Date 15/05/2020
Class- XII th
Subject- Mathematics
Topic - Vector
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problem 1:- Find the angle between $\vec{a} = 2\hat{i} + 3\hat{j}$ & $\vec{b} = \hat{i} + 2\hat{j}$.

<u>Solution</u>: Given that

$$\vec{a} = 2\hat{i} + 3\hat{j} \quad \& \quad \vec{b} = \hat{i} + 2\hat{j}$$

$$\therefore |\vec{a}| = \sqrt{(2)^2 + (3)^2} = \sqrt{4+9} = \sqrt{13}$$

$$\& \quad |\vec{b}| = \sqrt{(1)^2 + (2)^2} = \sqrt{1+4} = \sqrt{5}$$

$$\vec{a} \cdot \vec{b} = (2\hat{i} + 3\hat{j}) \cdot (\hat{i} + 2\hat{j})$$

$$= 2(\hat{i} \cdot \hat{i}) + 4(\hat{i} \cdot \hat{j}) + 3(\hat{j} \cdot \hat{i}) + 6(\hat{j} \cdot \hat{j})$$

$$= 2 \times 1 + 4 \times 0 + 3 \times 0 + 6 \times 1$$

$$= 2 + 0 + 0 + 6 = 8$$

Since $\cos\theta = \dfrac{\vec{a} \cdot \vec{b}}{|\vec{a}||\vec{b}|} = \dfrac{8}{\sqrt{13}\sqrt{5}}$

$$\therefore \theta = \cos^{-1}\left[\frac{8}{\sqrt{65}}\right].$$

$\therefore$ The angle between $\vec{a}$ & $\vec{b}$ is $\cos^{-1}\left(\dfrac{8}{\sqrt{65}}\right)$.

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problem ② . If $\vec{a} = 2\hat{i} + 4\hat{j} + 6\hat{k}$

& $\vec{b} = \hat{i} + 3\hat{j} + 5\hat{k}$

Then find (i) $\vec{a}\cdot\vec{b}$ & (ii) $|\vec{a}\times\vec{b}|$

Solution : (i) $\vec{a}\cdot\vec{b} = (2\hat{i} + 4\hat{j} + 6\hat{k})\cdot(\hat{i} + 3\hat{j} + 5\hat{k})$

$= 2\times1 + 4\times3 + 6\times5$

$= 2 + 12 + 30$

$= 44.$

(ii) $\vec{a}\times\vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 4 & 6 \\ 1 & 3 & 5 \end{vmatrix}$

$= \hat{i}\begin{vmatrix} 4 & 6 \\ 3 & 5 \end{vmatrix} - 2\begin{vmatrix} \hat{j} & \hat{k} \\ 3 & 5 \end{vmatrix} + 1\begin{vmatrix} \hat{j} & \hat{k} \\ 4 & 6 \end{vmatrix}$

$= \hat{i}(20-18) - 2(5\hat{j} - 3\hat{k}) + (6\hat{j} - 4\hat{k})$

$= 2\hat{i} - 10\hat{j} + 6\hat{k} + 6\hat{j} - 4\hat{k}$

$= 2\hat{i} - 4\hat{j} + 2\hat{k}$

$\therefore |\vec{a}\times\vec{b}| = \sqrt{4+16+4} = \sqrt{24} = 2\sqrt{6}.$