Equation of Unit Vector

1 12^{th} Maths - Chapter 11

This is Problem-2 from Exercise 3.2

1. Find the vector equation of a plane which is at a distance of 7 units from the origin and normal to the vector $3\hat{i} + 5\hat{j} - 6\hat{k}$

2 Solution

Normal vector to the plane is

$$\mathbf{n} = \begin{pmatrix} 3 \\ 5 \\ -6 \end{pmatrix} \tag{1}$$

$$d = \frac{\left|\mathbf{n}^\top \mathbf{n} - \mathbf{c}\right|}{\|\mathbf{n}\|} \tag{2}$$

$$\implies 7 = \frac{|\mathbf{c}|}{\|\mathbf{n}\|} \tag{3}$$

$$\|\mathbf{n}\| = \sqrt{\begin{pmatrix} 3 & 5 & -6 \end{pmatrix} \begin{pmatrix} 3 \\ 5 \\ -6 \end{pmatrix}} \tag{4}$$

$$= \sqrt{70} \tag{5}$$

$$\implies |\mathbf{c}| = 7\sqrt{70} \tag{6}$$

$$\implies \mathbf{c} = \pm 7\sqrt{70} \tag{7}$$