

Math 4013
Problem Set 1

1. Let $\mathbf{v} = 3\mathbf{i} + 4\mathbf{j} + 5\mathbf{k}$ and $\mathbf{w} = \mathbf{i} - \mathbf{j} + \mathbf{k}$. Compute $\mathbf{v} + \mathbf{w}$, $3\mathbf{v}$, $6\mathbf{v} + 8\mathbf{w}$, $-2\mathbf{v}$, $\mathbf{v} \cdot \mathbf{w}$, $\mathbf{v} \times \mathbf{w}$. Interpret each geometrically by graphing the vectors.

2.

1(a) Find the equation of the line through $(-1,2,-1)$ in the direction of \mathbf{j} . 1(b) Find the equation of the line passing through $(0,2,-1)$ and $(-3,1,0)$. 1(iii) Find the equation for the plane perpendicular to $(-2,1,2)$ and passing through $(-1,1,3)$.

3. Compute $\mathbf{v} \cdot \mathbf{w}$ for the following sets of vectors.

(a) $\mathbf{v} = -\mathbf{i} + \mathbf{j} = (-1, 1, 0)$; $\mathbf{w} = \mathbf{k} = (0, 0, 1)$.

(b) $\mathbf{v} = \mathbf{i} + 2\mathbf{j} - \mathbf{k} = (1, 2, -1)$; $\mathbf{w} = 3\mathbf{i} + \mathbf{j} = (3, 1, 0)$.

(c) $\mathbf{v} = -2\mathbf{i} - \mathbf{j} + \mathbf{k} = (-2, -1, 1)$; $\mathbf{w} = 3\mathbf{i} + 2\mathbf{j} - 2\mathbf{k} = (3, 2, -2)$.

4. Compute $\mathbf{v} \times \mathbf{w}$ for the vectors in Exercise 5.

5. Convert the point $(0,3,4)$ from Cartesian to cylindrical and spherical coordinates.

6. Convert the point $(1, \pi/4, 1)$ from cylindrical to Cartesian and spherical coordinates.

7. Convert the point $(1, \pi/2, \pi)$ from spherical to Cartesian and cylindrical coordinates.