

# 2.2.16

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## Question:

The angle between the planes

$$\mathbf{r} \cdot (2\hat{i} - 3\hat{j} + \hat{k}) = 1 \text{ and}$$

$$\mathbf{r} \cdot (\hat{i} - \hat{j}) = 4$$

## Solution:

Let  $P_1$  and  $P_2$  are the planes given respectively.

The normal vector of the planes, say  $n_1$  and  $n_2$  are:

$$\mathbf{n}_1 = \begin{pmatrix} 2 \\ -3 \\ 1 \end{pmatrix} \quad (0.1)$$

$$\mathbf{n}_2 = \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix} \quad (0.2)$$

Thus, the cosine of the angle between the two is

$$\cos \theta = \frac{\mathbf{n}_1 \cdot \mathbf{n}_2}{|n_1||n_2|} \quad (0.3)$$

$$= \frac{5}{\sqrt{14} \times \sqrt{2}} = \frac{5}{\sqrt{28}} \quad (0.4)$$

$$\Rightarrow \theta = \cos^{-1} \frac{5}{\sqrt{28}} \quad (0.5)$$

where  $\theta$  is the acute angle between the planes.

