YAKEEN NEET 2.0

2026

Vectors

Physics

Assignment Solution 03

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Question

Two forces having magnitude A and $\frac{A}{2}$ are perpendicular to each other. The magnitude of their resultant is:

[JEE Mains 2023]

$\theta = 90^\circ$

$$R = \sqrt{A^2 + \left(\frac{A}{2}\right)^2 + 2A\cdot\frac{A}{2}\cos 90^\circ}$$

$$= \sqrt{A^2 + \frac{A^2}{4}}$$

$$= \sqrt{\frac{5A^2}{4}} = \frac{A\sqrt{5}}{2}$$ ✓

1. $\frac{\sqrt{5}A}{4}$
2. $\frac{\sqrt{5}A}{2}$
3. $\frac{5A}{2}$
4. $\frac{\sqrt{5}A^2}{2}$

Question

At any instant the velocity of a particle of mass 500g is $(2t\,\hat{i} + 3t^2\,\hat{j})$ m s^{-1}. If the force acting on the particle at $t = 1$s is $(\hat{i} + x\,\hat{j})$ N. Then the value of x will be:

[JEE Mains 2023]

1. 3
2. 4
3. 2
4. 6

$m = \frac{1}{2}$ kg

$V = 2t\,\hat{i} + 3t^2\,\hat{j}$

$a = \frac{dv}{dt} = 2\frac{dt}{dt}\hat{i} + 3\frac{dt^2}{dt}\hat{j}$

$= 2\hat{i} + 3(2t)\hat{j}$

$a = 2\hat{i} + 6t\hat{j}$

at $t = 1$

$F = \hat{i} + x\hat{j}$

$F = m \times a$

$= \frac{1}{2}(2\hat{i} + 6t\hat{j})$

$F = \hat{i} + 3t\hat{j}$

$x = 3t$

$t = 1$

$x = 3$

Question

$\vec{A} - \vec{B}$ या $\vec{B} - \vec{A}$

When vector $\vec{A} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ is subtracted from vector $\vec{B}$ it gives a vector equal to $2\hat{j}$. Then the magnitude of vector $\vec{B}$ will be: **[JEE Mains 2023]**

1. $\sqrt{5}$
2. 3
3. $\sqrt{6}$
4. $\sqrt{33}$ ✓

$\vec{A} = 2\hat{i} + 3\hat{j} + 2\hat{k}$

$\vec{B} - \vec{A} = 2\hat{j}$ ✓

$\vec{B} = 2\hat{j} + \vec{A}$

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

$|\vec{B}| = 2\hat{i} + 5\hat{j} + 2\hat{k}$

$|B| = \sqrt{4 + 25 + 4}$

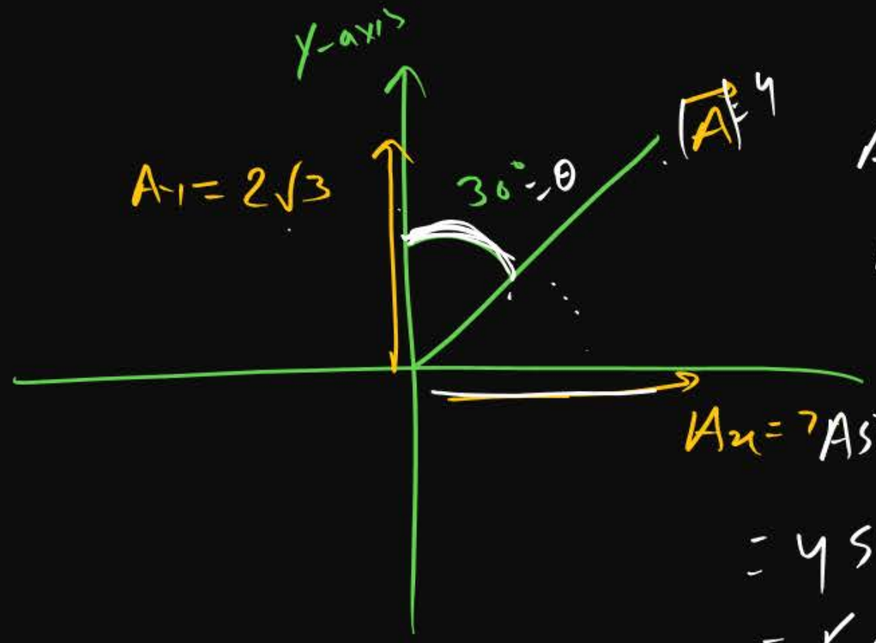
$= \sqrt{33}$ ✓

Question

A vector in x-y plane makes an angle of 30° with y-axis. The magnitude of y-component of vector is $2\sqrt{3}$. The magnitude of x-component of the vector will be:

[JEE Mains 2023]

1. $1/\sqrt{3}$
2. 6
3. 2
4. $\sqrt{3}$



$A\cos 30^\circ = 2\sqrt{3}$

$A\,\frac{\sqrt{3}}{2} = 2\sqrt{3}$

$A = 4$

$= 4\sin 30$

$= 4 \times \frac{1}{2} = 2$

Question

The position vector of a particle related to time t is given by $\vec{r} = (10t\hat{i} + 15t^2\hat{j} + 7\hat{k})m$.
The direction of net force experienced by the particle is: **[JEE Mains 2023]**

1. Positive x-axis
2. In x-y plane
3. Positive y-axis ✓ Ans
4. Positive z-axis

$$\vec{r} = 10t\,\hat{i} + 15t^2\hat{j} + 7\hat{k}$$

$$\frac{d\vec{r}}{dt} = \vec{v} = 10\,\hat{i} + 15(2t)\hat{j} + 0\,\hat{k}$$

$$\vec{v} = 10\,\hat{i} + 30t\,\hat{j}$$

$$\vec{a} = \frac{d\vec{v}}{dt} = 0 + 30 \times 1\,\hat{j}$$

Question

Vectors $a\hat{i} + b\hat{j} + \hat{k}$ and $2\hat{i} - 3\hat{j} + 4\hat{k}$ are perpendicular to each other when $3a + 2b = 7$, the ratio of a to b is $\frac{x}{2}$. The value of x is _____. **[JEE Mains 2023]**

$$(a\hat{i}+b\hat{j}+\hat{k})\cdot(2\hat{i}-3\hat{j}+4\hat{k}) = 0$$

$$2a - 3b + 4 = 0$$

$$2a - 3b = -4 \quad \text{— (I)} \times 2$$

$$3a + 2b = 7 \quad \text{— (II)} \times 3$$

$$4a - 6b = -8$$
$$9a + 6b = 21$$

$$13a = 13 \quad \boxed{a = 1}$$

Put $a = 1$

$$3 \times 1 + 2b = 7$$

$$2b = 7 - 3$$
$$2b = 4$$

$$\boxed{b = 2}$$

$$\frac{a}{b} = \frac{x}{2} = \frac{1}{2}$$

$$\boxed{x = 1}$$

Question

If two vectors $\vec{P} = \hat{i} + 2m\hat{j} + m\hat{k}$ and $\vec{Q} = 4\hat{i} - 2\hat{j} + m\hat{k}$ are perpendicular to each other. Then, the value of m will be **[JEE Mains 2023]**

1. -1
2. 2
3. 3
4. 1

$$4 - 4m + m^2 = 0$$

$$m^2 - 4m + 4 = 0$$

$$m^2 - 2m - 2m + 4 = 0$$

$$m(m-2) - 2(m-2) = 0$$

$$m = 2$$

Question

If $\vec{P} = 3\hat{i} + \sqrt{3}\hat{j} + 2\hat{k}$ and $\vec{Q} = 4\hat{i} + \sqrt{3}\hat{j} + 2.5\hat{k}$ then, the unit vector in the direction of $\vec{P} \times \vec{Q}$ is $\frac{1}{x}(\sqrt{3}\hat{i} + \hat{j} - 2\sqrt{3}\hat{k})$. The value of x is _____. **[JEE Mains 2023]**

$$\vec{P} \times \vec{Q} = \begin{vmatrix} i & j & k \\ 3 & \sqrt{3} & 2 \\ 4 & \sqrt{3} & 5/2 \end{vmatrix} = i\left(\frac{\sqrt{3}5}{2} - 2\sqrt{3}\right) + \hat{j}\left(8 - \frac{15}{2}\right) + \hat{k}\left|3\sqrt{3} - 4\sqrt{3}\right|$$

$$\vec{P} \times \vec{Q} = \frac{1}{2}\sqrt{3}\,\hat{i} + \frac{1}{2}\hat{j} - \sqrt{3}\,\hat{k}$$

$$= \frac{\vec{P} \times \vec{Q}}{|\vec{P} \times \vec{Q}|} = \frac{1}{2}\left(\frac{\sqrt{3}}{2} i + \frac{1}{2} j - \sqrt{3} k\right)$$

$$= \frac{1}{4}\left(\sqrt{3}\,i + j - 2\sqrt{3}\,k\right)$$

$$|\vec{P} \times \vec{Q}| = \sqrt{\frac{3}{4} + \frac{1}{4} + 3} = \sqrt{\frac{3+1+12}{4}} = \sqrt{4} = 2$$

$x = 4$

Question

A block of $\sqrt{3}$ kg is attached to a string whose other end is attached to the wall. An unknown force F is applied so that the string makes an angle of 30° with the wall. The tension T is: (Given $g = 10\ \text{m s}^{-2}$)

[JEE Mains 2023]

1. 20 N
2. 25 N
3. 10 N
4. 15 N

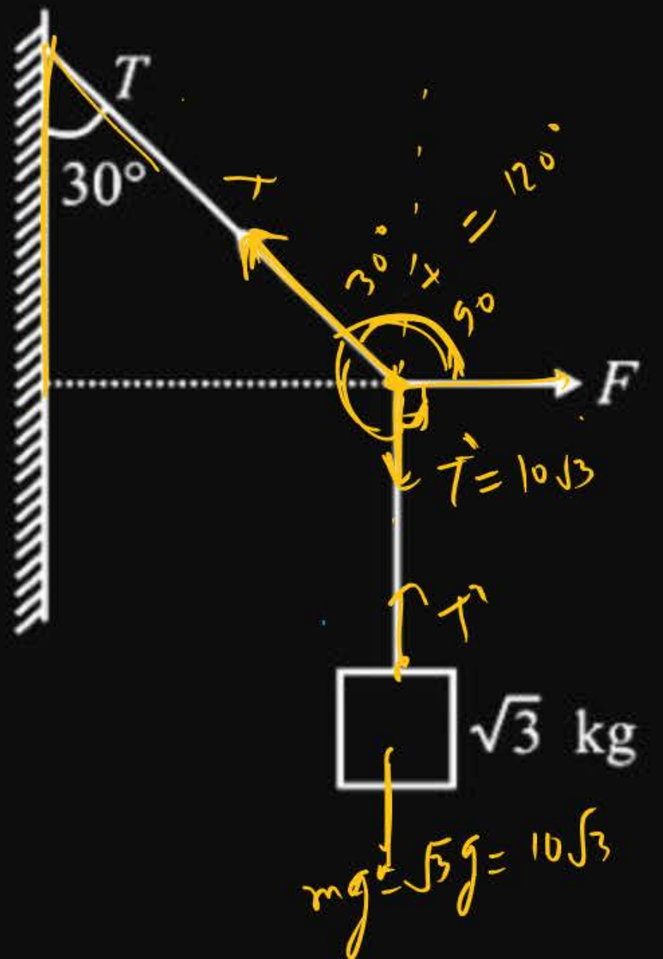
Lami's th^m

$$\frac{10\sqrt{3}}{\sin 120^\circ} = \frac{T}{\sin 30^\circ}$$

$$\Rightarrow \frac{10\sqrt{3}}{\sqrt{3}/2} = T$$

$$T = 20\ \text{N}$$

Ans 2



Question

diagram missing

Expression for an electric field is given by $\vec{E} = 4000\, x^2\, \hat{i}$ V m^{-1}. The electric flux through the cube of side 20 cm when placed in electric field (as shown in the figure) is ____ V-cm.

[JEE Mains 2023]

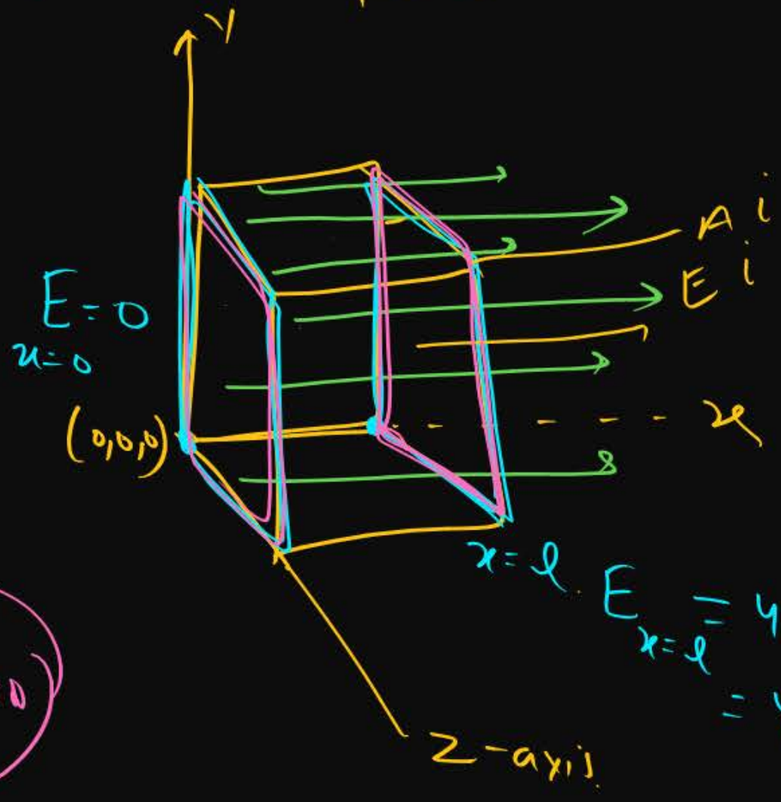
variable

$\ell = \frac{20}{100}$ m $= \frac{1}{5}$ m

$\phi = \vec{E} \cdot \vec{A}$

level it

electric field



$E_{x=\ell} = 4000(\ell^2)\,\hat{i}$

$= 4000\left(\frac{1}{25}\right)\hat{i}$

plane (YZ)

Area $\rightarrow \hat{i}$

$\phi = 4000 \times \left(\frac{1}{25}\right) \cdot (\ell)^2$

$= \cancel{4000}^{16} \times \frac{1}{25} \times \frac{1}{25}$

$= 16 \times \cancel{16}^{2} \times \frac{1}{\cancel{25}_{5}} = \frac{32}{5}$ V-m

$= \frac{32}{5} \times \cancel{100}^{20}$ (m

$\phi = (640)$

Question

final pos | dis |

$\vec{r}_i$

A small particle moves to position $5\hat{\imath} - 2\hat{\jmath} + \hat{k}$ from its initial position $2\hat{\imath} + 3\hat{\jmath} - 4\hat{k}$ under the action of force $5\hat{\imath} + 2\hat{\jmath} + 7\hat{k}$ N. The value of work done will be _____ J.

[JEE Mains 2023]

Force $= (5i + 2j + 7k)$

$W = F \cdot S = (5i + 2j + 7k) \cdot (3i - 5j + 5k)$

$= 15 - 10 + 35$

$= 40$

Question

Position of an ant (S in metres) moving in Y-Z plane is given by $S = 2t^2\hat{j} + 5\hat{k}$ (where t is in second). The magnitude and direction of velocity of the ant at $t = 1s$ will be:

[JEE Mains 2024]

1. $16\ m\ s^{-1}$ in y-direction
2. $4\ m\ s^{-1}$ in x-direction
3. $9\ m\ s^{-1}$ in z-direction
4. $4\ m\ s^{-1}$ in y-direction

$$S = 2t^2\hat{j} + 5\hat{k}$$

$$\vec{v} = 2(2t)\hat{j} + 0$$

$$v = 4t\hat{j}$$

Question

An electric field is given by $(6\hat{\imath} + 5\hat{\jmath} + 3\hat{k})$ N C^{-1}. The electric flux through a surface area $30\hat{\imath}$ m^2 lying in YZ-plane (in SI unit) is:

[JEE Mains 2024]

1. 90
2. 150
3. 180
4. 60

Question

A vector has magnitude same as that of $\vec{A} = 3\hat{j} + 4\hat{j}$ and is parallel to $\vec{B} = 4\hat{i} + 3\hat{j}$. The x and y components of this vector in first quadrant are x and 3 respectively where $x =$ _____.

[JEE Mains 2024]

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

$= \sqrt{25}$

$= 5$ ✓

$\vec{M} = |\vec{M}|\,\hat{m}$

$\vec{C} = |\vec{C}|\,\hat{C}$

$= |\vec{A}|\,\hat{B}$

$= 5\left(\frac{4\hat{i}+3\hat{j}}{5}\right)$

$\vec{C} = 4\hat{i} + 3\hat{j}$

$\hat{B} = \frac{\vec{B}}{|\vec{B}|}$

$4 = x$

Question

If two vectors $\vec{A}$ and $\vec{B}$ having equal magnitude R are inclined at an angle θ, then

[JEE Mains 2024]

$|\vec{A}| = |\vec{B}| = R$

1. $\vec{A} - \vec{B} = \sqrt{2}R \sin\frac{\theta}{2}$ ✗
2. $\vec{A} + \vec{B} = 2R \sin\frac{\theta}{2}$ ✗
3. $\vec{A} + \vec{B} = 2R \cos\frac{\theta}{2}$ ✓
4. $\vec{A} - \vec{B} = 2R \cos\frac{\theta}{2}$

Question

$72\ km/hr \times \frac{5}{18} = 20\ m/s$

Train A is moving along two parallel rail tracks towards north with 72 km h^{-1} and train B is moving towards south with speed 108 km h^{-1}. Velocity of train B with respect to A and velocity of ground with respect to B are (in m s^{-1}): **[JEE Mains 2024]**

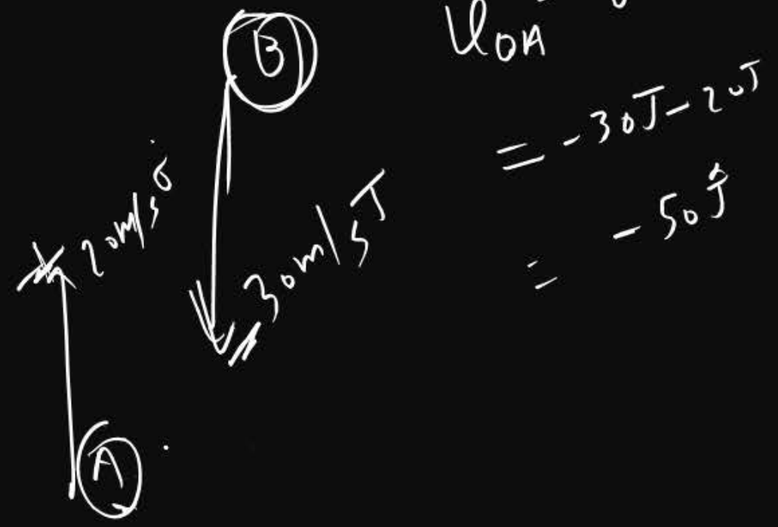
1. –30 and 50
2. –50 and –30
3. –50 and 30
4. 50 and –30

$108 \times \frac{5}{18} = 30\ m/s$

$\vec{v}_{GB} = \vec{v}_G - \vec{v}_B$

$= -\vec{v}_B$

$= +30$



$\vec{v}_{BA} = \vec{v}_B - \vec{v}_A$

$= -30\hat{j} - 20\hat{j}$

$= -50\hat{j}$

Question

A body of mass 4 kg experiences two force $\vec{F}_1 = 5\hat{i} + 8\hat{j} + 7\hat{k}$ and $\vec{F}_2 = 3\hat{i} - 4\hat{j} - 3\hat{k}$. The acceleration acting on the body is: **[JEE Mains 2024]**

1. $-2\hat{i} - \hat{j} - \hat{k}$
2. $4\hat{i} + 2\hat{j} + 2\hat{k}$
3. $2\hat{i} + \hat{j} + \hat{k}$
4. $2\hat{i} + 3\hat{j} + 3\hat{k}$

$$a = \frac{\vec{F}_1 + \vec{F}_2}{m}$$

$$= \frac{8i + 4\hat{j} + 4\hat{k}}{4}$$

$$a = 2i + \hat{j} + \hat{k}$$

Question

Two forces $\vec{F}_1$ and $\vec{F}_2$ are acting on a body. One force has magnitude thrice that of the other force and the resultant of the two forces is equal to the force of larger magnitude. The angle between $\vec{F}_1$ and $\vec{F}_2$ is $\cos^{-1}\left(\frac{1}{n}\right)$. The value of $|n|$ is _____. **[JEE Mains 2024]**

$\cos\theta = -1/6$

$n = 6$

$R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$

$R^2 = A^2 + B^2 + 2AB\cos\theta$

$(3x)^2 = x^2 + (3x)^2 + 2x \cdot 3x\cos\theta$

$9x^2 = 10x^2 + 6x^2\cos\theta$

$9 - 10 = 6\cos\theta$

$-1 = 6\cos\theta$

$\cos\theta = 1/6$

$|\vec{F}_1| = x$ (let)

$|\vec{F}_2| = 3x$

$|F_{net}| = 3x$

Question

The angle between vector $\vec{Q}$ and the resultant of $(2\vec{Q} + 2\vec{P})$ and $(2\vec{Q} - 2\vec{P})$ is:

[JEE Mains 2024]

1. $\tan^{-1}\dfrac{(2\vec{Q}_1 - 2\vec{P})}{2\vec{Q} + 2\vec{P}}$
2. $0°$
3. $\tan^{-1}(P/Q)$
4. $\tan^{-1}(2\,Q/P)$

Question

A particle moves in x-y plane under the influence of a force $\vec{F}$ such that its linear momentum is $\vec{p}(t) = \hat{\imath}\cos(kt) - \hat{\jmath}\sin(kt)$. If k is constant, the angle between $\vec{F}$ and $\vec{p}$ will be

[JEE Mains 2024]

1. $\pi/4$
2. $\pi/6$
3. $\pi/2$
4. $\pi/3$

$$\vec{P}(t) = \cos(kt)\,\hat{i} - \sin(kt)\,\hat{j}$$

$$\vec{F} = \frac{d\vec{P}}{dt} = -k\sin(kt)\,\hat{i} - k\cos(kt)\,\hat{j}$$

$$\vec{P}\cdot\vec{F} = 0$$

Question

For three vectors $\vec{A} = (-x\hat{i} - 6\hat{j} - 2\hat{k})$, $\vec{B} = (-\hat{i} + 4\hat{j} + 3\hat{k})$ and $\vec{C} = (-8\hat{i} - \hat{j} + 3\hat{k})$, if $\vec{A} \cdot (\vec{B} \times \vec{C}) = 0$, then value of x is _____.

[JEE Mains 2024]

$$\vec{B} \times \vec{C} = \begin{vmatrix} i & j & k \\ -1 & +4 & +3 \\ -8 & -1 & +3 \end{vmatrix}$$

$$= i(12+3) + \hat{j}(-24+3) + \hat{k}(1+32)$$

$$= (15i - 21\hat{j} + 33\hat{k}) \cdot (-xi - 6j - 2k) = 0$$

$$-15x + 126 - 66 = 0$$

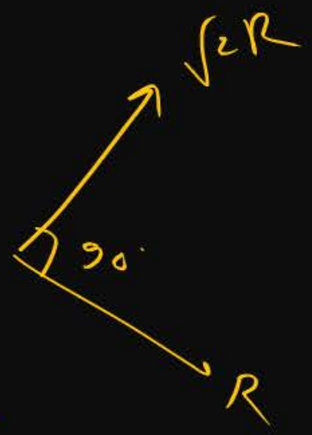
$$15x = 126 - 66$$

$$15x = 60$$

$$\therefore x = 4$$

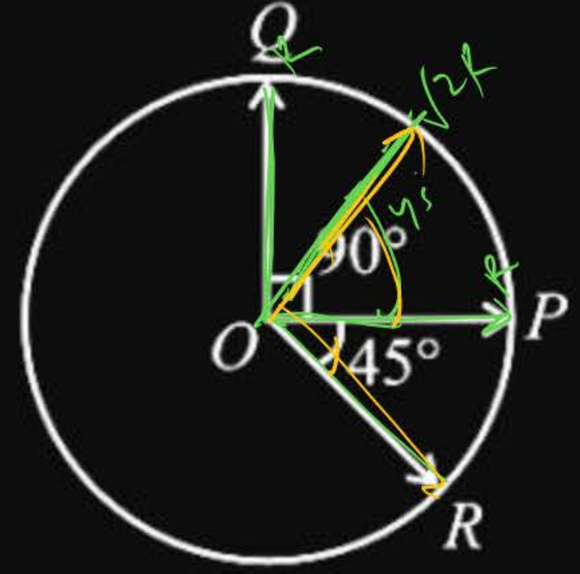
Question

Three vectors $\overrightarrow{OP}, \overrightarrow{OQ}$ and $\overrightarrow{OR}$ each of magnitude A are acting as shown in figure. The resultant of the three vectors is $A\sqrt{x}$. The value of x is _____. **[JEE Mains 2024]**



$$R_{net} = \sqrt{R^2 + 2R^2}$$

$$= \sqrt{3R^2} = \sqrt{3}\,R = \sqrt{3}A = \sqrt{x}A$$



Question

$\theta = \cos^{-1}\left(\frac{5}{9}\right)$ $\cos\theta = \frac{5}{9}$

If $\vec{a}$ and $\vec{b}$ makes an angle $\cos^{-1}\left(\frac{5}{9}\right)$ with each other, then $|\vec{a}+\vec{b}| = \sqrt{2}|\vec{a}-\vec{b}|$ for $|\vec{a}| = n|\vec{b}|$. The integer value of n is ___3___. **[JEE Mains 2024]**

Leave it

$$|\vec{a}+\vec{b}| = \sqrt{2}|\vec{a}-\vec{b}|$$

$$\sqrt{a^2+b^2+2ab\cos\theta} = \sqrt{2}\times\sqrt{a^2+b^2-2ab\cos\theta}$$

square both

$$a^2+b^2 = 2a^2+2b^2-4ab\cos\theta-2ab\cos\theta$$

$$+a^2+b^2 = +6ab\cos\theta$$

$$a^2+b^2 = 6ab\cos\theta$$

$$n^2b^2+b^2 = 6nb\times b\cos\theta$$

$$n^2+1 = 6n\times\frac{5}{9}$$

$$3n^2+3 = 10n$$

$$3n^2-10n+3 = 0$$

$3n^2-10n+3=0$

$3n^2-9n-n+3=0$

$3n(n-3)-1(n-3)=0$

$(n-3)(3n-1)=0$

$n-3=0$ | $3n-1=0$

$n=3$ | $3n=1$

$n=\frac{1}{3}$

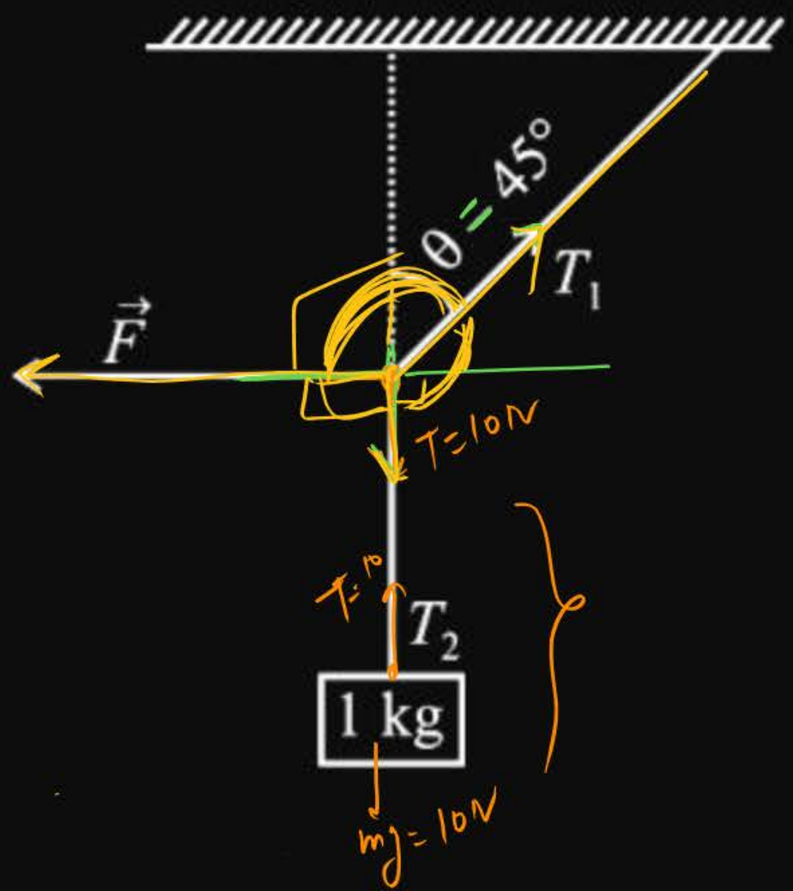
Question

A 1 kg mass is suspended from the ceiling by a rope of length 4 m. A horizontal force 'F' is applied at the mid point of the rope so that the rope makes an angle of 45° with respect to the vertical axis as shown in figure. The magnitude of F is: (Assume that the system is in equilibrium and $g = 10\ m/s^2$)

[JEE Mains 2024]

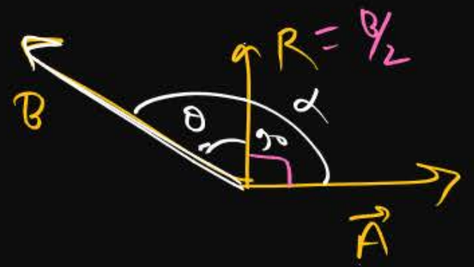
1. 10 N
2. $\frac{10}{\sqrt{2}}$ N
3. 1 N
4. $\frac{1}{10 \times \sqrt{2}}$ N

$$\frac{F}{\sin 45} = \frac{10}{\sin 45}$$



Question

The resultant of two vectors $\vec{A}$ and $\vec{B}$ is perpendicular to $\vec{A}$ and its magnitude is half that of $\vec{B}$. The angle between vectors $\vec{A}$ and $\vec{B}$ is ____ °. **[JEE Mains 2024]**



$B\cos\theta = \frac{B}{2}$

$\cos\theta = \frac{1}{2}$

$\theta = 60$

$\alpha = 90 + 60$

$= 150$

Question

The position vector of a moving body at any instant of time is given as $\vec{r} = (5t^2\hat{i} - 5t\hat{j})m$. The magnitude and direction of velocity at $t = 2s$ is:

[JEE Mains 2025]

1. $5\sqrt{15}$ m/s, making an angle of $\tan^{-1} 4$ with –ve Y
2. $5\sqrt{15}$ m/s, making an angle of $\tan^{-1} 4$ with +ve X
3. $5\sqrt{17}$ m/s, making an angle of $\tan^{-1} 4$ with +ve X
4. $5\sqrt{17}$ m/s, making an angle of $\tan^{-1} 4$ with –ve Y

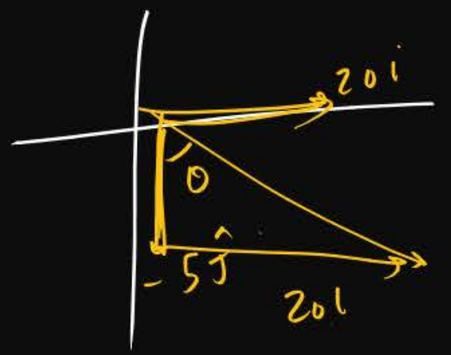
$\vec{r} = 5t^2\hat{i} - 5t\hat{j}$

$\frac{d\vec{r}}{dt} = \vec{v} = 10t\,i - 5\hat{j}$

$= 20i - 5\hat{j}$

$\tan\theta = \frac{5}{20}$

$\sqrt{425} = \sqrt{17 \times 25} = 5\sqrt{17}$



Question

The torque due to the force $(2\hat{i}+\hat{j}+2\hat{k})$ about the origin, acting on a particle whose position vector is $(\hat{i}+\hat{j}+\hat{k})$, would be

[JEE Mains 2025]

1. $\hat{i}-\hat{k}$
2. $\hat{i}+\hat{k}$
3. $\hat{j}+\hat{k}$
4. $\hat{i}-\hat{j}+\hat{k}$

$$\tau = \begin{vmatrix} i & j & k \\ 1 & 1 & 1 \\ 2 & 1 & 2 \end{vmatrix}$$

Question

The coordinates of a particle with respect to origin in a given reference frame is (1, 1, 1) meters. If a force of $\vec{F} = \hat{\imath} - \hat{\jmath} + \hat{k}$ acts on the particle, then the magnitude of torque (with respect to origin) in z-direction is _____. **[JEE Mains 2021/22]**

$$\begin{vmatrix} i & j & k \\ 1 & 1 & 1 \\ 1 & -1 & 1 \end{vmatrix} = \hat{k}(-1-1)$$

$$= -2\hat{k}$$

Ans 2

Question

$\vec{A}$ is a vector quantity such that $\vec{A}$ = non-zero constant. Which of the following expression is true for $\vec{A}$?

[JEE Mains 2021/22]

1. $\vec{A} \cdot \vec{A} = 0$

2. $\vec{A} \times \vec{A} < 0$

3. $\vec{A} \times \vec{A} = 0$

4. $\vec{A} \times \vec{A} > 0$

$\vec{A} \cdot \vec{A} = AA\cos 0^\circ = A^2$

Question

Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. If magnitudes of $\vec{A} + \vec{B}$ is equal to two times the magnitude of $\vec{A} - \vec{B}$, then the angle between $\vec{A}$ and $\vec{B}$ will be

[JEE Mains 2021/22]

1. $\cos^{-1}\left(\frac{3}{5}\right)$
2. $\cos^{-1}\left(\frac{1}{3}\right)$
3. $\sin^{-1}\left(\frac{1}{3}\right)$
4. $\sin^{-1}\left(\frac{3}{5}\right)$

$2A\cos\theta/2 = 2(2A\sin\theta/2)$

$\cos\theta/2 = 2\sin\theta/2$

$\cos\theta/2 = 2\sqrt{1-\cos^2\theta/2}$

$|\vec{A}+\vec{B}| = 2|\vec{A}-\vec{B}|$

$\sqrt{A^2+B^2+2AB\cos\theta} = 2\sqrt{A^2+B^2-2AB\cos\theta}$

Square on

$A^2+B^2+2AB\cos\theta = 4(A^2+B^2-2AB\cos\theta)$

$2A^2+2B^2\cos\theta = 8A^2-8B^2\cos\theta$

$10B\cos\theta = 6$

$\cos\theta = \frac{6}{10} = \frac{3}{5}$ $\quad \theta = \cos^{-1}\left(\frac{3}{5}\right)$

Question

If $\vec{A} = 2\hat{i} + 3\hat{j} - \hat{k}$ m and $\vec{B} = \hat{i} + 2\hat{j} + 2\hat{k}$ m. The magnitude of component of vector $\vec{A}$ along vector $\vec{B}$ will be ____ m.

[JEE Mains 2021/22]

$$\text{Comp}^{n} \text{ of } A \text{ along } B = \frac{\vec{A}\cdot\vec{B}}{B}$$

$$= \frac{2+6-2}{\sqrt{4+4+1}}$$

$$= \frac{6}{3} = 2$$

Question

Both are ⊥ or

If the projection of $2\hat{i} + 4\hat{j} - 2\hat{k}$ on $\hat{i} + 2\hat{j} + \alpha\hat{k}$ is zero. Then, the value of α will be ____.

[JEE Mains 2021/22]

$2 + 8 - 2\alpha = 0$

$\Rightarrow \alpha = 5$

Question

If $\vec{P} \times \vec{Q} = \vec{Q} \times \vec{P}$, the angle between $\vec{P}$ and $\vec{Q}$ is θ $(0° < \theta < 360°)$. The value of θ will be ____.

[JEE Mains 2021/22]

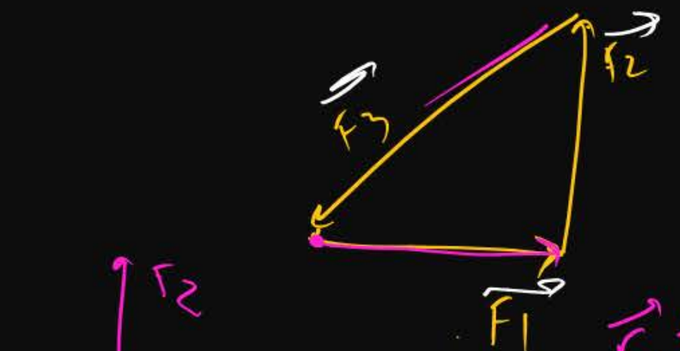
$\theta = 180°$

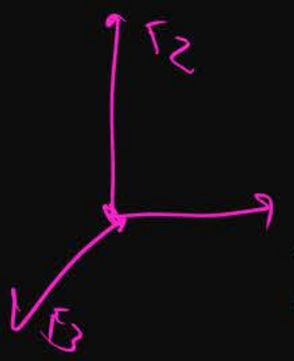
Question

Statement I: If three forces $\vec{F}_1$, $\vec{F}_2$ and $\vec{F}_3$ are represented by three sides of a triangle and vector $\vec{F}_1 + \vec{F}_2 = -\vec{F}_3$, then these three forces are concurrent forces and satisfy the condition for equilibrium.

Statement II: A triangle made up of three forces $\vec{F}_1$, $\vec{F}_2$ and $\vec{F}_3$ as its sides were taken in the same order, hence satisfies the condition for translatory equilibrium.

1. Both Statement I and Statement II are true.
2. Statement I is true but Statement II is false.
3. Both Statement I and Statement II are false.
4. Statement I is false but Statement II is true.





$\vec{F}_1 + \vec{F}_2 + \vec{F}_3 = 0$

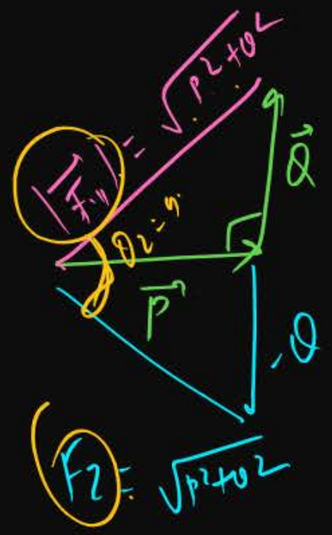
$\vec{F}_1 + \vec{F}_2 = -\vec{F}_3$

Question

Statement I: Two forces $\vec{P} + \vec{Q}$ and $\vec{P} - \vec{Q}$ where $\vec{P} \perp \vec{Q}$, when act at an angle θ_1 each other, the magnitude of their resultant is $\sqrt{3(P^2 + Q^2)}$, when they act at an angle θ_2, the magnitude of their resultant becomes $\sqrt{2(P^2 + Q^2)}$. This only when $\theta_1 < \theta_2$.

Statement II: In the situation given above.

$\theta_1 = 60°$ and $\theta_2 = 90°$



$R_m = 2\left(\sqrt{P^2+Q^2}\right)\cos\frac{\theta_1}{2}$

$= \frac{\sqrt{2}}{2}\sqrt{P^2+Q^2} + \frac{1}{\sqrt{2}}\sqrt{P^2+Q^2}$

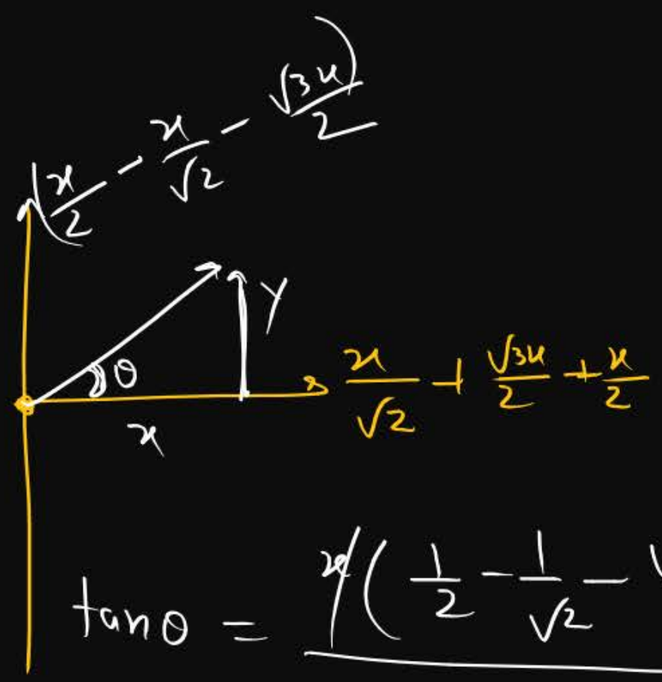
$= \sqrt{2(P^2+Q^2)}$

1. Statement I is false but Statement II is true.
2. Both Statement I and Statement II are true
3. Both Statement I and Statement II are false.
4. Statement I is true but Statement II is false.

Question

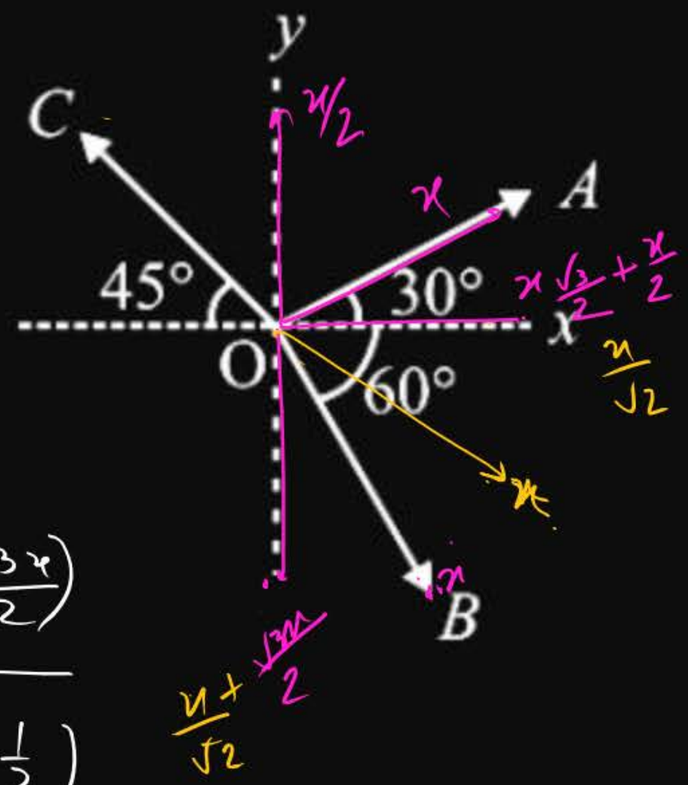
The magnitude of vectors $\overrightarrow{OA}$, $\overrightarrow{OB}$ and $\overrightarrow{OC}$ in the given figure are equal. The direction of $\overrightarrow{OA} + \overrightarrow{OB} - \overrightarrow{OC}$ with x-axis will be:

1. $\tan^{-1}\dfrac{(\sqrt{3}-1+\sqrt{2})}{(1+\sqrt{3}-\sqrt{2})}$
2. $\tan^{-1}\dfrac{(1-\sqrt{3}-\sqrt{2})}{(1+\sqrt{3}+\sqrt{2})}$
3. $\tan^{-1}\dfrac{(\sqrt{3}-1+\sqrt{2})}{(1-\sqrt{3}+\sqrt{2})}$
4. $\tan^{-1}\dfrac{(1-+\sqrt{3}-\sqrt{2})}{(1-\sqrt{3}-\sqrt{2})}$



$$\tan\theta = \frac{x\left(\frac{1}{2}-\frac{1}{\sqrt{2}}-\frac{\sqrt{3}}{2}\right)}{x\left(\frac{1}{\sqrt{2}}+\frac{\sqrt{3}}{2}+\frac{1}{2}\right)}$$

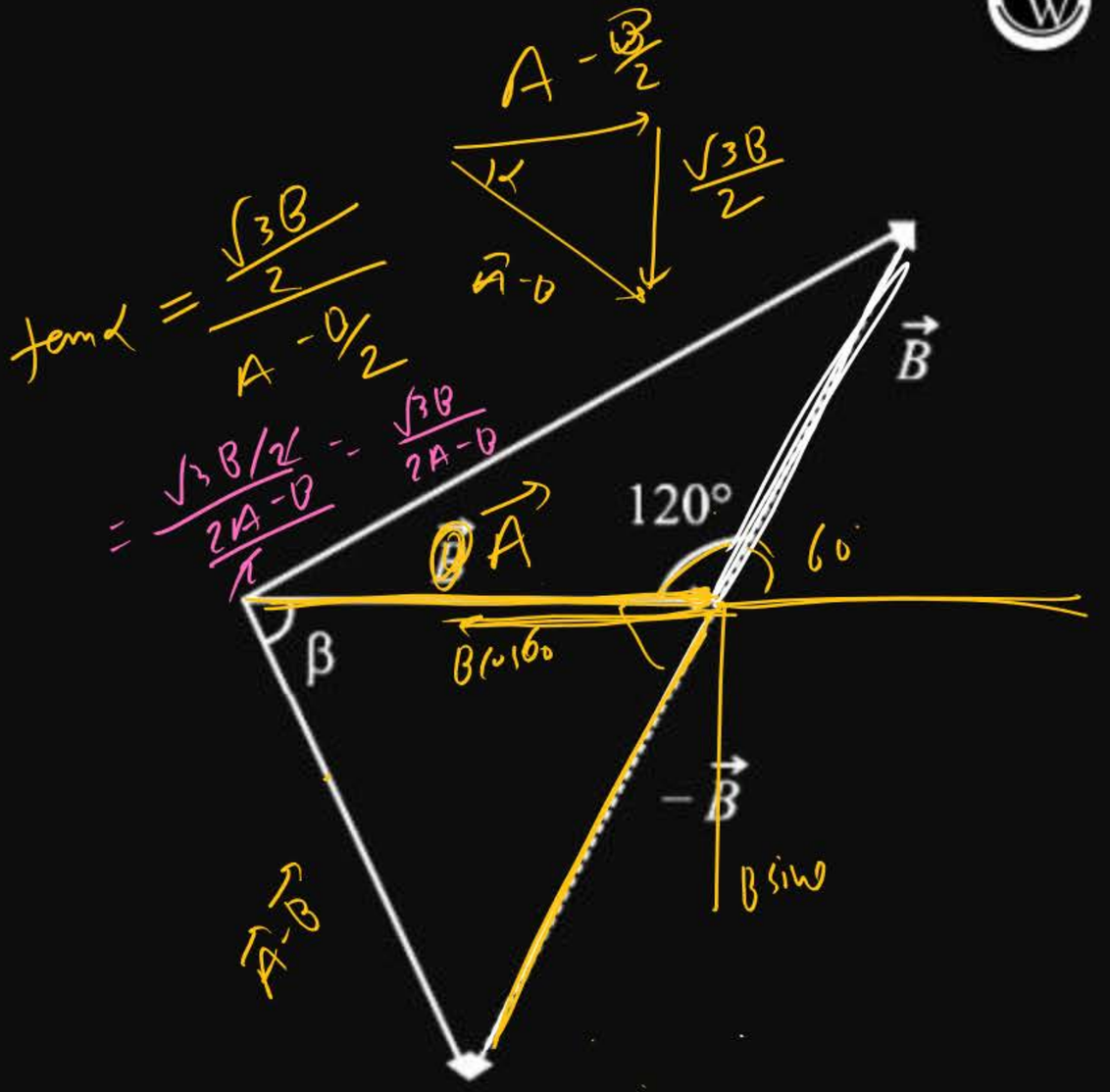
$$= \frac{\frac{1}{2}\left(1-\sqrt{2}-\sqrt{3}\right)}{\frac{1}{2}\left(\sqrt{2}+\sqrt{3}+1\right)}$$



Question

The angle between vector $(\vec{A})$ and $(\vec{A}-\vec{B})$ is:

1. $\tan^{-1}\left(\frac{B\cos\theta}{A-B\sin\theta}\right)$
2. $\tan^{-1}\left(\frac{\sqrt{3}B}{2A-B}\right)$
3. $\tan^{-1}\left(\frac{-\frac{B}{2}}{A-B\frac{\sqrt{3}}{2}}\right)$
4. $\tan^{-1}\left(\frac{A}{0.7B}\right)$

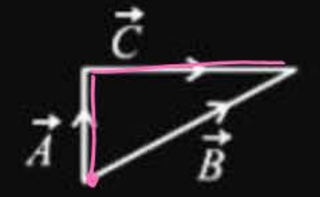
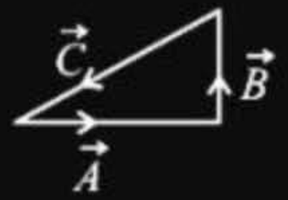
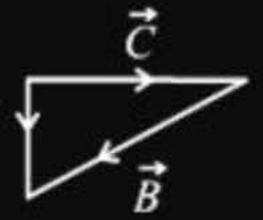


Question

Match List-I with List-II.

Choose the correct answer from the options given below:

1. (a)→(iv), (b)→(i), (c)→(iii), (d)→(ii)
2. (a)→(iv), (b)→(iii), (c)→(i), (d)→(ii)
3. (a)→(iii), (b)→(ii), (c)→(iv), (d)→(i)
4. (a)→(i), (b)→(iv), (c)→(ii), (d)→(iii)

List-I	List-II
(a) $\vec{C}-\vec{A}-\vec{B}=0$	(i) 
(b) $\vec{A}-\vec{C}-\vec{B}=0$	(ii) 
(c) $\vec{B}-\vec{A}-\vec{C}=0$	(iii) 
(d) $\vec{A}+\vec{B}=-\vec{C}$	(iv) 

Question

Two vectors $\vec{X}$ and $\vec{Y}$ have equal magnitude. The magnitude of $(\vec{X}-\vec{Y})$ is n times the magnitude of $(\vec{X}+\vec{Y})$. The angle between $\vec{X}$ and $\vec{Y}$ is:

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

$\sqrt{x^2+y^2-2xy\cos\theta} = n\sqrt{x^2+y^2+2xy\cos\theta}$

square

THANK YOU