

Math 275-002
February 9, 2005

Exam 1 Name _____

This test consists of 4 pages, none of which is intentionally left blank. Take a few seconds right now to be sure you have all the pages. The point value of each question is to the left of the question number. Show all your work in the space provided. If you run out of room for an answer, continue working on the back of the page. Your answers must be justified by your work.

1. Let $\vec{v} = \langle -3, 4, 2 \rangle$ and let $\vec{w} = \langle 2, -3, 3 \rangle$
- (4) (a) Find $\vec{v} \cdot \vec{w}$.
- (4) (b) Find $\vec{v} \times \vec{w}$.
- (4) (c) Find $|\vec{v}|$.
- (4) (d) Find $\text{comp}_{\vec{v}} \vec{w}$.
- (4) (e) Find $\overrightarrow{\text{proj}}_{\vec{v}} \vec{w}$.

- (10) 2. Find equation(s) of the line through the points $(-1, 3, 1)$ and $(2, -3, 2)$. You may use the vector, symmetric or parametric form for this problem.

3. Let $3x - 4y + 2z = 5$ be an equation of a plane \mathcal{K} and let $P(-2, 2, 4)$ be a point in \mathbb{R}^3

- (5) (a) Find a normal \vec{n} to \mathcal{K} .

- (3) (b) Find the coordinates of a point Q on \mathcal{K} .

- (2) (c) Find the vector \overrightarrow{QP} .

- (5) (d) Find the component of \overrightarrow{QP} in the direction of \vec{n} .

- (5) (e) What is the distance from the point P to the plane \mathcal{K}

(10) 4. A region in \mathbb{R}^3 is described in spherical coordinates by $2 \leq \rho \leq 4$, $\pi/3 \leq \phi \leq 2\pi/3$ and $0 \leq \theta \leq \pi/2$. Sketch the region.

5. Let $\vec{r}(t) = \langle 2 \sin(t), 5t, 2 \cos(t) \rangle$ be a position vector at time t .

(5) (a) Find the velocity at time t .

(5) (b) Find the speed at time t .

(5) (c) Find the unit tangent vector and the unit normal vector at the time $t = 0$.

(5) (d) Find the equation of the osculating plane at the time $t = 0$.

- (10) 6. Identify the quadric surface $16x - 4y^2 - 9z^2 = 0$ and draw its graph, showing traces where useful.

- (10) 7. Find the length of the curve $\vec{r}(t) = 2 \sin^2(t)\vec{i} + \cos^3(t)\vec{j} + \sin^3(t)\vec{k}$ for $0 \leq t \leq \pi/2$