YAKEEN NEET 2.0

2026

Vectors

PHYSICS | Lecture - 9

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Todays Goal

- Angle between vecter
- Component of one vector along another vector
- Ques practice.

$\vec{A}\cdot\vec{B} = AB\cos\theta$

$\vec{A} = 3\hat{i} + 4\hat{j} + 5\hat{k} \longrightarrow |\vec{A}| = 5\sqrt{2}$

$\vec{B} = \hat{i} - \hat{j} \longrightarrow |\vec{B}| = \sqrt{2}$

$\vec{A}\cdot\vec{B} = 3 - 4 = -1$

$\boxed{\vec{A}\cdot\vec{B} = AB\cos\theta}$

$-1 = 5\sqrt{2}\sqrt{2}\cos\theta$

$\boxed{\cos = -\frac{1}{10}}$

Q. Find angle b/w $\vec{A}$ & $\vec{B}$

$\vec{A} = 3\hat{i} - 4\hat{j} - 5\hat{k}$

$\vec{B} = \hat{i} - \hat{j} - \hat{k}$

$\vec{A} \cdot \vec{B} = AB\cos\theta$

$3 + 4 + 5 = 5\sqrt{2}\sqrt{3}\cos\theta$

$\cos\theta = \frac{12}{5\sqrt{6}}$

Q. $\vec{A} = 2\hat{i} + 4\hat{j} + 2\hat{k}$

$\vec{B} = -4\hat{i} - 4\hat{j} + 12\hat{k}$

$\vec{A} \cdot \vec{B} = -8 - 16 + 24 = 0$

$\vec{A} \cdot \vec{B} = AB\cos\theta = 0$

$\cos\theta = 0$

$\boxed{\theta = 90^\circ}$

अगर $\vec{A}$ & $\vec{B}$ एक दूसरे के perpendicular Hai उनका Dot Dot product zero होगा

Agar $\vec{A}$ & $\vec{B}$ Ek dusre ke perpendicular Hai Unka Dot Dot product zero Hoga.

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

$\vec{B} = 4\hat{i} + \alpha\hat{j} + 5\hat{k}$

find the Value of α so that $\vec{A} \perp \vec{B}$

Solⁿ $\vec{A} \cdot \vec{B} = 0$

$8 - 3\alpha + 20 = 0$

$\alpha = \frac{28}{3}$

Q $\vec{A} = -\hat{i} + \hat{j} + \hat{k}$

$\vec{B} = \alpha^2\hat{i} + 4\hat{j} + 5\hat{k}$

find Value of α so that $\vec{A} \perp \vec{B}$

Solⁿ $\vec{A} \cdot \vec{B} = 0$

$-\alpha^2 + 4 + 5 = 0$

$\alpha^2 = 9$

$\alpha = -3, +3$

$$\boxed{\sqrt{9} = 3 \qquad \alpha^2 = 9 \Rightarrow \alpha = \pm 3}$$

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: [24 January 2023 - Shift 2]

1. 1
2. –1
3. –3
4. 2

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

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

$(m-2)^2 = 0$

$\boxed{m = 2}$

Ans : (4)

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 ______. [24 January 2023 - Shift 1]

$2a-3b+4=0$

$$\boxed{\begin{aligned} 2a-3b &= -4 \\ 3a+2b &= 7 \end{aligned}}$$

Ans : (1)

31. If a vector $2\hat{i}+3\hat{j}+8\hat{k}$ is perpendicular to the vector $4\hat{j}-4\hat{i}+\alpha\hat{k}$, then the value of α is

(a) 1/2 (b) −1/2

(c) 1 (d) −1. (2005)

$\vec{A} = (2, 3, 8)$

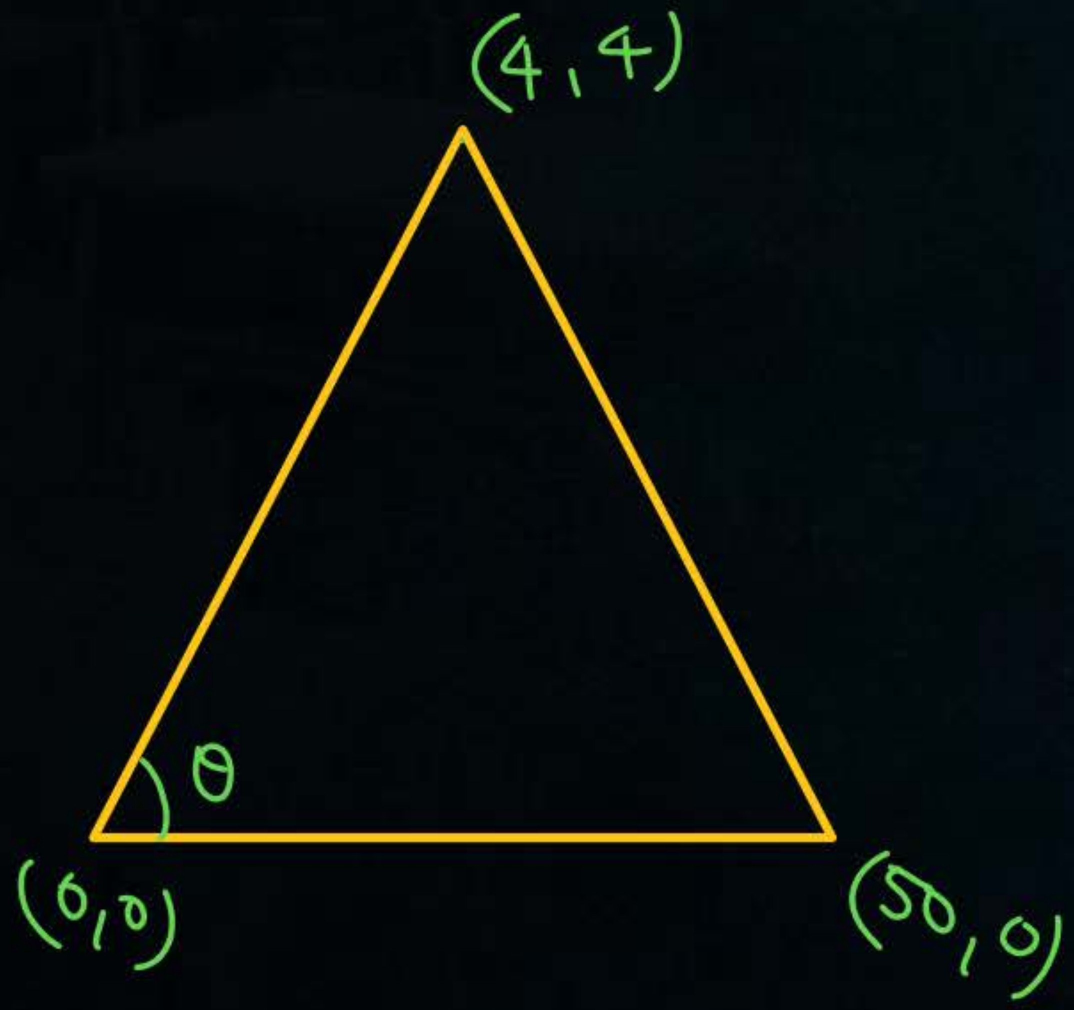
$\vec{B} = (-4, 4, \alpha)$

SKC

$\vec{A}\cdot\vec{B} = -8+12+8\alpha = 0$

$\alpha = -\frac{1}{2}$

Q Find θ



Sol^n

$$B = \sqrt{(50)^2 + 0^2 + 0^2}$$
$$= 50$$

$$\vec{A} \cdot \vec{B} = AB\cos\theta$$

$$50 \times 4 + 0 = 4\sqrt{2} \times 50 \times \cos\theta$$

$$\cos\theta = \frac{1}{\sqrt{2}}, \quad \theta = 45^\circ$$

$$a(b+c) = ab + ac$$

* $\vec{A} \cdot \vec{A} = A^2$

* $\vec{A} \perp \vec{B} \Rightarrow \vec{A} \cdot \vec{B} = 0$

* $\vec{A} \cdot (\vec{B} + \vec{C}) = \vec{A} \cdot \vec{B} + \vec{A} \cdot \vec{C}$

* $\vec{A} \cdot \vec{B} = \vec{B} \cdot \vec{A} = AB\cos\theta$

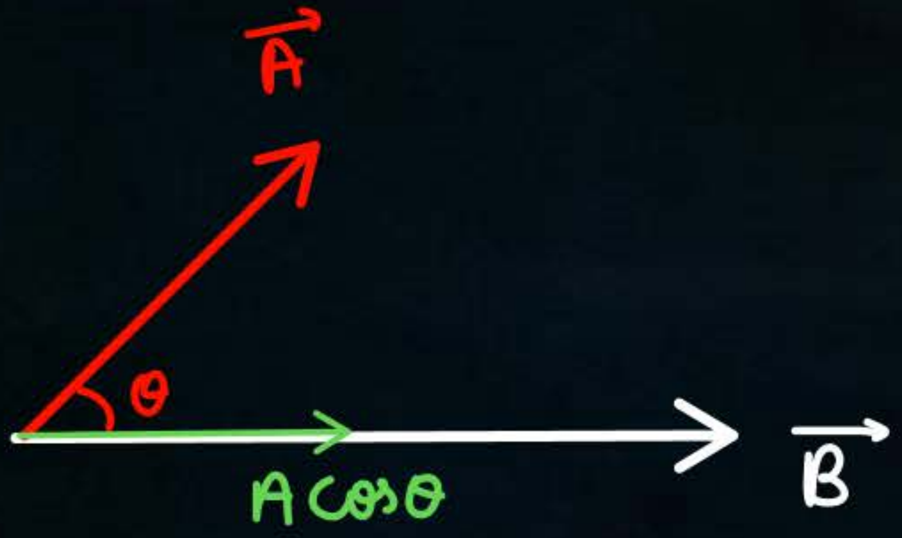
not imp

$\vec{A}\cdot\vec{B} = AB\cos\theta$

$\Rightarrow \vec{A}\cdot\vec{B} = (A\cos\theta)\cdot B$

(style)

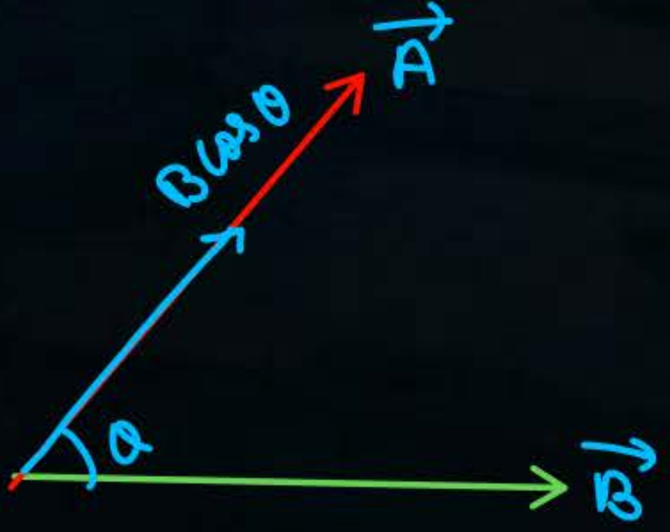
$\vec{A}\cdot\vec{B} =$ magnitude of component of $\vec{A}$ along $\vec{B}$ $\times$ magnitude of $\vec{B}$



Component Ka Dusra Nam Projection

$\vec{A}\cdot\vec{B} = A\,(B\cos\theta)$

$\vec{A}\cdot\vec{B} = \left(\text{magnitude of } A\right)\left(\text{magnitude of component of } \vec{B} \text{ along } \vec{A}\right)$



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

$\vec{B} = \hat{i} - \hat{j}$

$\vec{A}\cdot\vec{B} = AB\cos\theta$

$A\cos\theta = \dfrac{\vec{A}\cdot\vec{B}}{B}$

Component of $\vec{A}$ along $\vec{B}$ $= A\cos\theta = \dfrac{\vec{A}\cdot\vec{B}}{B} = \dfrac{4-3}{\sqrt{2}} = \dfrac{1}{\sqrt{2}}$ (magnitude)

Component of $\vec{A}$ along $\vec{B}$ in vector from $= \dfrac{1}{\sqrt{2}}\hat{B} = \dfrac{1}{\sqrt{2}}\left(\dfrac{\hat{i}-\hat{j}}{\sqrt{2}}\right) = \dfrac{\hat{i}}{2} - \dfrac{\hat{j}}{2}$

Q

$$\vec{A}\cdot\vec{B} = AB\cos\theta$$

Q. $\vec{A} = 3\hat{i} + 4\hat{j} - 5\hat{k}$

$\vec{B} = \hat{i} + \hat{j}$

Component of $\vec{A}$ along $\vec{B}$ = $A\cos\theta = \frac{\vec{A}\cdot\vec{B}}{B} = \frac{3+4+0}{\sqrt{2}} = \frac{7}{\sqrt{2}}$

Component of $\vec{A}$ along $\vec{B}$ (In Vector form) $= \frac{7}{\sqrt{2}}\cdot\hat{B} = \frac{7}{\sqrt{2}} \times \frac{\hat{i}+\hat{j}}{\sqrt{2}}$

$$= \frac{7}{2}(\hat{i}+\hat{j})$$

$$\boxed{\text{Component of } \vec{A} \text{ along } \vec{B} = \frac{\vec{A}\cdot\vec{B}}{B}}$$

$\vec{A}\cdot\vec{B} = AB\cos\theta$

Q $\vec{A} = 3\hat{i} - 4\hat{j} + 5\hat{k}$

$\vec{B} = \hat{j} - \hat{k}$

Component of $\vec{A}$ along $\vec{B}$ $= A\cos\theta = \dfrac{\vec{A}\cdot\vec{B}}{B} = \dfrac{-4-5}{\sqrt{2}} = \dfrac{-9}{\sqrt{2}}$

Vector form $= -\dfrac{9}{\sqrt{2}}\cdot\hat{B} = -\dfrac{9}{\sqrt{2}}\cdot\left(\dfrac{\hat{j}-\hat{k}}{\sqrt{2}}\right) = \dfrac{9}{2}(\hat{k}-\hat{j})$

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

$\vec{B} = 4\hat{i} - 3\hat{j}$

Component of $\vec{A}$ along $\vec{B} = A\cos\theta = \dfrac{\vec{A}\cdot\vec{B}}{B} = \dfrac{1}{5}$

Vector $\Rightarrow \dfrac{1}{5}\left(\dfrac{4\hat{i}-3\hat{j}}{5}\right)$

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

$\vec{B} = \hat{i} + \hat{j}$

$\vec{A} \cdot \vec{B} = AB\cos\theta$

Component of $\vec{A}$ along $\vec{B}$ $= A\cos\theta = \dfrac{\vec{A}\cdot\vec{B}}{B} = \dfrac{7}{\sqrt{2}}$

vector form $= \dfrac{7}{\sqrt{2}}\hat{B} = \dfrac{7}{\sqrt{2}}\left(\dfrac{\hat{i}+\hat{j}}{\sqrt{2}}\right) = \dfrac{7}{2}(\hat{i}+\hat{j})$

Component of $\vec{B}$ along $\vec{A}$ $= B\cos\theta = \dfrac{\vec{A}\cdot\vec{B}}{A} = \dfrac{7}{5}$

Vector $\Rightarrow \dfrac{7}{5}\hat{A} = \dfrac{7}{5}\left(\dfrac{3\hat{i}+4\hat{j}}{5}\right)$

Promise $\equiv$ 98%

$\vec{A}$ = given

$\vec{B}$ = given

Component of $\vec{A}$ along $\vec{B}$ $= A\cos\theta = \dfrac{\vec{A}\cdot\vec{B}}{B}$

Q. If the magnitude of the sum of two vectors is equal to the magnitude of difference of the two vectors, the angle between these vectors is

note

Rm

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

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

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

$$2AB\cos\theta = -2AB\cos\theta$$

$$4\cancel{AB}\cos\theta = 0$$

$$\theta = 90$$

note

Q3 If the sum of two unit vectors is a unit vector, then the magnitude of their difference is:

$\vec{A} + \vec{B} = \vec{C}$

$A = 1, \; B = 1, \; C = 1$

$|\vec{A} - \vec{B}| = ?$

$|\vec{A} + \vec{B}| = |\vec{C}|$

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

$\sqrt{1 + 1 + 2 \times 1 \times 1 \cos\theta} = 1$

$\boxed{\cos\theta = -\frac{1}{2}}$ $\theta = 120^\circ$

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

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

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

$= \sqrt{3}$

Exp hw

QUESTION

$P = Q = x$

Two vectors $\vec{P}$ and $\vec{Q}$ have equal magnitudes. If the magnitude of $\vec{P}+\vec{Q}$ is n times the magnitude of $\vec{P}-\vec{Q}$, then angle between $\vec{P}$ and $\vec{Q}$ is: [JEE Main-2021]

$$|\vec{P}+\vec{Q}| = n|\vec{P}-\vec{Q}|$$

$$\sqrt{P^2+Q^2+2PQ\cos\theta} = n\sqrt{P^2+Q^2-2PQ\cos\theta}$$

$$x^2+x^2+2x^2\cos\theta = n^2(x^2+x^2-2x^2\cos\theta)$$

$$2+2\cos\theta = n^2(2-2\cos\theta)$$

$$1+\cos\theta = n^2-n^2\cos\theta$$

$$\cos\theta+n^2\cos\theta = n^2-1$$

$$\boxed{\cos\theta = \frac{n^2-1}{n^2+1}}$$

(1) $\sin^{-1}\left(\frac{n-1}{n+1}\right)$

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

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

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

Ans : (4)

QUESTION

compont

What will be the projection of vector $\vec{A} = \hat{i} + \hat{j} + \hat{k}$ on vector $\vec{B} = \hat{i} + \hat{j}$?

[JEE Main 2021]

1. $\sqrt{2}(\hat{i} + \hat{j} + \hat{k})$
2. $2(\hat{i} + \hat{j} + \hat{k})$
3. $\sqrt{2}(\hat{i} + \hat{j})$
4. $(\hat{i} + \hat{j})$

Ans : (4)

QUESTION

x, x

Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitude. If magnitude 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 Main-2022]

$$\sqrt{x^2+x^2+2xx\cos\theta} = 2\sqrt{x^2+x^2-2xx\cos\theta}$$

(1) $\sin^{-1}\left(\frac{3}{5}\right)$

(2) $\sin^{-1}\left(\frac{1}{3}\right)$

(3) $\cos^{-1}\left(\frac{3}{5}\right)$

(4) $\cos^{-1}\left(\frac{1}{3}\right)$

Ans : (3)

QUESTION

Which of the following relation is true for two unit vectors $\hat{A}$ and $\hat{B}$ making an angle θ to each other? [JEE Main-2022]

(1) $|\hat{A}+\hat{B}| = |\hat{A}-\hat{B}|\tan\frac{\theta}{2}$

(2) $|\hat{A}-\hat{B}| = |\hat{A}+\hat{B}|\tan\frac{\theta}{2}$

(3) $|\hat{A}+\hat{B}| = |\hat{A}-\hat{B}|\cos\frac{\theta}{2}$

(4) $|\hat{A}-\hat{B}| = |\hat{A}+\hat{B}|\cos\frac{\theta}{2}$

$$|\hat{A}+\hat{B}| = \sqrt{1+1+2\times1\times1\times\cos\theta}$$

$$|\hat{A}-\hat{B}| = \sqrt{1+1-2\times1\times1\cos\theta}$$

$$\frac{|\hat{A}+\hat{B}|}{|\hat{A}-\hat{B}|} = \sqrt{\frac{1+\cos\theta}{1-\cos\theta}} =$$

Ans : (2)

QUESTION

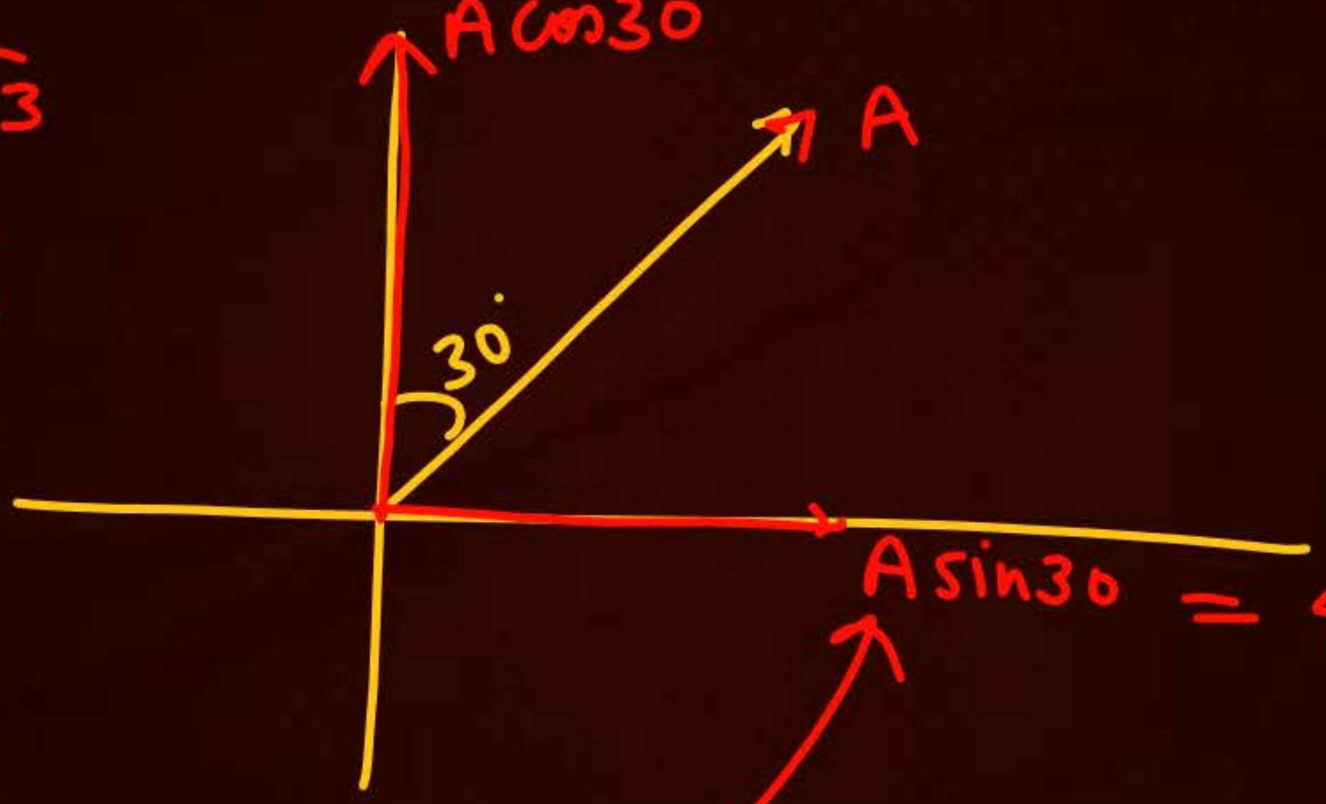
A vector in $x-y$ plane makes an angle of $30°$ with y-axis. The magnitude of y-component of vector is $2\sqrt{3}$. The magnitude of x-component of the vector will be:

[15 April 2023 - Shift 1]

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

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

$$A = 4$$



$A\sin 30 = 4\sin 30 = \underline{2}$

(1) $\frac{1}{\sqrt{3}}$

(2) 6

(3) 2

(4) $\sqrt{3}$

Ans : (3)

Q11 The unit vector parallel to the resultant of the vectors $\vec{A} = 4\hat{i} + 3\hat{j} + 6\hat{k}$ and $\vec{B} = -\hat{i} + 3\hat{j} - 8\hat{k}$ is

(A) $\frac{1}{7}(3\hat{i} + 6\hat{j} - 2\hat{k})$

(B) $\frac{1}{7}(3\hat{i} + 6\hat{j} + 2\hat{k})$

(C) $\frac{1}{49}(3\hat{i} + 6\hat{j} - 2\hat{k})$

(D) $\frac{1}{49}(3\hat{i} - 6\hat{j} + 2\hat{k})$

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: [JEE Main-2021]

(1) $\cos^{-1}\left(\dfrac{-n^2-1}{n^2-1}\right)$

(2) $\cos^{-1}\left(\dfrac{n^2-1}{-n^2-1}\right)$

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

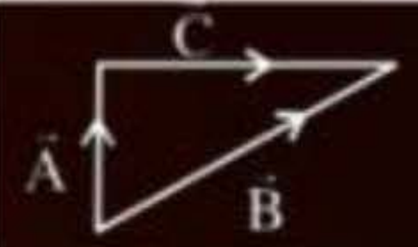
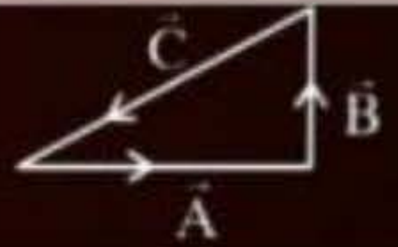
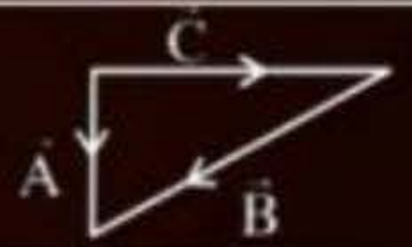
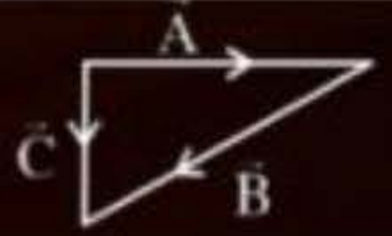
(4) $\cos^{-1}\left(\dfrac{n^2+1}{n^2-1}\right)$

Ans : (2)

QUESTION

Match List I with List II. [JEE Main-2021]

Choose the correct answer from the options given below:

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)	

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)

Ans : (2)

QUESTION

If $\vec{A} = (2\hat{i} + 3\hat{j} - \hat{k})$m and $\vec{B} = (\hat{i} + 3\hat{j} + 2\hat{k})$m. The magnitude of component of vector $\vec{A}$ along vector $\vec{B}$ will be ______ m. [JEE Main-2022]

Ans : (2)

QUESTION

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 Main-2022]

$A\cos\theta = 0$

$\theta = 90$

$2 + 8 - 2\alpha = 0$

$\alpha = 5$

Ans : (5)

QUESTION

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:

[11 April 2023 - Shift 2]

$$\vec{B} - (2\hat{i} + 3\hat{j} + 2\hat{k}) = 2\hat{j}$$

(1) $\sqrt{5}$

(2) 3

(3) $\sqrt{6}$

(4) $\sqrt{33}$

Ans : (4)

QUESTION

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

[08 April 2023 - Shift 1]

(1) $\frac{\sqrt{5}\,A}{4}$

(2) $\frac{\sqrt{5}\,A}{2}$

(3) $\frac{5\,A}{2}$

(4) $\frac{\sqrt{5}\,A^2}{2}$

$$\sqrt{A^2+\left(\frac{A}{2}\right)^2}$$

$$=\frac{\sqrt{5}}{2}A$$

Ans : (2)

QUESTION

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

[31 Jan. 2024 - Shift 2]

(1) $|\vec{A}-\vec{B}| = \sqrt{2}R\sin\left(\frac{\theta}{2}\right)$

(2) $|\vec{A}+\vec{B}| = 2R\sin\left(\frac{\theta}{2}\right)$

(3) $|\vec{A}+\vec{B}| = 2R\cos\left(\frac{\theta}{2}\right)$

(4) $|\vec{A}-\vec{B}| = 2R\cos\left(\frac{\theta}{2}\right)$

Ans : (3)

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:

[05 Apr. 2024 - Shift 1]

(1) $\tan^{-1}\dfrac{(2\vec{Q} - 2\vec{P})}{2\vec{Q} + 2\vec{P}}$

(2) $0°$

(3) $\tan^{-1}(P/Q)$

(4) $\tan^{-1}(2Q/P)$

Ans : (2)

Find the value of m so that the vector $3\hat{i} - 2\hat{j} + \hat{k}$ may be perpendicular to the vector $2\hat{i} + 6\hat{j} + m\hat{k}$.

$6 - 12 + m = 0$

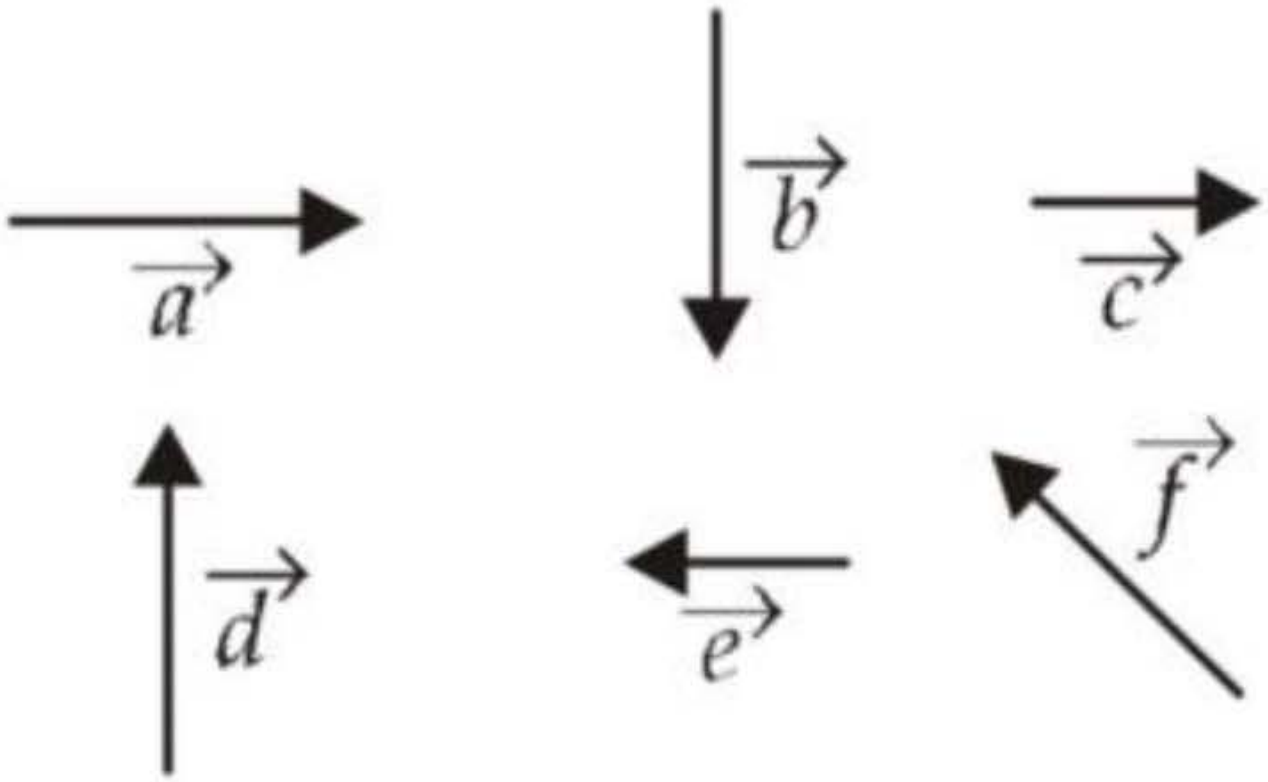
$m = 6$

3. If the magnitude of sum of two vectors is equal to the magnitude of difference of the two vectors, the angle between these vectors is

(a) 45° (b) 180°

(c) 0° (d) 90° *(NEET-I 2016)*

19. Six vectors, $\vec{a}$ through $\vec{f}$ have the magnitudes and directions indicated in the figure. Which of the following statements is true?



(a) $\vec{b}+\vec{c}=\vec{f}$ (b) $\vec{d}+\vec{c}=\vec{f}$

(c) $\vec{d}+\vec{e}=\vec{f}$ (d) $\vec{b}+\vec{e}=\vec{f}$ *(2010)*

18. A particle has initial velocity $(3\hat{i} + 4\hat{j})$ and has acceleration $(0.4\hat{i} + 0.3\hat{j})$. Its speed after 10 s is

(a) 7 units

(b) $7\sqrt{2}$ units

(c) 8.5 units

(d) 10 units *(2010)*

27. The vectors $\vec{A}$ and $\vec{B}$ are such that $|\vec{A}+\vec{B}| = |\vec{A}-\vec{B}|$. The angle between the two vectors is

(a) $45°$ (b) $90°$ (c) $60°$ (d) $75°$.

(2006, 1996, 1991)

33. The vector sum of two forces is perpendicular to their vector differences. In that case, the forces

(a) are equal to each other

(b) are equal to each other in magnitude

(c) are not equal to each other in magnitude

(d) cannot be predicted. *(2003)*

Join

Home work

- Ques are attached in this ppt
- Revise all vector
- KPP → After next class so that we can play with full vector
- DPP
- Summary lecture i will provide very soon.

THANK
YOU