

07/05/2020 General Mathematics II

~~Mathematics~~

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MAT 102

ANS

- ① If  $M = pi - 6j - 3k$ ,  $N = 4i + 3j - k$ ,  $O = i - 5j + 2k$ , find the value of  $p$  for which (a)  $M$  and  $N$  are perpendicular to each other  
(b)  $M$ ,  $N$  and  $O$  are coplanar

ANS

- ② Vector  $M$  and  $N$  are perpendicular, which means the angle between them is  $90^\circ$ .

$$M \cdot N = MN \cos \phi \quad \text{note: } \phi = 90^\circ$$
$$= MN \cos 90 = MN \times 0$$

$$M \cdot N = 0$$

$$(pi - 6j - 3k) \cdot (4i + 3j - k) = 0$$

$$\Rightarrow 4p - 18 + 3 = 0$$

$$p = \frac{-18 + 3}{4} = \frac{-15}{4}$$

$$p = -3.75 //$$

- ③  $M = pi - 6j - 3k$ ,  $N = 4i + 3j - k$ ,  $O = i - 5j + 2k$

$$M \cdot (N \times O) = \begin{vmatrix} p & -6 & -3 \\ 4 & 3 & -1 \\ 1 & -5 & 2 \end{vmatrix} = 0$$

$$= p(6 + 3) + 6(8 - 1) - 3(-12 + 3) = 0$$

$$= 9p + 42 + 27 = 0$$

$$p = \frac{-69}{9} = -7.67 //$$

② Find the direction cosines and the unit vector along the sum of  $3\mathbf{i} + 2\mathbf{j} + 5\mathbf{k}$ ,  $2\mathbf{i} - \mathbf{j} + 6\mathbf{k}$  and  $5\mathbf{i} + 2\mathbf{j} - 3\mathbf{k}$

Solu

$$(3\mathbf{i} + 2\mathbf{j} + 5\mathbf{k}) + (2\mathbf{i} - \mathbf{j} + 6\mathbf{k}) + (5\mathbf{i} + 2\mathbf{j} - 3\mathbf{k})$$

$$(3\mathbf{i} + 2\mathbf{j} + 5\mathbf{k}) + (2\mathbf{i} - \mathbf{j} + 6\mathbf{k}) = 5\mathbf{i} + \mathbf{j} + 11\mathbf{k}$$

$$(5\mathbf{i} + \mathbf{j} + 11\mathbf{k}) + (5\mathbf{i} + 2\mathbf{j} - 3\mathbf{k}) = 10\mathbf{i} + 3\mathbf{j} + 8\mathbf{k}$$

$$\text{magnitude, } r = \sqrt{10^2 + 3^2 + 8^2}$$

$$= \sqrt{173} = 13.15 //$$

$$\text{direction cosines} = \frac{10}{\sqrt{173}}, \frac{3}{\sqrt{173}}, \frac{8}{\sqrt{173}} //$$

$$\text{unit vector} = \frac{10}{\sqrt{173}} \mathbf{i} + \frac{3}{\sqrt{173}} \mathbf{j} + \frac{8}{\sqrt{173}} \mathbf{k} //$$