

Assignment 7: 4.7.52

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Question:

If the points $(1, 1, p)$ and $(-3, 0, 1)$ be equidistant from the plane $\mathbf{r} \cdot (3\hat{i} + 4\hat{j} - 12\hat{k}) + 13 = 0$, then find the value of p .

Solution:

Given:

$$\mathbf{A} = \begin{pmatrix} 1 \\ 1 \\ p \end{pmatrix} \quad (1)$$

$$\mathbf{B} = \begin{pmatrix} -3 \\ 0 \\ 1 \end{pmatrix} \quad (2)$$

$$(3 \ 4 \ -12)\mathbf{r} = -13 \quad (3)$$

We know,

$$d = \frac{|\mathbf{n}^\top \mathbf{P} - c|}{\|\mathbf{n}\|} \quad (4)$$

Thus

$$\frac{|\mathbf{n}^\top \mathbf{A} - c|}{\|\mathbf{n}\|} = \frac{|\mathbf{n}^\top \mathbf{B} - c|}{\|\mathbf{n}\|} \quad (5)$$

$$\mathbf{n}^\top \mathbf{A} = \mathbf{n}^\top \mathbf{B} \text{ OR } \mathbf{n}^\top \mathbf{A} = 2c - \mathbf{n}^\top \mathbf{B} \quad (6)$$

Substituting values

$$7 - 12p = -21 \text{ OR } 7 - 12p = -26 + 21 \quad (7)$$

$$p = 7/3 \text{ OR } p = 1 \quad (8)$$

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