

**Worksheet 3 - Chapter 12**

1. Find a vector with length 4 and direction  $\frac{1}{\sqrt{3}}\vec{i} - \frac{1}{\sqrt{3}}\vec{j} + \frac{1}{\sqrt{3}}\vec{k}$ .
2. Find the distance between the points  $P_1(4, 1, 2)$  and  $P_2(4, -2, 6)$ . Write the vector  $\overrightarrow{P_1P_2}$  in component form. What is the length of the vector  $\overrightarrow{P_1P_2}$ ? What is the direction of the vector  $\overrightarrow{P_1P_2}$ ?
3. Given the vectors  $\vec{u} = \vec{i} - \vec{j} + 2\vec{k}$  and  $\vec{v} = 3\vec{i} - \vec{k}$ , find  $\cos \theta$ , where  $\theta$  is the angle between  $\vec{u}$  and  $\vec{v}$ .
4. Find a unit vector orthogonal to the plane determined by the points  $P(2, -2, 1)$  and  $Q(-1, 0, -2)$  and  $R(0, -1, 2)$ . Find the area of the triangle  $\Delta PQR$ .
5. Find the volume of the parallelepiped determined by the vectors  $\vec{u} = 2\vec{i} - \vec{k}$ ,  $\vec{v} = -2\vec{i} + \vec{j}$ , and  $\vec{w} = \vec{i} + 2\vec{j} - 2\vec{k}$ .