VECTOR

1. Two forces P and Q of magnitude 2F and 3F, respectively, are at an angle θ with each other. If the force Q is doubled, then their resultant also gets doubled. Then, the angle is :

(1) 30º (2) 60º

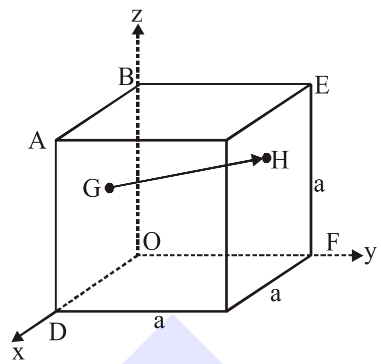
(3) 90º (4) 120º

2. Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. The magnitude of $(\vec{A}+\vec{B})$ is 'n' times the magnitude of $(\vec{A}-\vec{B})$. The angle between $\vec{A}$ and $\vec{B}$ is :

(1) $\sin^{-1}\left[\frac{n^2-1}{n^2+1}\right]$ (2) $\cos^{-1}\left[\frac{n-1}{n+1}\right]$

(3) $\cos^{-1}\left[\frac{n^2-1}{n^2+1}\right]$ (4) $\sin^{-1}\left[\frac{n-1}{n+1}\right]$

3. In the cube of side 'a' shown in the figure, the vector from the central point of the face ABOD to the central point of the face BEFO will be:



(1) $\frac{1}{2}a(\hat{i}-\hat{k})$ (2) $\frac{1}{2}a(\hat{j}-\hat{i})$

(3) $\frac{1}{2}a(\hat{k}-\hat{i})$ (4) $\frac{1}{2}a(\hat{j}-\hat{k})$

4. Let $|\vec{A}_1|=3$, $|\vec{A}_2|=5$ and $|\vec{A}_1+\vec{A}_2|=5$. The value of $(2\vec{A}_1+3\vec{A}_2).(3\vec{A}_1-2\vec{A}_2)$ is :-

(1) –112.5 (2) –106.5

(3) –118.5 (4) –99.5

SOLUTION

1. Ans. (4)

2. Ans. (3)

$|\vec{A}+\vec{B}| = 2a\cos\theta/2$ ____(1)

$|\vec{A}-\vec{B}| = 2a\cos\frac{(\pi-\theta)}{2} = 2a\sin\theta/2$ ____(2)

$\Rightarrow n\left(2a\cos\frac{\theta}{2}\right) = 2a\frac{\sin\theta}{2}$

$\Rightarrow \tan\frac{\theta}{2} = n$

3. Ans. (2)

$\vec{r}_g = \frac{a}{2}\hat{i} + \frac{a}{2}\hat{k}$

$\vec{r}_H = \frac{a}{2}\hat{j} + \frac{a}{2}\hat{k}$

$\vec{r}_H - \vec{r}_g = \frac{a}{2}(\hat{j} - \hat{i})$

4. Ans. (3)

Sol. $|\vec{A}_1| = 3$ $|\vec{A}_2| = 5$ $|\vec{A}_1 + \vec{A}_2| = 5$

$|\vec{A}_1 + \vec{A}_2| = \sqrt{|\vec{A}_1|^2 + |\vec{A}_2|^2 + 2|\vec{A}_1||\vec{A}_2|\cos\theta}$

$5 = \sqrt{9 + 25 + 2\times3\times5\cos\theta}$

$\cos\theta = -\frac{9}{2\times3\times5} = -\frac{3}{10}$

$(2\vec{A}_1 + 3\vec{A}_2).(3\vec{A}_1 - 2\vec{A}_2)$

$= 6|\vec{A}_1|^2 + 9\vec{A}_1.\vec{A}_2 - 4\vec{A}_1\vec{A}_2 - 6|\vec{A}_2|^2$

$54 + 5\times3\times5\left(-\frac{3}{10}\right) - 6\times25$

$= 54 - 150 - \frac{45}{2} = -118.5$