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JEE Main & Advanced
Physics DPP

DPP-1 Vectors

(Basics, Angle between vectors & Triangle law of vector addition)

By Physicsaholics Team
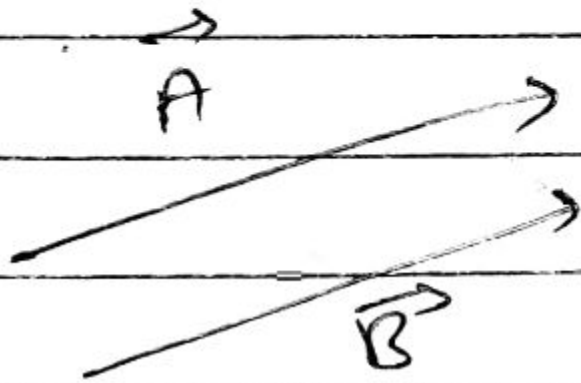
Q) Two vectors are said to be equal only if they have:

(a) Same magnitude and same direction
(b) Same magnitude and opposite direction
(c) Same magnitude only
(d) Same direction only

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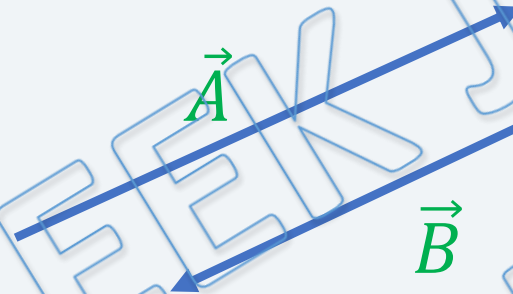**Physicslive**

Ans. a

For two vectors to be equal

$\vec{A}$

$\vec{B}$

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

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

direction of $\vec{A}$ = direction of $\vec{B}$

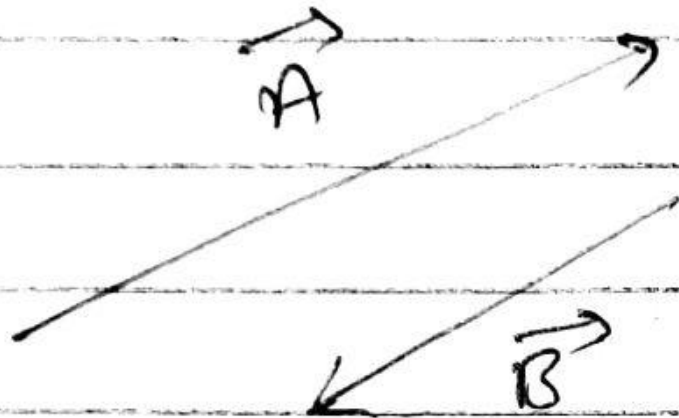∴ They should have same magnitude and same direction.

Q) Vectors shown in figure are:

(a) Parallel vector
(b) Antiparallel vector
(c) Equal vector
(d) None of these
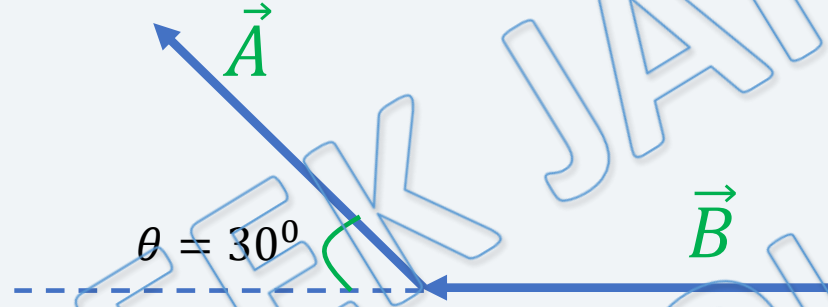
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Ans. b

$\vec{A}$ & $\vec{B}$ are opposite in direction ;

∴ $\vec{A}$ & $\vec{B}$ are antiparallel vectors.

Q) Find angle between vectors $\vec{A}$ & $\vec{B}$:

$\vec{A}$

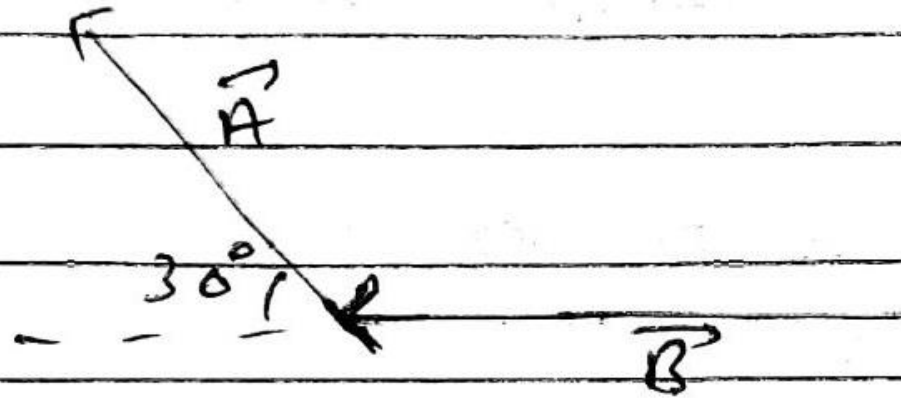$\theta = 30^0$

$\vec{B}$

(a) 150^0 (b) 120^0 (c) 60^0 (d) 30^0
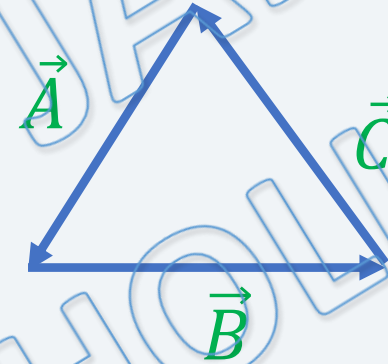
Ans. d

$\vec{A}$

$30°$

$\vec{B}$

$\vec{A}$

$30°$

$\vec{B}$
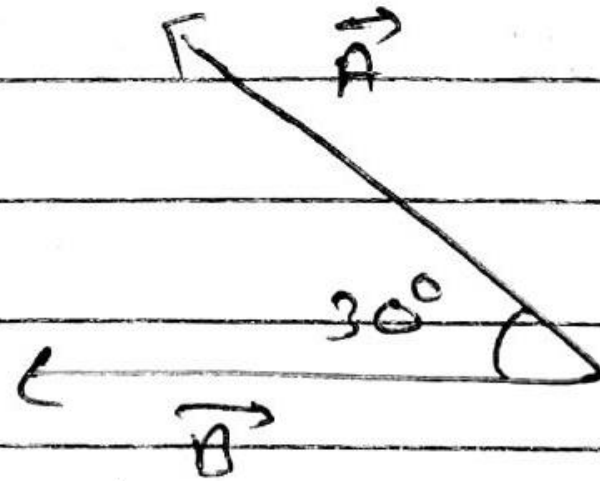
∴ Angle between $\vec{A}$ & $\vec{B} = 30°$

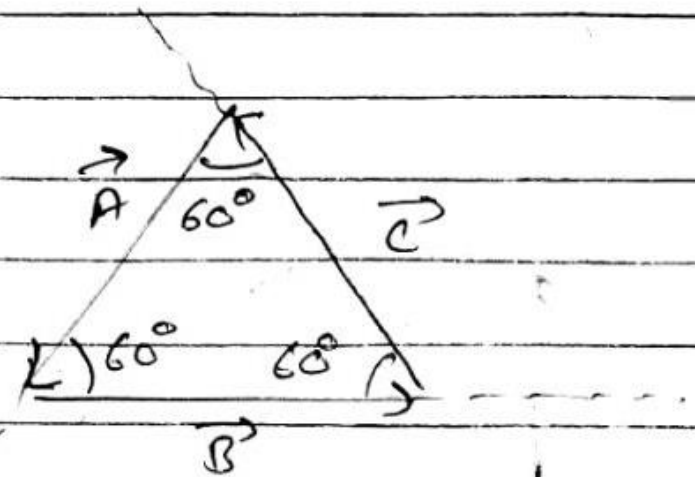Q) Vectors $\vec{A}$, $\vec{B}$ & $\vec{C}$ forms an equilateral triangle. Then angles between them are:

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

(a) 60^0, 60^0, 60^0
(b) 60^0, 120^0, 60^0
(c) 120^0, 120^0, 120^0
(d) None of these

Ans. c

$\vec{A}$ 60° $\vec{C}$

60°   60°

$\vec{B}$

∴ Angle between $\vec{A}$ & $\vec{B}$ is: 120°

60°

120° $\vec{B}$

$\vec{A}$
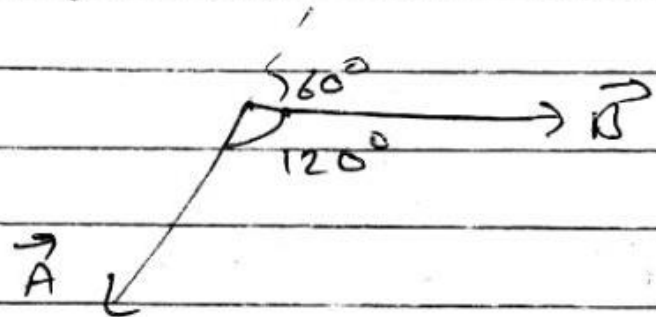
Angle between $\vec{B}$ & $\vec{C}$ is: 120°

$\vec{C}$

60°   120°

$\vec{B}$

Angle between $\vec{A}$ & $\vec{C}$

$\vec{C}$

120°

60°

$\vec{A}$
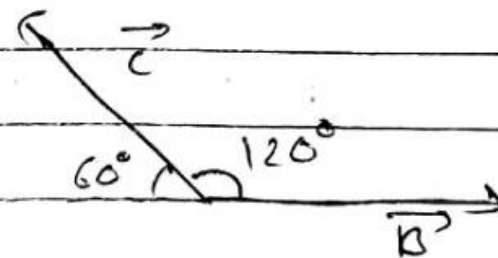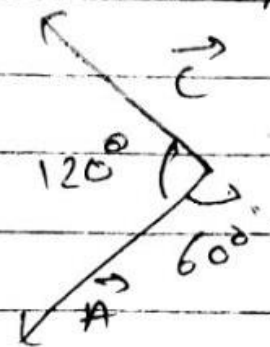
∴ Angles are   120°, 120°, 120°

Q) Two vectors have magnitudes 6 and 8 units respectively. Find the magnitude of the resultant vector if the angle between vectors is 60^0:

(a) 10 unit

(b) $2\sqrt{13}$ unit

(c) $2\sqrt{37}$ unit

(d) $2\sqrt{2}$ unit

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Ans. c

$$|\vec{A}| = A = 6 \text{ units}$$

$$|\vec{B}| = B = 8 \text{ Units}$$

$$\theta = 60°$$

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

$$= \sqrt{6^2 + 8^2 + 2(6)(8)\cos 60°}$$

$$= \sqrt{6^2 + 8^2 + 2(6)(8)\left(\frac{1}{2}\right)}$$

$$= \sqrt{36 + 64 + 48}$$

$$= \sqrt{148} = \sqrt{4 \times 37}$$

$$\boxed{R = 2\sqrt{37} \text{ Units}}$$

Q) Given that $\vec{A} + \vec{B} + \vec{C} = 0$. Out of three vectors, two are equal in magnitude and the magnitude of third vector is $\sqrt{2}$ times that of either of the two having equal magnitude. Then, the angles between the vectors are given by.

(a) $30^0, 60^0, 90^0$

(b) $45^0, 45^0, 90^0$

(c) $45^0, 60^0, 90^0$

(d) $90^0, 135^0, 135^0$

Ans. d

$$\vec{A} + \vec{B} + \vec{C} = 0$$

$$135° \quad \vec{A}$$

$$45°$$

$$\vec{C} \quad |\vec{C}| = \sqrt{2}\,a$$

$$\vec{A} \quad |\vec{A}| = a$$

$$90° \quad 45° \quad 135°$$

$$\vec{B}$$

$$|\vec{B}| = a$$
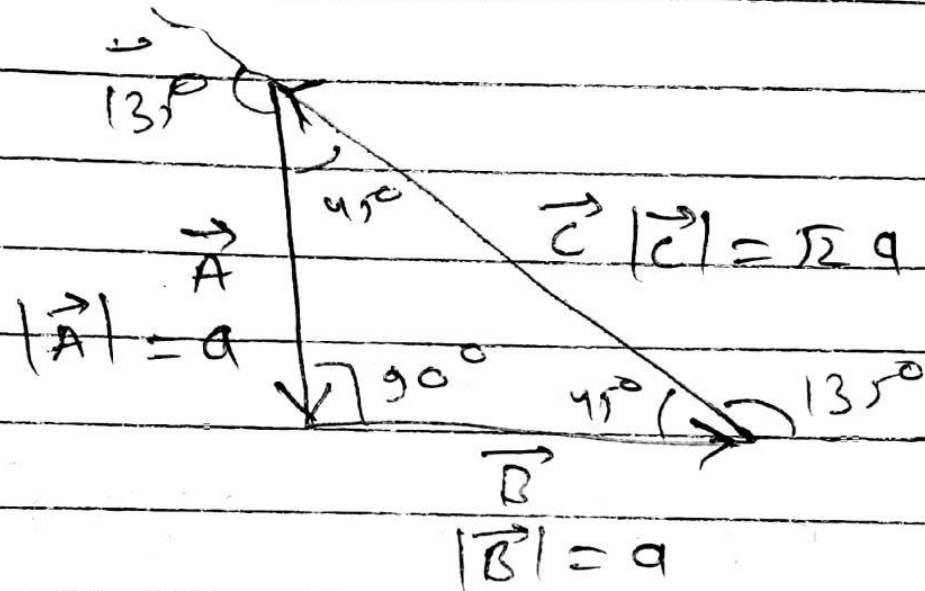
Angles are:
$$\angle \vec{A} \, \vec{B} = 90°$$
$$\angle \vec{B} \, \vec{C} = 135°$$
$$\angle \vec{C} \, \vec{A} = 135°$$

$$\therefore \text{ Angles are: } 90°, \ 135°, \ 135°$$

Q) Two non-zero vectors $\vec{A}$ and $\vec{B}$ are drawn from a common point and $\vec{C} = \vec{A} + \vec{B}$, then which of the option incorrect regarding the angle between $\vec{A}$ and $\vec{B}$

(a) 90^0 if $C^2 = A^2 + B^2$

(b) Greater than 90^0 if $C^2 < A^2 + B^2$

(c) Greater than 90^0 if $C^2 > A^2 + B^2$

(d) Less than 90^0 if $C^2 > A^2 + B^2$

Ans. c

(a)   if $\theta = 90°$

$$R^2 = A^2 + B^2 + 2AB \cancel{\cos\theta}^{\,0}$$

$$R^2 = A^2 + B^2$$

(b)   if $\theta > 90°$

↳ⓒ $R^2 = A^2 + B^2 + 2AB\cos\theta$

for $\theta > 90° \Rightarrow \cos\theta = -ve$

∴ $R^2 < A^2 + B^2$

$\Rightarrow c^2 < A^2 + B^2$

ⓓ   if $\theta < 90°$

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

for $\theta < 90°$, $\cos\theta = +ve$

∴ $R^2 > A^2 + B^2$

$\Rightarrow c^2 > A^2 + B^2$

∴ Incorrect option is ⓒ

Q) A vector **a** makes 30^0, and vector **b** makes 120^0 angle with the x-axis. The magnitude of these vectors are 3 unit and 4 unit, respectively. The magnitude of resultant vector is:
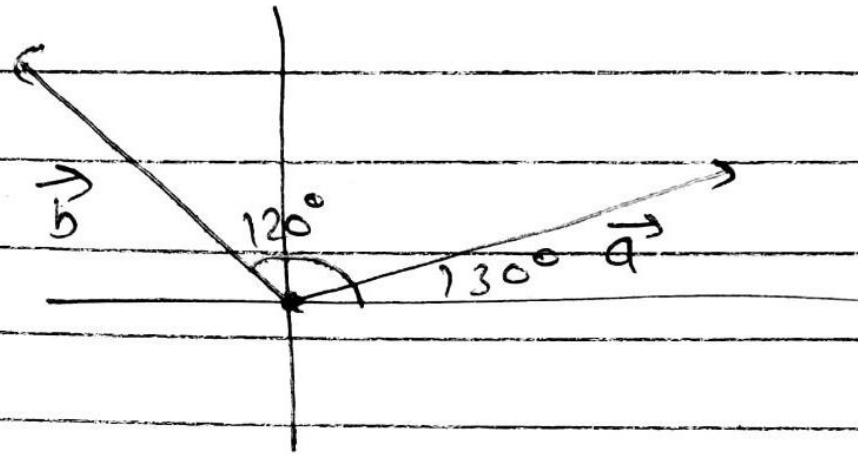
(a) 5 unit

(b) 4 unit

(c) 3 unit

(d) 7 unit

Ans. a

Angle between

$\vec{a}$ & $\vec{b}$ is $= 120 - 30^\circ$

$= 90^\circ$

$\therefore \quad R^2 = A^2 + B^2 + 2AB \cos 90^\circ$

$R^2 = A^2 + B^2$

$R^2 = (3)^2 + (4)^2 = 5^2$

$R = 5 \text{ unit}$

Q) Two Vectors having equal magnitude of 5 units, have an angle of 60^0 between them. Find the magnitude of their resultant vector and its angle α from one of the vectors:

(a) 8.66 unit, 90^0

(b) 8.66 unit, 30^0

(c) 16.8 unit, 30^0

(d) 8.66 unit, 45^0

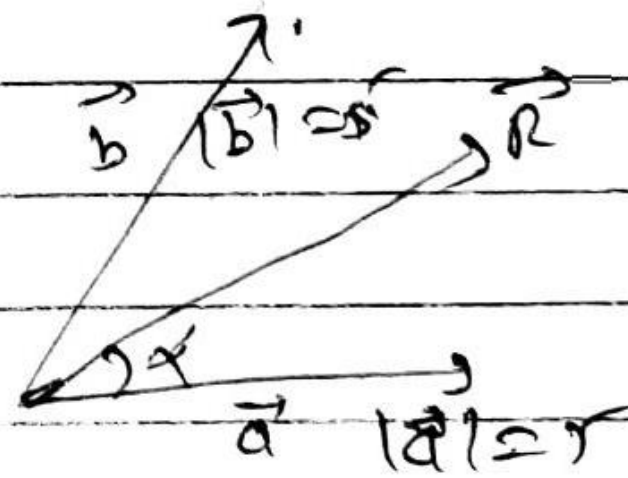**Join Unacademy PLUS Referral Code :**

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Ans. b

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

$$R^2 = (5)^2 + (5)^2 + 2(5)(5)\cos 60^\circ$$

$$R^2 = 2(5)^2 + 2(5)^2 \frac{1}{2} = 3(5)^2$$

$$R = 5\sqrt{3} \text{ unit}$$

$$R = 8.66 \text{ unit}$$

$$\tan\alpha = \frac{b\sin\theta}{a + b\cos\theta}$$

$$\tan\alpha = \frac{(5)(\sin 60^\circ)}{5 + 5(\cos 60^\circ)} = \frac{\sqrt{3}/2}{1 + \frac{1}{2}} = \frac{1}{\sqrt{3}}$$

$$\boxed{\alpha = 30^\circ}$$

Q) A force of 6 N and another of 8 N can be applied together to produce the effect of a single force of:

(a) 1 N   (b) 11 N   (c) 15 N   (d) 20 N

Ans. b

F_{net} of 6N 4 8N !

$$|(F_1 - F_2)| \leq |F_{net}| \leq |(F_1 + F_2)|$$

$$2 \leq F_{net} \leq 14$$

$\therefore F_{net}$ can be 11 N.

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Chalo Niklo