1) Scalar product obeys commutative law of multiplication.

$$\text{i.e.}\ \vec{P}.\vec{Q} = \vec{Q}.\vec{P}$$

2) The scalar product obeys the distributive law of multiplication.

$\text{i.e.}\ \vec{P}.\left(\vec{Q} + \vec{R}\right) = \vec{P}.\vec{Q} + \vec{P}.\vec{R}$

3) If θ =0. i.e., if the two nonzero vectors are parallel to each other, their scalar product is equal to magnitude of vectors only.

$\vec{P}.\vec{Q}$= P Q

Then from this we can conclude that,

$\hat{\imath} \times \hat{\imath} = 1\ , \hat{\jmath} \times \hat{\jmath} = 1\ ,\ \hat{k} \times \hat{k} = 1$

4) If θ = 180°, i.e., if the two nonzero vectors are anti-parallel,

$\vec{P}.\vec{Q}$= -P Q

5) If θ = 90°, i.e., if the two nonzero vectors are perpendicular to each other, the magnitude of their scalar product is zero

$\text{i.e.}\ \vec{P}.\vec{Q} = 0$

Then from this we can conclude that,

$\hat{\imath} \times \hat{\jmath} = 0\ , \hat{\jmath} \times \hat{k} = 0\ ,\ \hat{k} \times \hat{\imath} = 0$

6) If $\vec{P} = \vec{Q}$, then $\vec{P}.\vec{Q} = P^2 = Q^2$

7) If the vectors $\vec{P}$ and $\vec{Q}$ are given in terms of its component vectors as,

$\vec{P} = P_x\hat{\imath} + P_y\hat{\jmath} + P_z\hat{k}$ and $\vec{Q} = Q_x\hat{\imath} + Q_y\hat{\jmath} + Q_z\hat{k}$ then the magnitude of vector products is given as,

$$\vec{P}.\vec{Q} = (P_xQ_x + P_yQ_y + P_zQ_z)$$

Let's learn some numerical on vector product of vectors…!

1) Force applied on object $\vec{F} = 3\hat{\imath} + 3\hat{\jmath} + 5\hat{k}$ N displaced it through $\vec{s} = \hat{\imath} + 2\hat{\jmath} + 2\hat{k}$. Find the work done.

Solution:Work done, $=\vec{F}.\vec{s}$

$\therefore W = \left(3\hat{\imath} + 3\hat{\jmath} + 5\hat{k}\right).(\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$

$\therefore W = 3 + 6 + 10$

$\therefore W = 19\ J$