SHOW YOUR WORK

1. (10 pts.) Find $x$ so that the vectors $\mathbf{i} + x\mathbf{j} + \mathbf{k}$ and $-\mathbf{i} + 3\mathbf{j} + 2\mathbf{k}$ are orthogonal.

2. (10 pts.) Find the equation of the plane containing the lines

$$L_1: x = 1 + t, \quad y = 1 + t, \quad z = 1 + t$$

$$L_2: x = 1 - t, \quad y = 1, \quad z = 1 + t$$

3. (10 pts.) Find the equation of the surface consisting of all points equidistant from the point $(1,0,0)$ and the $y$-axis.

4. (10 pts.) Which one of the curves

$$\mathbf{u}(t) = \langle \cos 4t, t, \sin 4t \rangle, \quad \text{and}$$

$$\mathbf{v}(t) = \langle \sin t, \cos t, \ln t \rangle$$

lies on the surface $x^2 + y^2 = 1$?

5. (10 pts.) Find the position function for a particle whose velocity function and initial position are

$$\mathbf{v}(t) = 2t\mathbf{i} - \mathbf{k} \quad \text{and} \quad \mathbf{r}(0) = \mathbf{j} + \mathbf{k}$$

6. Let $\mathbf{r}(t) = t^2\mathbf{i} + e^{2t}\mathbf{j} + t\mathbf{k}$ be the position of a particle at time $t$.

(a) (10 pts.) Find the unit tangent vector when $t = 0$.

(b) (10 pts.) Find the equation of the line tangent to the path of the particle when $t = 0$.

(c) (10 pts.) Find the tangential and normal components of acceleration when $t = 0$.

7. (10 pts.) Write the equation $x^2 + y^2 = z^2$ in spherical coordinates.

8. (10 pts.) Suppose that $\mathbf{r}(t)$ has the property that $\frac{d\mathbf{N}}{dt}$ is always parallel to $\mathbf{T}$.

Compute $\frac{d\mathbf{B}}{dt}$.  

Exam 1
M275-001
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