Date 17/05/2020

Class- XII th

Subject- Mathematics, Topic- Vector

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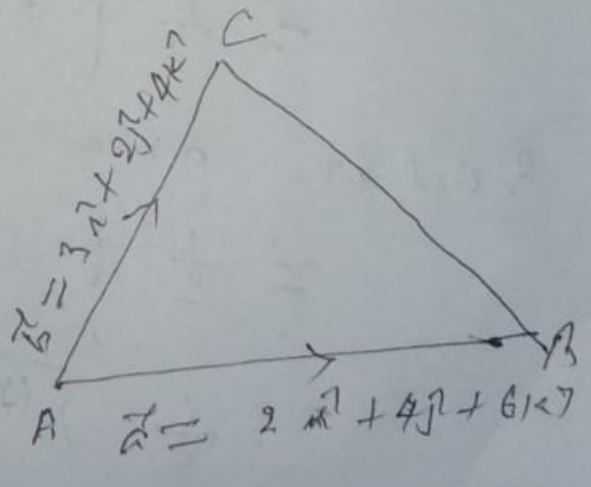
problem 1:- If $\vec{a} = 2\hat{i} + 4\hat{j} + 6\hat{k}$ & $\vec{b} = 3\hat{i} + 2\hat{j} + 4\hat{k}$ represent two sides of a triangle then calculate the scalar area of the triangle.

Solution:- Given that

$\vec{a} = 2\hat{i} + 4\hat{j} + 6\hat{k}$ & $\vec{b} = 3\hat{i} + 2\hat{j} + 4$

Let side AB and AC of $\triangle ABC$ are represented by $\vec{a}$ & $\vec{b}$ respectively.



Now Vector area of $\triangle ABC$

$$= \frac{1}{2} \vec{AB} \times \vec{AC}$$

$$= \frac{1}{2} (2\hat{i} + 4\hat{j} + 6\hat{k}) \times (3\hat{i} + 2\hat{j} + 4\hat{k}$$

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

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$$\Rightarrow ar(\Delta ABC) = \frac{1}{2}\left[\hat{i}\begin{vmatrix} 4 & 6 \\ 2 & 4 \end{vmatrix} - 2\begin{vmatrix} \hat{j} & \hat{k} \\ 2 & 4 \end{vmatrix} + 3\begin{vmatrix} \hat{j} & \hat{k} \\ 4 & 6 \end{vmatrix}\right]$$

$$= \frac{1}{2}\left[\hat{i}(16-12) - 2(4\hat{j} - 2\hat{k}) + 3(6\hat{j} - 4\hat{k})\right]$$

$$= \frac{1}{2}\left[4\hat{i} - 8\hat{j} + 4\hat{k} + 18\hat{j} - 12\hat{k}\right]$$

$$= \frac{1}{2}\left[4\hat{i} + 10\hat{j} - 8\hat{k}\right]$$

$\therefore$ Scalar area of ΔABC

$$= \frac{1}{2}\left|4\hat{i} + 10\hat{j} - 8\hat{k}\right|$$

$$= \frac{1}{2}\sqrt{(4)^2 + (10)^2 + (-8)^2}$$

$$= \frac{1}{2}\sqrt{16 + 100 + 64}$$

$$= \frac{1}{2}\sqrt{100 + 100}$$

$$= \frac{1}{2}\sqrt{2 \times 100}$$

$$= \frac{1}{2} \times 10\sqrt{2} \text{ sq. unit}$$

$$= 5\sqrt{2} \text{ square unit}$$