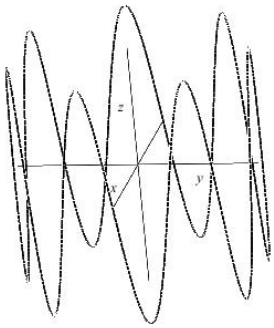
   (c) Find the equation of the tangent line to the curve at the point where $t = \pi/4$. (5 points)

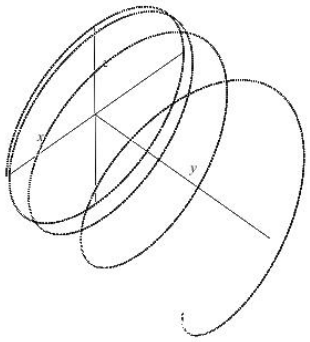
4. (a) Match the following vector equations by the curves below. In all graphs, the z axis points up. (6 points)

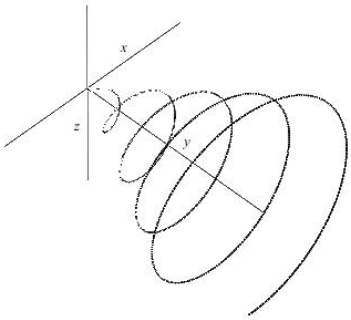
$\mathbf{r_1}(t) = \langle \sin t, \cos t, \cos 7t \rangle$ $\mathbf{r_2}(t) = \langle 4t\cos t, t, 4t\sin t \rangle$ $\mathbf{r_3}(t) = \langle 2\cos t + 1, \sin t + 2, 5\cos t + 1 \rangle$

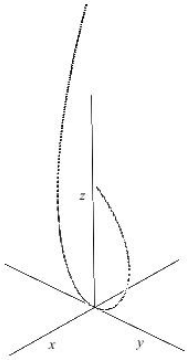
$\mathbf{r_4}(t) = \langle 4\cos t, t, 4\sin t \rangle$ $\mathbf{r_5}(t) = \langle t^3, 5t, 2t^2 \rangle$ $\mathbf{r_6}(t) = \langle 4\cos t, t^3, 4\sin t \rangle$

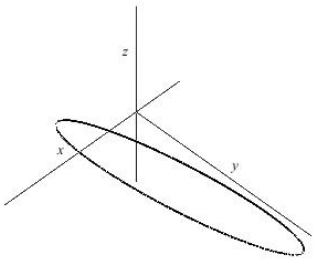












(b) Decide if the following are True or False. You do not need to explain your answer. (4 points)

1. _____ If $\mathbf{u}(t)$ and $\mathbf{v}(t)$ are differentiable vector functions then $\frac{d}{dt}(\mathbf{u}(t) \times \mathbf{v}(t)) = \mathbf{u}'(t) \times \mathbf{v}'(t)$.

2. _____ If $|\mathbf{r}(t)| = 1$ for all t, then $\mathbf{r}'(t)$ is orthogonal to $\mathbf{r}(t)$ for all t.

3. _____ If $\mathbf{u} \cdot \mathbf{v} = 0$ then $\mathbf{u} = 0$ or $\mathbf{v} = 0$.

4. _____ For any two vectors $\mathbf{u}$ and $\mathbf{v}$, $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{v} = 0$.