**MA 271 EXAM 1 FALL 2002 Name** _____

1. Find the angle between the curves at the indicated point.

$$\mathbf{r}_1(t) = (\cos t)\mathbf{i} + (\sin t)\mathbf{i} + t\mathbf{k},$$

$$\mathbf{r}_2(t) = (1+t)\mathbf{i} + t^2\mathbf{j} + te^t\mathbf{k},$$

at $(1, 0, 0)$.

2. Solve the initial value problem

$$\mathbf{r}(0) = 0,\ \frac{d\mathbf{r}}{dt}(0) = \mathbf{i} + \mathbf{j} + \mathbf{k},\ \frac{d^2\mathbf{r}}{dt} = t^2\mathbf{i} + t\mathbf{j} + \mathbf{k}$$

3. Find the arc length

$$\mathbf{r}(t) = t^2\mathbf{i} + 2t\mathbf{j} + (\ln t)\mathbf{k}, \qquad 1 \le t \le e^2.$$

4. Convert to Cartesian equation

$$r = 4\tan\theta\sec\theta$$

5. Find the area of the region shared by the circles $r = 2\sin\theta$ and $r = 2\cos\theta$.

6. Find the center and radius of the sphere

$$x^2 + y^2 + z^2 + 6x - 8y + 4z + 4 = 0.$$

7. Find the equation for the plane through $(1, 1, -1)$, $(2, 0, 2)$ and $(0, -2, 1)$.

8. Describe the surfaces.
   (a) $x^2 + 4y^2 + 9z^2 = 1$
   (b) $y^2 = -4x$
   (c) $y^2 + x^2 = z^2$
   (d) $x^2 + y^2 - z^2 = -1$
   (e) $x = yz$

9. Find the equation of tangent line at time $t = \sqrt{3}$.

$$\mathbf{r}(t) = (\ln(t^2 + 1))\mathbf{i} + (\tan^{-1} t)\mathbf{j} + (\sqrt{t^2 + 1})\mathbf{k}$$

10. Let $C$ be the intersection of $x^2 + y^2 = 16$ and $x + y + z = 5$. Find the curvature at $(0, 4, 1)$.