Calculus III Section11.2

Vectors in Space:

a) Distance Between the points (x_1, y_1, z_1) and (x_2, y_2, z_2):

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

b) Let $\mathbf{u} = \langle u_1, u_2, u_3 \rangle$ and $\mathbf{v} = \langle v_1, v_2, v_3 \rangle$

- Vector Equality: $\mathbf{u} = \mathbf{v}$ if and only if $u_1 = v_1,\ u_2 = v_2,\ u_3 = v_3$.
- Magnitude or Length: $\|\mathbf{u}\| = \sqrt{(u_1)^2 + (u_2)^2 + (u_3)^2}$; $\|\mathbf{v}\| = \sqrt{(v_1)^2 + (v_2)^2 + (v_3)^2}$

c) Equation of Sphere: Let (x_o, y_o, z_o) be center of sphere and r be the radius.

$$(x - x_0)^2 + (y - y_0)^2 + (z - z_0)^2 = r^2$$

1) Describe the set of points that satistifies the given condition.

a) $z = 0$

b) $y = 0$

c) $x = 0$

d) $z = 4$

e) $x = -2$

2) Describe the set of points that satistifies the given condition.

a) $z < 0$

b) $y > 0$

c) $xy > 0$

3) Find the equation of the sphere.

center: (1,3,5) radius = 4

4) Find center and radius of the sphere.

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

5) Find center and radius of the sphere.

$$x^2 + y^2 + z^2 - x - y - z - 6 = 0$$

6) Let $\mathbf{u} = \langle 2,3,5 \rangle$, $\mathbf{v} = \langle 1,8,12 \rangle$, and $\mathbf{w} = \langle -1,-8,2 \rangle$

a) Find $3\mathbf{u} - \mathbf{5v} + 2\mathbf{w}$

b) Find $\frac{1}{2}\mathbf{u} - 4\mathbf{v} + \frac{1}{3}\mathbf{w}$

7) Let $\mathbf{u} = \langle 2,3,5 \rangle$, $\mathbf{v} = \langle 1,8,12 \rangle$, and $\mathbf{w} = \langle -1,-8,2 \rangle$

a) Find $\|\mathbf{u}\|$

b) Find $\|\mathbf{v}\|$

c) Find $\|\mathbf{w}\|$

8) Let $\mathbf{u} = \langle 2,3,5 \rangle$, $\mathbf{v} = \langle 1,8,12 \rangle$, and $\mathbf{w} = \langle -1,-8,2 \rangle$

a) Find $\frac{\mathbf{u}}{\|\mathbf{u}\|}$ and $\left\| \frac{\mathbf{u}}{\|\mathbf{u}\|} \right\|$.

b) Find $\frac{\mathbf{v}}{\|\mathbf{v}\|}$ and $\left\| \frac{\mathbf{v}}{\|\mathbf{v}\|} \right\|$.

c) Find $\frac{\mathbf{w}}{\|\mathbf{w}\|}$ and $\left\| \frac{\mathbf{w}}{\|\mathbf{w}\|} \right\|$.