

Calc III - 3450:223  
EXAM #1 Fall 99

NAME \_\_\_\_\_  
ROW \_\_\_\_\_

100 Points

Show **ALL** your work.

1. Given vectors **a**, **b**, and **c**, show using magnitudes and/or the dot product and/or the cross product how you would

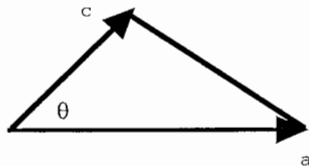
a) decide if **a** and **b** are parallel

2 Points

b) decide if **a** and **b** are orthogonal

2 Points

c) calculate the area of the triangle determined by **a** and **c**

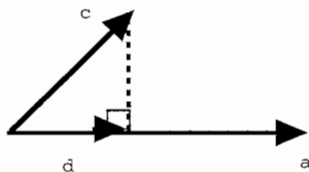


2 Points

d) calculate the angle  $\theta$

2 Points

e) find the vector **d**



3 Points

f) determine a vector parallel to **a** which is 5 units long.

3 Points

2. Identify the given surface and convert its equation to cylindrical coordinates:  $x^2 + y^2 + z^2 = 2x$ .

8 Points

22 Points

3. The position of a projectile is given by  $\mathbf{r}(t) = 6 \mathbf{i} + t \mathbf{j} + \ln[\cos(t)] \mathbf{k}$ ,  $\cos(t) > 0$ . Find the following:

a) The projectile's velocity,  $\mathbf{v}$

2 Points

b) The speed of the projectile

2 Points

c) The unit tangent vector,  $\mathbf{T}$

2 Points

d) The unit normal vector,  $\mathbf{N}$

3 Points

e) The curvature,  $\kappa$

3 Points

f) The acceleration of the projectile written in terms of  $\mathbf{T}$  and  $\mathbf{N}$ . You do not have to write out  $\mathbf{T}$  and  $\mathbf{N}$  in your answer.

6 Points

18 Points

4. Find an equation for the plane through the point  $(-4, 6, 1)$  and containing the line  $x = 3 - t, y = 2 - 3t, z = 1 + 2t$ .

10 Points

5. Write  $\mathbf{u} = \mathbf{i} - \mathbf{j} + 2\mathbf{k}$  as the sum of a vector parallel to and a vector orthogonal to  $\mathbf{v} = 3\mathbf{i} + \mathbf{k}$ .

10 Points

6. At time  $t = 0$  a particle has the velocity  $4\mathbf{i}$ . At time  $t = 3$  the particle is located at the point  $(13, -9, 25)$ . If the particle's acceleration is given by  $\mathbf{a}(t) = -2\mathbf{j} + 6t\mathbf{k}$ , find parametric equations for the line tangent to the particle's curve of motion at  $t = 3$ .

10 Points

30 Points

7. Convert the following equation in spherical coordinates to one in rectangular coordinates and sketch its graph:  $\rho^2[\sin^2\phi \cos^2\theta + \cos^2\phi] = 16$ .

10 Points

8. Find the angle between AB and AC given the points A(1, 0, 1), B(3, 2, 0), and C(6, -3, 3).

10 Points

9. A projectile is fired horizontally with initial speed of 2 ft/s from a position 9 ft above the ground. Where does the projectile hit the ground?

10 Points

30 Points