Thank

①

Impulse, momentum both are vectors and dimensions

are $= MLT^{-1}$

Power, force $\rightarrow$ $[Power] = ML^2T^{-3} \rightarrow$ scalar

$[Force] = MLT^{-2} \rightarrow$ vector

work, Energy $\rightarrow$ both are scalars $\rightarrow$ dimensions $= ML^2T^{-2}$

speed $\rightarrow$ scalar & velocity $\rightarrow$ vector but dimensions

are same $= M^0LT^{-1}$ $\rightarrow$ D

④

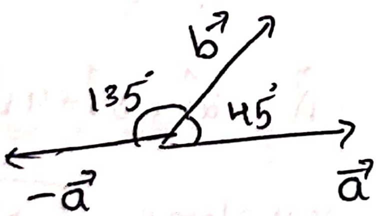
Given $\vec{Q} = 10\hat{i} + 8\hat{j} + 6\hat{k}$.

Magnitude of $\vec{Q}$ in YZ plane $= \sqrt{y^2+z^2} = \sqrt{8^2+6^2}$

$= \sqrt{100} = 10$ $\rightarrow$ B

⑤

Given angle between $\vec{a}$ and $\vec{b}$ is $45°$



$\therefore$ angle between $\vec{a}$ and $-\vec{b}$ is

$135°$. $\rightarrow$ D

⑥

Here for two vectors Tail–Tail connected.

so the angle between them is $120°$ $\rightarrow$ A

(8)

(12)

Given $\vec{A} = 3i + 4j + 5k$. It is a 3D vector

For any 3D vector

$\vec{A} = A_x\hat{i} + A_y\hat{j} + A_z\hat{k}$

$|\vec{A}| = \sqrt{A_x^2 + A_y^2 + A_z^2}$

$|\vec{A}| = \sqrt{3^2+4^2+5^2}$

$= \sqrt{9+16+25}$

$= \sqrt{50}$

$\Rightarrow 5\sqrt{2} \rightarrow C$

(9)

Given

$|2\hat{i} + y\hat{j} + 3\hat{k}| = 5$

It is a 3D vector so it's magnitude $= \sqrt{x^2+y^2+z^2}$

$\Rightarrow \sqrt{2^2+y^2+3^2} = 5$

$\Rightarrow (2^2+y^2+3^2) = 5^2$

$\Rightarrow 4+y^2+9 = 25 \Rightarrow y^2 = 25-13$

$\Rightarrow y = 12$

$y = \sqrt{12} = 2\sqrt{3} \rightarrow B$

(10)

let the vector be $\vec{A} = 2\hat{i} + 3\hat{j} + 4\hat{k}$

length of vector in xy-plane $= \sqrt{x^2+y^2}$

$= \sqrt{2^2+3^2}$

$= \sqrt{4+9}$

$= \sqrt{13} \rightarrow A$

vector
3D vector
$+ A_z \hat{k}$

(12)

Electric current is a vector because it does not follow laws of vector addition.

Any quantity is a vector if it has both magnitude, direction and follows laws of vector addition.

(13)

Given $\vec{A} = 3\hat{i} + 4\hat{j}$ and $\vec{B} = 12\hat{i} + 5\hat{j}$

$$|\vec{A}| = \sqrt{3^2+4^2} = \sqrt{9+16} = \sqrt{25} = 5$$

$$|\vec{B}| = \sqrt{12^2+5^2} = \sqrt{144+25} = \sqrt{169} = 13$$

B is not a ~~vect~~ unit vector.

$$\text{unit vector of } \vec{A} = \frac{\vec{A}}{|\vec{A}|} = \frac{3\hat{i}+4\hat{j}}{5}$$

(14). (15) (16)

let $\vec{A} = 2\hat{i} + 2\hat{j}$ & $\vec{B} = 2\hat{i} - 4\hat{j}$.

$$\text{Magnitude of } \vec{B} = \sqrt{2^2+(-4)^2} = \sqrt{4+16} = \sqrt{20} = 2\sqrt{5} \rightarrow A$$

$$\text{magnitude of } \vec{A} = \sqrt{2^2+2^2} = \sqrt{4+4} = 2\sqrt{2} \rightarrow B$$

$$\text{unit vector of } \vec{A} = \frac{\vec{A}}{|\vec{A}|} = \frac{2\hat{i}+2\hat{j}}{2\sqrt{2}} = \frac{2\hat{i}+2\hat{j}}{\sqrt{8}} \rightarrow A$$

(17)

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

$\vec{c} = 2\hat{j} + 2\hat{i} + \hat{k}$

$|\vec{a}| = \sqrt{3^2+4^2} = \sqrt{9+16} = \sqrt{25} = 5$

$|\vec{b}| = \sqrt{2^2+4^2+6^2} = \sqrt{4+16+36} = \sqrt{56}$

$|\vec{c}| = \sqrt{2^2+2^2+1^2} = \sqrt{4+4+1} = 3$

c, a, b is the increasing order.

L Task (Jee mains level)

(1)

let the vector be $\vec{A} = 3\hat{i} - 12\hat{j} - 4\hat{k}$

It is a 3D vector whose magnitude $= \sqrt{x^2+y^2+z^2}$

$\therefore |\vec{A}| = \sqrt{3^2+(-12)^2+(-4)^2} = \sqrt{9+144+16}$

$= \sqrt{169} = 13 \rightarrow A$

(2)

let $\vec{A} = \frac{2}{3}\hat{i} - \frac{1}{3}\hat{j} + \frac{2}{3}\hat{k}$.

It is a 3D vector whose magnitude $= \sqrt{x^2+y^2+z^2}$

$|\vec{A}| = \sqrt{(\frac{2}{3})^2+(-\frac{1}{3})^2+(\frac{2}{3})^2}$

$= \sqrt{\frac{4}{9}+\frac{1}{9}+\frac{4}{9}}$

$= \sqrt{\frac{9}{9}} = 1 \rightarrow B$

(3)

Given $\vec{A} = 5\hat{i} + p\hat{j} + 4\sqrt{2}\hat{k}$ is 11.

It is a 3D vector so it's magnitude $= \sqrt{x^2+y^2+z^2}$

$|\vec{A}| = 11$

$\Rightarrow \sqrt{5^2+p^2+(4\sqrt{2})^2} = 11^2$

$\Rightarrow 25+p^2+32 = 11^2$

$\Rightarrow p^2+57 = 121 \Rightarrow p^2 = 121-57$

$\Rightarrow p^2 = 64$

$\Rightarrow p = \pm 8 \rightarrow$ C.

(4)

Given that $0.5\hat{i} + 0.8\hat{j} + c\hat{k}$ is a unit vector.

$\Rightarrow |0.5\hat{i} + 0.8\hat{j} + c\hat{k}| = 1$

$\Rightarrow \sqrt{(0.5)^2+(0.8)^2+c^2} = 1$

$\Rightarrow 0.25+0.64+c^2 = 1$

$\Rightarrow 0.89+c^2 = 1 \Rightarrow c^2 = 1-0.89$

$\Rightarrow c = \sqrt{0.11} \rightarrow$ D

(5)

let the vector be $\vec{A} = 3\hat{i} + \hat{j} + 2\hat{k}$

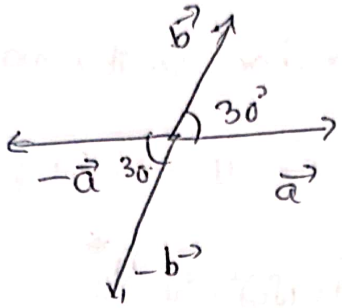
length of vector in xy plane $= \sqrt{x^2+y^2}$

$= \sqrt{3^2+1^2}$

$= \sqrt{10} \rightarrow$ C.

(6)

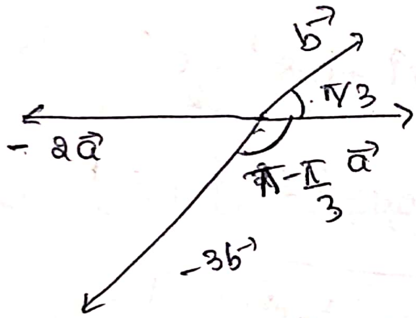
Given angle between $\vec{a}$ and $\vec{b}$ is $30°$ (a)



We can measure the angle between two vectors as the minimum angle between the two vectors which must have common starting point and common end point.

(7)

Given angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{3}$



The angle between $2\vec{a}$ and $-3\vec{b}$

$\pi - \frac{\pi}{3} = \frac{2\pi}{3}$.

(8)

Given $|x\hat{i} - 3\hat{j} + 5\hat{k}| = \sqrt{98}$

$\Rightarrow \sqrt{x^2+3^2+5^2} = \sqrt{98}$ squaring on both sides

$\Rightarrow \left[\sqrt{x^2+9+25}\right]^2 = [\sqrt{98}]^2$

$\Rightarrow x^2 + 34 = 98$

$\Rightarrow x^2 = 98 - 34 \Rightarrow 64$

$\Rightarrow x = \sqrt{64} = \pm 8.$

$\rightarrow$ P

(9)

let $\vec{a} = 3\hat{i} + 2\hat{j} \Rightarrow$ magnitude $= \sqrt{3^2 + 2^2} = \sqrt{9+4} = \sqrt{13}$

$\vec{b} = 2\hat{i} + 2\hat{j} + 6k \rightarrow$ magnitude $= \sqrt{2^2+2^2+6^2} = \sqrt{44}$

$\vec{c} = \hat{i} + \hat{j} + \hat{k} \rightarrow$ magnitude $= \sqrt{1^2+1^2+1^2} = \sqrt{3}$ ..

$\rightarrow B$

(10)

Given $\vec{A} = 2\hat{i} - 3\hat{j} + 4\hat{k}$.

it's length in yz-plane $= \sqrt{y^2+z^2} = \sqrt{(-3)^2+4^2}$

$= \sqrt{9+16} = \sqrt{25} = \underline{\underline{5}}$.

length in zx-plane $= \sqrt{z^2+x^2} = \sqrt{4^2+2^2} = \sqrt{20} = \underline{2\sqrt{5}}$

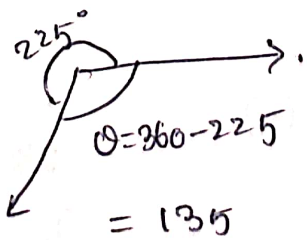
$\rightarrow B$

(12)

Electric current is a scalar because it does not follow laws of vector addition.

Any quantity is a vector if it has magnitude direction and follows laws of vector addition

(13)

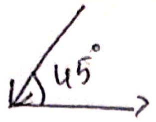


$\theta = 360 - 225$

$= 135$

we have to take minimum angle between the vectors when they have common starting point(or) end point.

(14)



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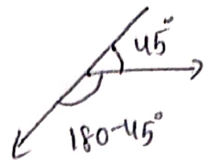
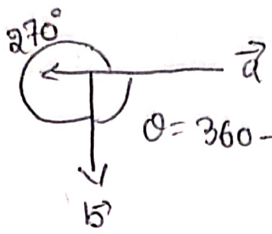


⇒ $180-45° = 135°$

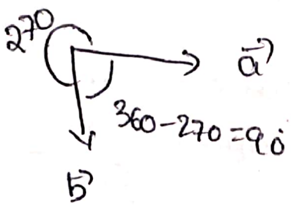
(15)



$\theta = 360-270 = 90°$.

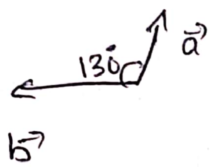
we have to take minimum angle between the vectors

(16)

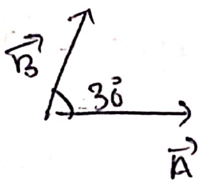


Even the two vectors are starting from same point. but we have to take minimum angle between them.

(17)



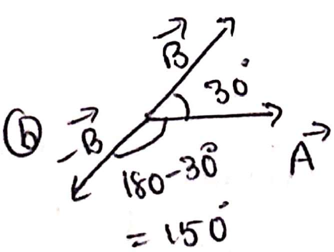
(18)



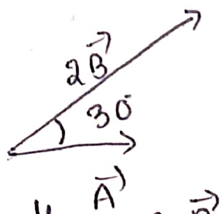
(a) $\vec{A}$ & $\vec{A}$ are Parallel so angle between them is 0°

(d) $\vec{A}$ and $-2\vec{A}$ are anti Parallel then the angle $\theta = 180°$

(b)



(c)



Here length of $\vec{B}$ is doubled but not direction. so angle is same.