Math 2401 M
Calculus III
Fall 2012, Georgia Tech

Feb 16, 2012

Midterm 1

Time: 50 minutes

Name:

Each problem is worth 15 *points.*

1. Write an expression for the angle between the main diagonal of a cube and the diagonal of one of its sides.

2. Find the equation in x, y, z for the plane passing through the points $(1, 0, 1)$, $(2, 1, 0)$, $(1, 1, 1)$.

3. Let $\mathbf{r}(t)$ be the position vector of a moving particle. Show that if $\|\mathbf{r}(t)\|$ is constant, then $\mathbf{r}(t)$ is orthogonal to $\mathbf{r}'(t)$.

4. Find the length of the curve $\mathbf{r}(t) = 3\cos t\,\mathbf{i} + 3\sin t\,\mathbf{j} + 4t\,\mathbf{k}$ from $t = 0$ to $t = 3\pi$.

5. Find the unit tangent and principal normal of the curve $\mathbf{r}(t) = (1, 2t, t^2)$.

6. Identify and sketch the surface $9x^2 + 4y^2 + 36z^2 - 36 = 0$.

7. Let f be a smooth function of x and y. Is it possible that

$$\frac{\partial f}{\partial x} = x + y \quad \text{and} \quad \frac{\partial f}{\partial y} = y - x$$