# Math 2210 - Exam 1

University of Utah

Fall 2008

**Name:** _____

1. For the vectors:

$$\mathbf{a} = 3\mathbf{i} + 4\mathbf{j} - 2\mathbf{k}$$
and
$$\mathbf{b} = 2\mathbf{i} + \mathbf{j} + 3\mathbf{k}$$

calculate: (10 points)

(a) $\mathbf{a} + \mathbf{b}$ (3 points)

(b) $\mathbf{a} \cdot \mathbf{b}$ (3 points)

(c) $\mathbf{a} \times \mathbf{b}$ (4 points)

2. For the curve given by the vector equation:

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

calculate: (20 points)

(a) The velocity $\mathbf{v}(t) = \mathbf{r}'(t)$ (3 points)

(b) The acceleration $\mathbf{a}(t) = \mathbf{r}''(t)$ (2 points)

(c) The parametric equations of the tangent line to the curve at $t = \pi/4$. (4 points)

(d) The symmetric equations of this tangent line. (2 points)

(e) The plane containing the point $\mathbf{r}(\pi/4)$ that is perpendicular to the tangent line to the curve at that point. (4 points)

(f) The length of the curve from $t = 0$ to $t = \pi/4$. (4 points)

3. Find symmetric equations of the line through $(4, 5, 8)$ and perpendicular to the plane $3x + 5y + 2z = 30$. (5 points)

4. Make the following conversions: (10 points)

   (a) Change the point given by $(6, \pi/6, -2)$ in cylindrical coordinates to its repersentation in Cartesian (rectangular) coordinates. (1 point)

   (b) Change the point given by $(4, 4\pi/3, -8)$ in cylindrical coordinates to its representation in Cartesian (rectangular) coordinates. (1 point)

   (c) Change the point givey by $(8, \pi/4, \pi/6)$ in spherical coordinates to its representation in Cartesian (rectangular) coordinates. (1 point)

   (d) Change the point givey by $(4, \pi/3, 3\pi/4)$ in spherical coordinates to its representation in Cartesian (rectangular) coordinates. (1 point)

(e) Write the following Cartesian equation in cylindrical coordinate form: (2 points)

$$x^2 + y^2 = 9$$

(f) Find the Cartesian equation corresponding to the following cylindrical coordinate equation: (2 points)

$$r^2 + z^2 = 9$$

(g) Write the following equation in spherical coordinates: (2 points)

$$x^2 + y^2 = z$$

5. Graph and name the surface described by the quadric equation: (5 points)

$$z = x^2 + y^2$$