YAKEEN NEET 2.0

2026

KPP (Discussion)

Vectors

PHYSICS | Lecture - 09

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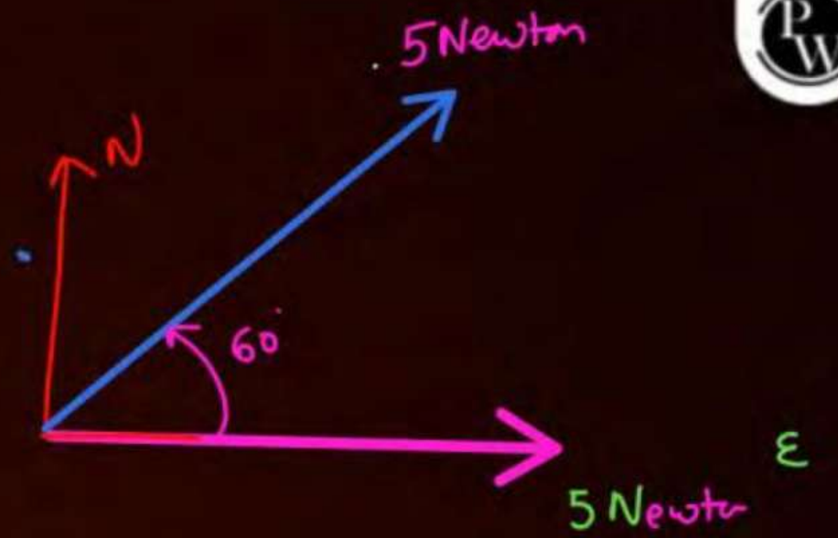
QUESTION - 01

A block is applied two forces of magnitude 5N each. One force is acting towards East and the other acting along 60° North of East. The resultant of the two forces (in N) is of magnitude:



$R = 5\sqrt{3}$

Ans : $\sqrt{75}$

QUESTION - 02

The resultant of $\vec{P}$ and $\vec{Q}$ is $\vec{R}$. If $\vec{Q}$ is doubled, $\vec{R}$ is doubled; when $\vec{Q}$ is reversed, $\vec{R}$ is again doubled. Find $P : Q : R$.

$$R^2 = P^2 + Q^2 + 2PQ\cos\theta \quad \text{— (1)}$$

$$(2R)^2 = P^2 + (2Q)^2 + 2P(2Q)\cos\theta$$

$$4R^2 = P^2 + 4Q^2 + 4PQ\cos\theta \quad \text{— (2)}$$

$$(2R)^2 = P^2 + Q^2 + 2PQ\cos(180-\theta)$$

$$4R^2 = P^2 + Q^2 - 2PQ\cos\theta \quad \text{— (3)}$$

Ans : $\sqrt{2} : \sqrt{3} : \sqrt{2}$

$R^2 = P^2 + Q^2 + 2PQ\cos\theta$ ..... ①

$4R^2 = P^2 + 4Q^2 + 4PQ\cos\theta$ ..... ②

$4R^2 = P^2 + Q^2 - 2PQ\cos\theta$ ..... ③

Eqn ② − ① $\quad 3R^2 = 3Q^2 + 2PQ\cos\theta$ ..... ④

eqn ① + ③ $\quad 5R^2 = 2P^2 + 2Q^2$ ..... ⑤

eqn ③ + ④ $\quad 7R^2 = P^2 + 4Q^2$ ..... ⑥

Solve ⑤ and ⑥

$$\begin{array}{r} 10R^2 = 4P^2 + 4Q^2 \\ -7R^2 = -P^2 - 4Q^2 \\ \hline 3R^2 = 3P^2 \end{array}$$

$|R| = |P|$

$7R^2 = P^2 + 4Q^2$

$7R^2 = R^2 + 4Q^2$

$6R^2 = 4Q^2$

$3R^2 = 2Q^2$

$\sqrt{3}R = \sqrt{2}Q$

$Q = \frac{\sqrt{3}}{\sqrt{2}}R$

Let $|R| = |P| = x \Rightarrow Q = \sqrt{\frac{3}{2}}x$

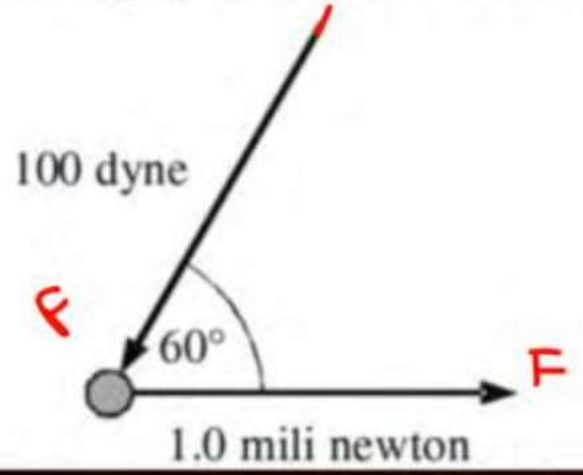
$P : Q : R \Rightarrow x : \frac{\sqrt{3}}{\sqrt{2}}x : x$

$=$

$\sqrt{2} : \sqrt{3} : \sqrt{2}$

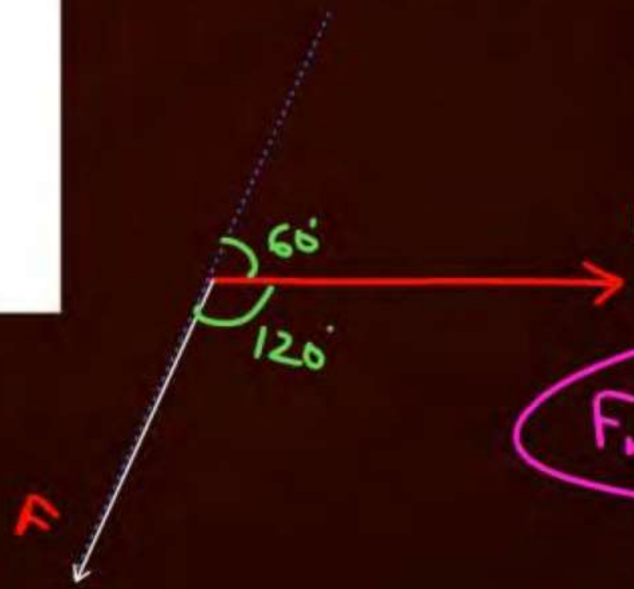
QUESTION - 03

Two forces act on a particle simultaneously as shown in the figure. Find net force in milli newton on the particle. [Dyne is the CGS unit of force]



$100\ \text{dyne} = 100 \times 10^{-5}\ \text{Newton}$

$= 10^{-3}\ N = 1\ \text{milinewton}$



$F_{net} = F = 10^{-3}\ N$

$= 1\ \text{milinewton}$

Ans : (1)

QUESTION - 04

At what angle should the two force vectors $2F$ and $\sqrt{2}F$ act so that the resultant force is $\sqrt{10}F$?

$$\sqrt{10}F = \sqrt{4F^2 + 2F^2 + 2 \times 2F \times \sqrt{2}F \cos\theta}$$

$$10F^2 = 4F^2 + 2F^2 + 4\sqrt{2}F^2\cos\theta$$

$$4 = 4\sqrt{2}\cos\theta$$

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

$$\theta = 45^\circ$$

Ans : (45°)

QUESTION - 05

The maximum and minimum magnitudes of the resultant of two forces are 35 N and 5 N respectively. Find the magnitude of resultant force when act orthogonally to each other.

$A+B=35$

$A-B=5$

$2A=40$

$A=20$

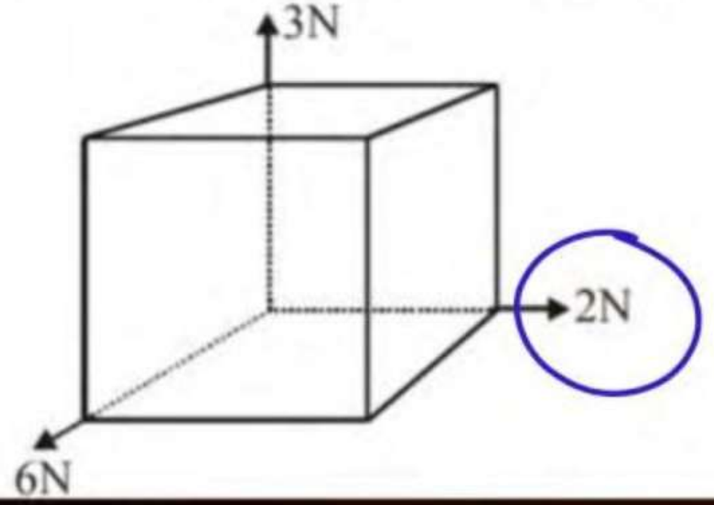
$B=15$

Ans $\sqrt{A^2+B^2} = \sqrt{(20)^2+(15)^2} = 25$

Ans : (25)

QUESTION - 06

Three forces of magnitudes 2 N, 3 N and 6 N act at corners of a cube along three sides as shown in figure. Find the resultant of these forces in N.



$$\vec{F}_{net} = 2\hat{i} + 3\hat{j} + 6\hat{k}$$

$$|\vec{F}_{net}| = \sqrt{2^2 + 3^2 + 6^2} = 7$$

Ans : (7)

QUESTION - 07

Two forces, while acting on a particle in opposite directions, have the resultant of 10 N. If they act at right angles to each other, the resultant is found to be 50 N. Find the two forces.

Direct ≡ data benefit

$40^2 + 30^2 = 50$

$A - B = 10$

$\sqrt{A^2 + B^2} = 50$

$A^2 + B^2 = 2500$

$A^2 + B^2 - 2AB = 100$

$2500 - 2AB = 100$

$AB = 1200$

$B = \frac{1200}{A}$

$A - \frac{1200}{A} = 10$

$A^2 - 10A - 1200 = 0$

$A^2 - 40A + 30A - 1200 = 0$

$(A - 40)(A + 30) = 0$

$A = 40$

$B = 30$

Ans : 40 N, 30 N

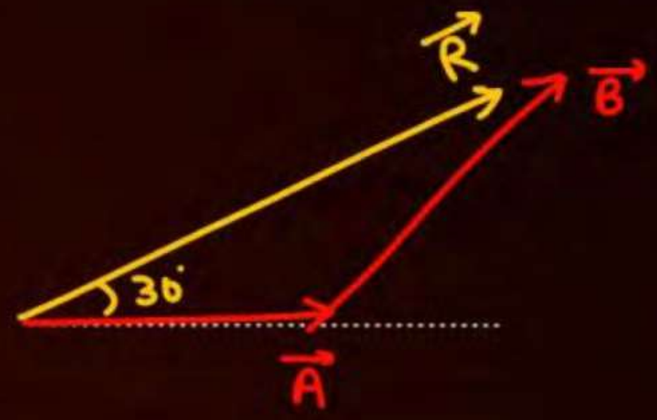
QUESTION - 08

The resultant of two forces has magnitude 20 N. One of the forces is of magnitude $20\sqrt{3}$ N and makes an angle of 30° with the resultant. Then what is the magnitude of the other force?

$R = 20$

$A = 20\sqrt{3}$

Angle 30



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

$$\boxed{\vec{B} = \vec{R} - \vec{A}}$$

$$|\vec{R} - \vec{A}| \text{ magnitude} = \sqrt{R^2 + A^2 - 2RA\cos\theta}$$

$$= \sqrt{400 + 1200 - 2 \times 20 \times 20\sqrt{3} \times \frac{\sqrt{3}}{2}} = 20$$

Ans : 20 N

QUESTION - 09

A car is moving with a speed of 10 ms^{-1}. If the east direction taken as x-axis and the north direction as y-axis. Write the velocity vector of car in unit vector notation. If it is moving

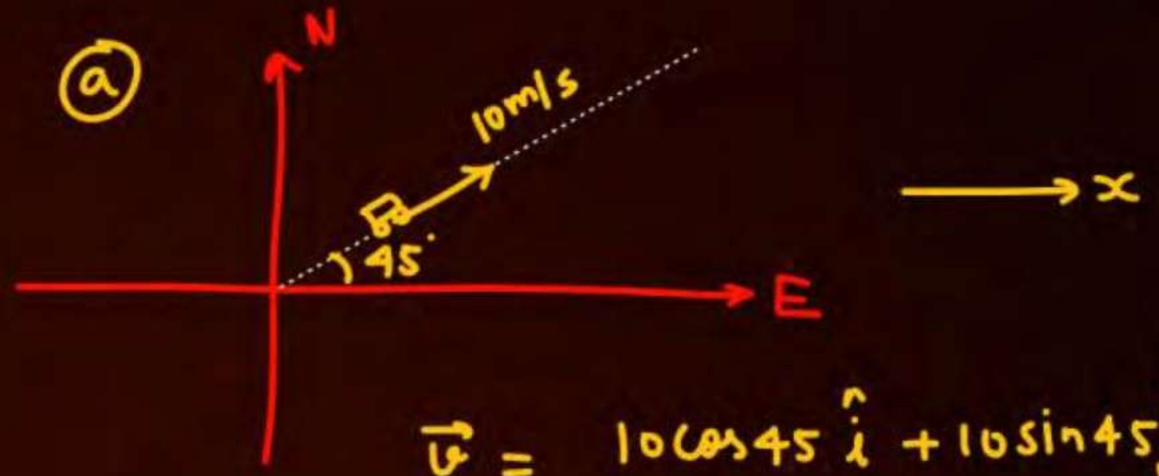
(a) in the direction of N-E, 45°

(b) in the direction of N-W,

(c) in the direction of S-W, and

(d) in the direction of S-E.

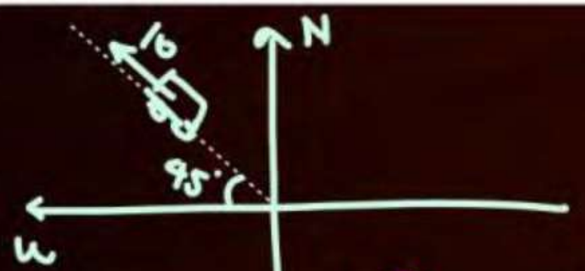
(a)



$$\vec{v} = 10\cos 45\,\hat{i} + 10\sin 45\,\hat{j}$$

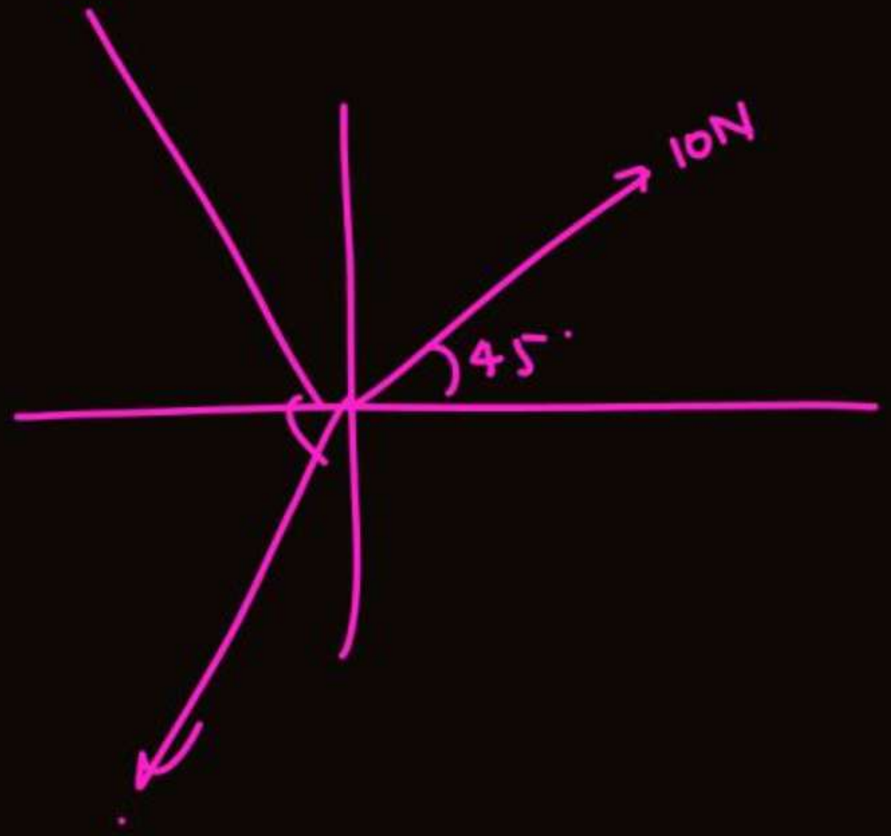
$$\vec{v} = \frac{10}{\sqrt{2}}\hat{i} + \frac{10}{\sqrt{2}}\hat{j}$$

(b)



$$\vec{v} = \frac{10}{\sqrt{2}}(-\hat{i}) + \frac{10}{\sqrt{2}}\hat{j}$$

Ans : (*)


10N
45°

QUESTION - 10

Find the vector that must be added to the vector $\hat{i}-3\hat{j}+2\hat{k}$ and $3\hat{i}+6\hat{j}-7\hat{k}$ so that the resultant vector is a unit vector along the y-axis.

$$\vec{A}+\hat{i}-3\hat{j}+2\hat{k}+3\hat{i}+6\hat{j}-7\hat{k}=\hat{j}$$

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

$$\vec{A}=-4\hat{i}-2\hat{j}+5\hat{k}$$

Ans : $-4\hat{i}-2\hat{j}+5\hat{k}$

QUESTION - 11

Find magnitude of resultant of $\vec{a}+\vec{b}$

Given: $\vec{a}=3\hat{i}+4\hat{j}$ and $\vec{b}=3\hat{j}+4\hat{k}$

$(3,4,0)$
$(0,3,4)$

$3\hat{i}+7\hat{j}+4\hat{k}$

$\sqrt{3^2+7^2+4^2}=\sqrt{74}$

Ans : $\sqrt{74}$ units

QUESTION - 12

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

Find the unit vector of (i) $(\vec{A} + \vec{B})$ and (ii) $(\vec{A} - \vec{B})$

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

$\vec{A} - \vec{B} = -\hat{i} + \hat{j} + 5\hat{k}$

$$\frac{5\hat{i} - 3\hat{j} + \hat{k}}{\sqrt{5^2 + 3^2 + 1^2}}$$

Ans : (i) $\frac{(5\hat{i} - 3\hat{j} + \hat{k})}{\sqrt{35}}$, (ii) $\frac{(-\hat{i} + \hat{j} + 5\hat{k})}{\sqrt{27}}$

QUESTION - 13

Determine that vector which when added to the resultant of $\vec{A} = 3\hat{i} - 5\hat{j} + 7\hat{k}$ and $\vec{B} = 2\hat{i} + 4\hat{j} - 3\hat{k}$ gives unit vector along y-direction.

Ans : (*)

QUESTION - 14

Two vectors $\vec{a}$ and $\vec{b}$ add to give a resultant $\vec{c} = \vec{a} + \vec{b}$. In which of these cases angle between $\vec{a}$ and $\vec{b}$ is maximum: (a, b, c represent the magnitudes of respective vectors)

(1) $c = a + b$

(2) $c^2 = a^2 + b^2$

(3) $c = a - b$

(4) can not be determined

Ans : (3)

QUESTION - 15

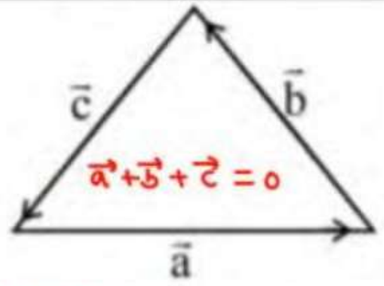
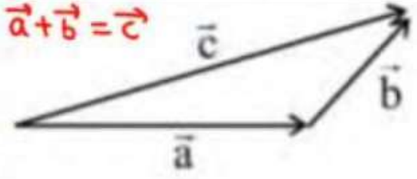
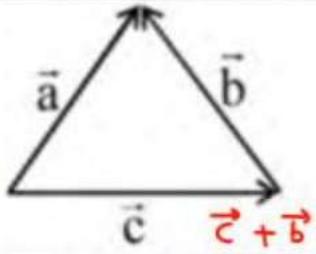
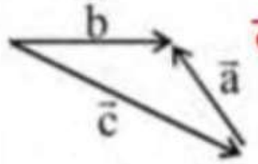
Column-I show vector diagram relating three vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$. Match the vector equation in columnII, with vector diagram in column-I:

(A) $\vec{a}+\vec{b}+\vec{c}=0$

(B) $\vec{a}+\vec{b}-\vec{c}=0$

(C) $-\vec{a}+\vec{b}+\vec{c}=0$

(D) $\vec{a}-\vec{b}+\vec{c}=0$

Column-I		Column-II	
(A) (R)		(P)	$\vec{a}-(\vec{b}+\vec{c})=0$ $\vec{a}-\vec{b}-\vec{c}=0$ $-\vec{a}+\vec{b}+\vec{c}=0$
(B) (S)		(Q)	$\vec{b}-\vec{c}=\vec{a}$ $-\vec{a}+\vec{b}-\vec{c}=0$ $\vec{a}-\vec{b}+\vec{c}=0$
(C) (P)		(R)	$\vec{a}+\vec{b}=-\vec{c}$ $\vec{a}+\vec{b}+\vec{c}=0$
(D)		(S)	$\vec{a}+\vec{b}=\vec{c}$ $\vec{a}+\vec{b}-\vec{c}=0$

Ans : (A)-R; (B)-S; (C)-P; (D)-Q

QUESTION - 16

Which of the following pairs of forces cannot be added to give a resultant force of 4 N?

(1) 2 N and 8 N
(2) 2 N and 2 N
(3) 2 N and 6 N
(4) 2 N and 4 N

① [6, 10]
② [0, 4]
③ [4, 8]
④ [2, 6]

QUESTION - 17

Out of the following forces, the resultant of which cannot be 10 N?

(1) 15 N and 20 N

(2) 10 N and 10 N

(3) 5 N and 12 N

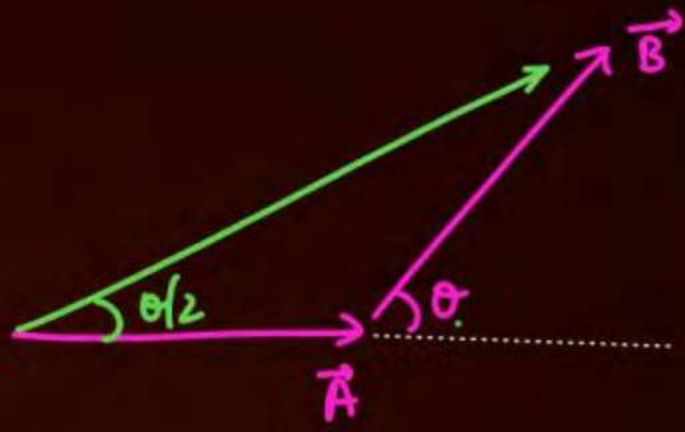
(4) 12 N and 1 N

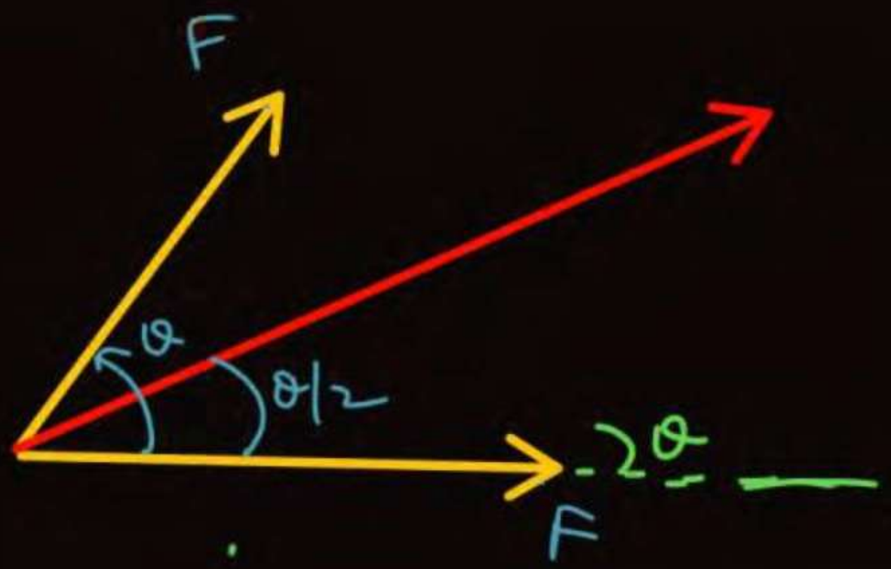
QUESTION - 18

The angle between two vectors $\vec{A}$ and $\vec{B}$ is θ. The resultant of these vectors $\vec{R}$ makes an angle of $\theta/2$ with A. Which of the following is true?

(1) $A = 2B$ (2) $A = B/2$

(3) $A = B$ (4) $AB = 1$




F
θ
θ/2
F
2θ

QUESTION - 19

The resultant $\vec{C}$ of $\vec{A}$ and $\vec{B}$ is perpendicular to $\vec{A}$. Also, $|\vec{A}|=|\vec{C}|$. The angle between $\vec{A}$ and $\vec{B}$ is:

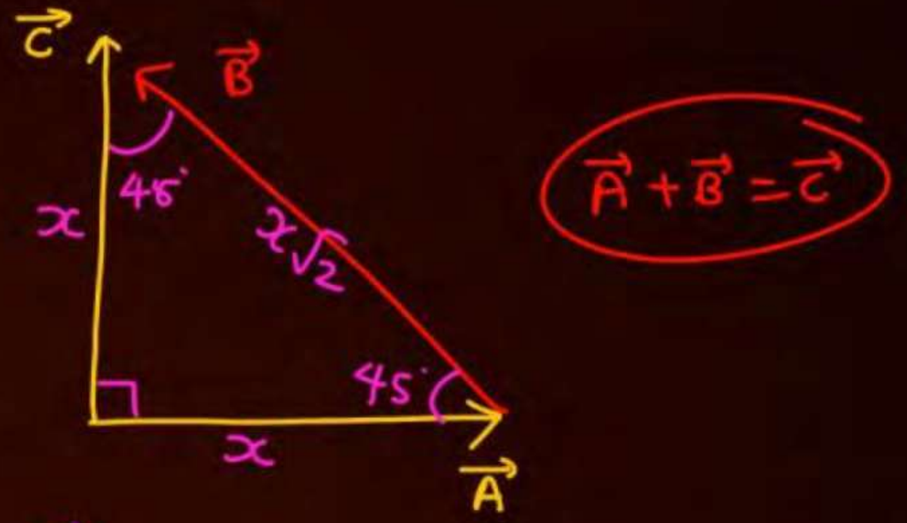
$135^\circ \Rightarrow 3\pi/4$

(1) $\frac{\pi}{4}$ rad

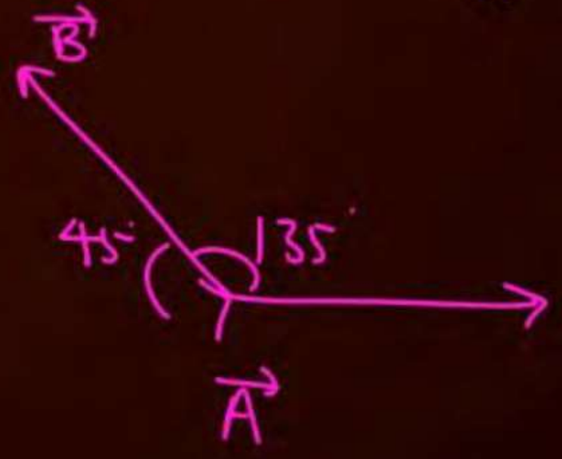
(2) $\frac{3\pi}{4}$ rad

(3) $\frac{5\pi}{4}$ rad

(4) $\frac{7\pi}{4}$ rad



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



QUESTION - 20

Two vectors $\vec{a}$ and $\vec{b}$ are at angle of $60°$ with each other. Their resultant makes an angle of $45°$ with $\vec{a}$. If $|\vec{b}| = 2$ units, then $|\vec{a}|$ is:

(1) $\sqrt{3}$ (2) $\sqrt{3}-1$

(3) $\sqrt{3}+1$ (4) $\sqrt{3}/2$

$$\tan 45 = \frac{B\sin\theta}{A + B\cos\theta}$$

$$1 = \frac{2\sin\theta}{A + 2\cos\theta}$$

$$A + 2\cos\theta = 2\sin\theta$$

$$A = 2(\sin\theta - \cos\theta) \qquad \theta = 60$$

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

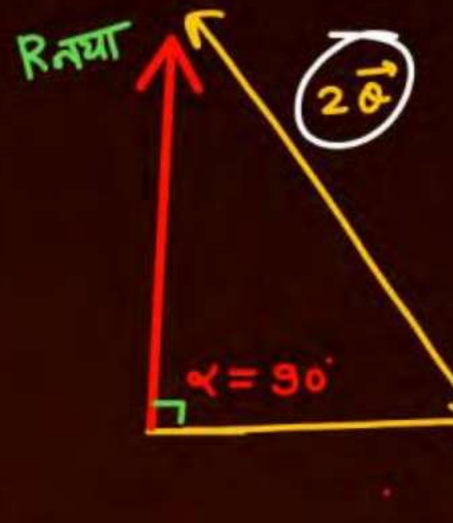
$$\begin{cases} c^2 = a^2 + 4 + 2 \times a \times 2 \times \frac{1}{2} \\ c^2 = a^2 + 4 + 2a \end{cases}$$

QUESTION - 21

The resultant of two vectors $\vec{P}$ and $\vec{Q}$ is $\vec{R}$. If the magnitude of $\vec{Q}$ is doubled, the new resultant vector becomes Perpendicular to $\vec{P}$. Then, the magnitude of $\vec{R}$ is equal to:

(1) $P+Q$ (2) P

(3) $P-Q$ (4) Q



$$\tan 90 = \frac{B\sin\theta}{A+B\cos\theta} = \frac{2Q\sin\theta}{P+2Q\cos\theta}$$

$$R^2 = P^2 + Q^2 + 2PQ\cos\theta$$

$$P + 2Q\cos\theta = 0$$

$$\cos\theta = \frac{-P}{2Q}$$

$$R^2 = P^2 + Q^2 + 2PQ\left(\frac{-P}{2Q}\right)$$

$$R^2 = P^2 + Q^2 - P^2 = Q^2$$

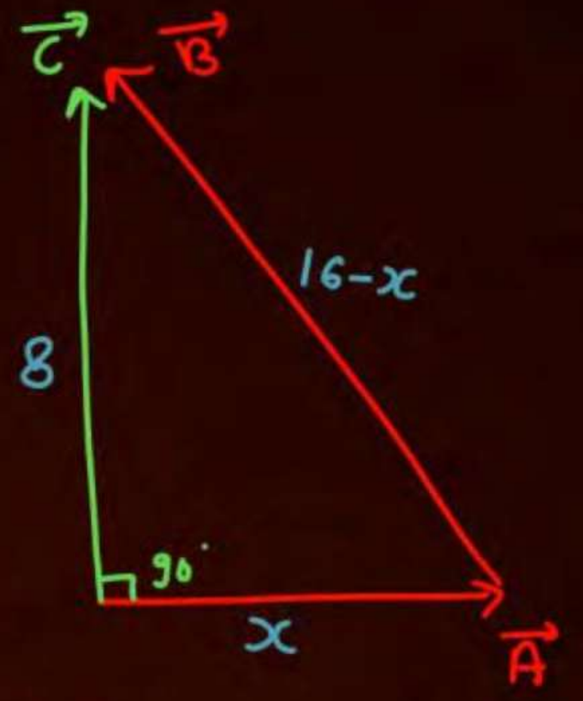
QUESTION - 22

The sum of the magnitudes of two forces acting at a point is 16 N. The resultant of these forces is perpendicular to the smaller force and has a magnitude of 8 N. If the smaller force is of magnitude x, then the value of x is:

(1) 2 N (2) 4 N

(3) 6 N (4) 7 N

6, 10



$$x^2 + 8^2 = (16-x)^2$$

$$64 = (16-x)^2 - x^2 =$$

$$64 = 16 \times (16-2x)$$

THANK YOU