

M272/275-001

September 14, 1999

TEST #1 Name _____

This test consists of **4** pages, all different and none intentionally left blank.

Take a minute *right now* to ensure that you have all 4 of these pages. In order to receive credit for your answers, you must show your work!!

1. Let $\mathbf{v} = 2\mathbf{i} - 3\mathbf{j} + \mathbf{k}$ and $\mathbf{w} = 2\mathbf{i} - 2\mathbf{j}$ Find each of the following (3 points each):

(a) $2\mathbf{v} + 3\mathbf{w}$

(b) $|\mathbf{v}|^2 - |\mathbf{w}|^2$

(c) $\text{proj}_{\mathbf{w}}\mathbf{v}$ (The vector projection of \mathbf{v} onto \mathbf{w})

(d) $\text{comp}_{\mathbf{w}}\mathbf{v}$

(e) $\mathbf{v} \cdot \mathbf{w}$

(f) $\mathbf{v} \times \mathbf{w}$

2. (10 points) Find (an appropriate form of an equation of) the line of intersection between the planes $2x - 4y + z = 4$ and $-x + y - 3z = 2$

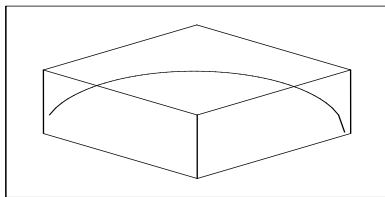
3. (10 points) Show the following lines intersect and find the (acute) angle of intersection of the lines

$$\frac{x+3}{3} = \frac{y}{-2} = \frac{z-7}{6} \text{ and } \frac{x+6}{1} = \frac{y+5}{-3} = \frac{z-1}{2}$$

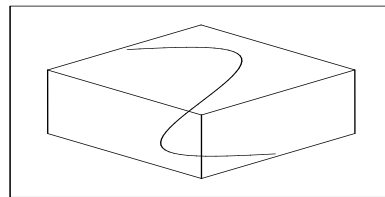
4. (10 points) Find an equation of the plane which passes through the points $(1, 0, 0)$, $(2, 2, 0)$, and $(1, 2, 3)$

5. (10 points) Find the osculating plane of the curve $\mathbf{r}(t) = \langle \sin(4t), 3t, \cos(4t) \rangle$ at the point $\mathbf{r}(\pi/6)$

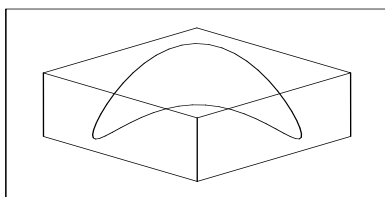
6. (10 points) Among the following four graphs are the graphs of $\mathbf{r}(t) = \langle t, -t, \sqrt{2-t^2} \rangle$ and $\mathbf{r}(t) = \langle \sin(t), \cos(t), \sin(2t) \rangle$. Identify which is which and explain your reasoning.



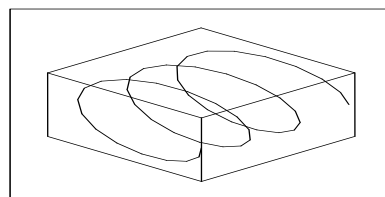
I



II



III



IV

7. (10 points) Find the curvature of $\mathbf{r}(t) = \langle 3 \cos(t), 4 \sin(t), t \rangle$ at the point $t = \pi/2$.
8. (10 points) Find the tangential and normal components of the acceleration at the point $t = \pi/2$ if the position function is the function given in the preceding problem.
9. (10 points) Identify the following quadric surface and sketch its graph.

$$4x^2 - y^2 + z^2 + 8x + 8z + 24 = 0$$