HOMEWORK ASSIGNMENT #2, Math 253

1. Find the equation of a sphere if one of its diameters has end points $(1, 0, 5)$ and $(5, -4, 7)$.

2. Find vector, parametric, and symmetric equations of the following lines.

   (a) the line passing through the points $(3, 1, \frac{1}{2})$ and $(4, -3, 3)$

   (b) the line passing through the origin and perpendicular to the plane $2x - 4y = 9$

   (c) the line lying on the planes $x + y - z = 2$ and $3x - 4y + 5z = 6$

3. Find the equation of the following planes.

   (a) the plane passing through the points $(-1, 1, -1)$, $(1, -1, 2)$, and $(4, 0, 3)$

   (b) the plane passing through the point $(0, 1, 2)$ and containing the line $x = y = z$

   (c) the plane containing the lines

$$L_1 : x = 1 + t, \quad y = 2 - t, \quad z = 4t$$

$$L_2 : x = 2 - s, \quad y = 1 + 2s, \quad z = 4 + s$$

4. Find the intersection of the line $x = t$, $y = 2t$, $z = 3t$, and the plane $x + y + z = 1$.

5. Find the distance between the point $(2, 8, 5)$ and the plane $x - 2y - 2z = 1$.

6. Show that the lines
$$L_1 : \frac{x - 4}{2} = \frac{y + 5}{4} = \frac{z - 1}{-3}$$
$$L_2 : \frac{x - 2}{1} = \frac{y + 1}{3} = \frac{z}{2}$$
   are skew. Find the distance between the two lines.

7. Identify and sketch the following surfaces.

   (a) $4x^2 + 9y^2 + 36z^2 = 36$
   (b) $4z^2 - x^2 - y^2 = 1$
   (c) $y^2 = x^2 + z^2$
   (d) $x^2 + 4z^2 - y = 0$
   (e) $y^2 + 9z^2 = 9$
   (f) $y = z^2 - x^2$

8. Find the polar equation for the curve represented by the following Cartesian equation.

   (a) $x = 4$

(b) $x^2 + y^2 = -2x$

(c) $x^2 - y^2 = 1$

9. Sketch the curve of the following polar equations.

   (a) $r = 5$

   (b) $\theta = \frac{3\pi}{4}$

   (c) $r = 2\sin\theta$

   (d) $r = 3(1 - \cos\theta)$

10. (a) Change $(3, \frac{\pi}{3}, 1)$ from cylindrical to rectangular coordinates

   (b) Change $(\sqrt{3}, 1, 4)$ from rectangular to cylindrical coordinates

   (c) Change $(\sqrt{3}, 1, 2\sqrt{3})$ from rectangular to spherical coordinates

   (d) Change $(4, \frac{\pi}{4}, \frac{\pi}{3})$ from spherical to cylindrical coordinates