



# PHYSICS

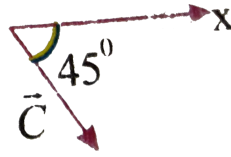
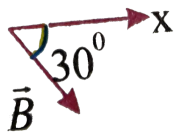
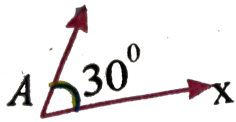
## AIMED AT STUDENTS PREPARING FOR IIT JEE EXAMS

### VECTORS

#### Solved Example

1. Three vectors  $\vec{A}$ ,  $\vec{B}$ ,  $\vec{C}$  are shown in the figure. Find angle between

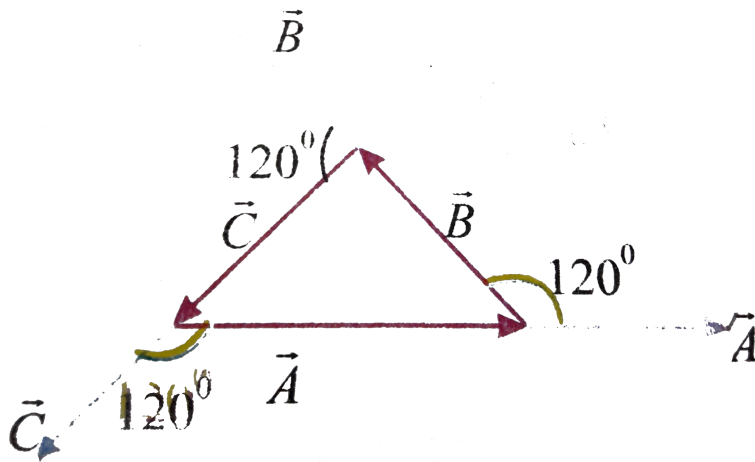
(i)  $\vec{A}$  and  $\vec{B}$  (ii)  $\vec{B}$  and  $\vec{C}$  (iii)  $\vec{A}$  and  $\vec{C}$ .



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2. If  $\vec{A}$ ,  $\vec{B}$ ,  $\vec{C}$  represents the three sides of an equilateral triangle taken in the same order then find the angle between

(i)  $\vec{A}$  and  $\vec{B}$  (ii)  $\vec{B}$  and  $\vec{C}$  (iii)  $\vec{A}$  and  $\vec{C}$ .



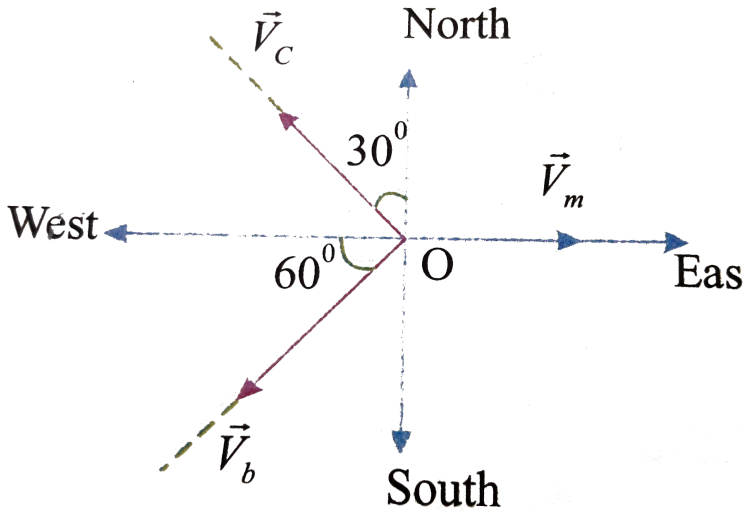
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3. A man walks towards east with certain velocity. A car is travelling along a road which is  $30^\circ$  west of north. While a bus is travelling in another road which is  $60^\circ$  south of west.

Find the angle between velocity vector of

(a) man and car (b) car and bus

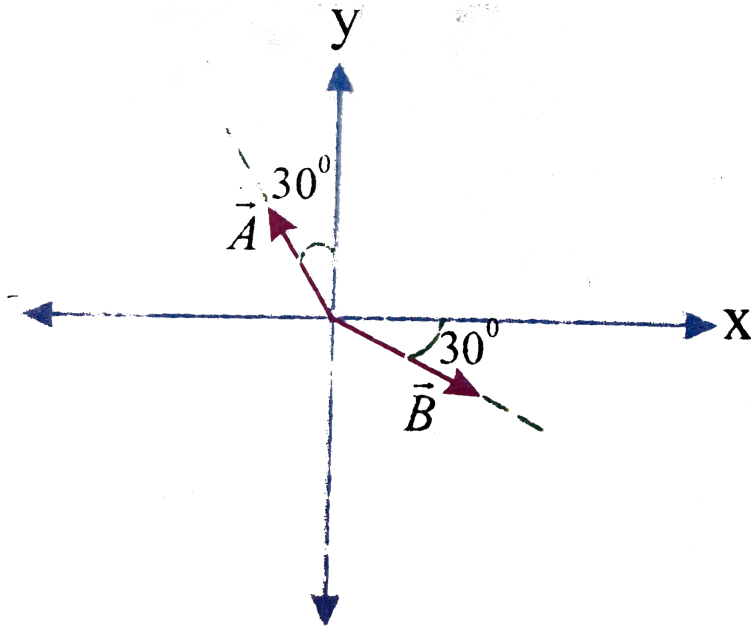
(c) bus and man.



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4. A vector  $\vec{A}$  makes an angle  $30^\circ$  with the Y-axis in anticlockwise direction. Another vector

$\vec{B}$  makes an angle  $30^\circ$  with the x-axis in clockwise direction. Find angle between vectors  $\vec{A}$  and  $\vec{B}$ .



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5. The components of a vector along the x- and y- directions are  $(n + 1)$  and 1, respectively. If the coordinate system is rotated by an angle  $\theta = 60^\circ$ , then the components change to  $n$  and 3. The value of  $n$  is



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6. A weight  $mg$  is suspended from the middle of a rope whose ends are at the same level. The rope is no longer horizontal. Find the

minimum tension required to completely straighten the rope.



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7. Sum of magnitudes of the two forces acting at a point is  $16N$  if their resultant is normal to the smaller forces and has a magnitude  $8N$  then the forces are .



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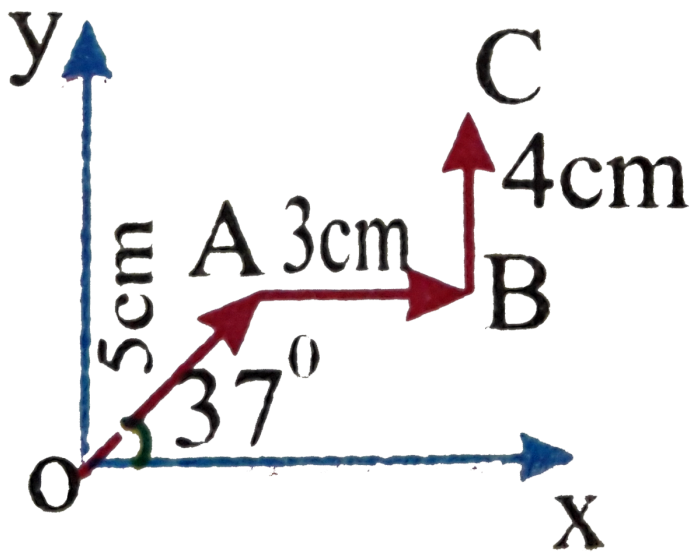
**8.** A bird moves with velocity  $20\text{m/s}$  in a direction making an angle of  $60^\circ$  with the eastern line and  $60^\circ$  with the vertical upward. Represent the velocity vector in rectangular form.



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**9.** Find the resultant of the vectors shown in figure.

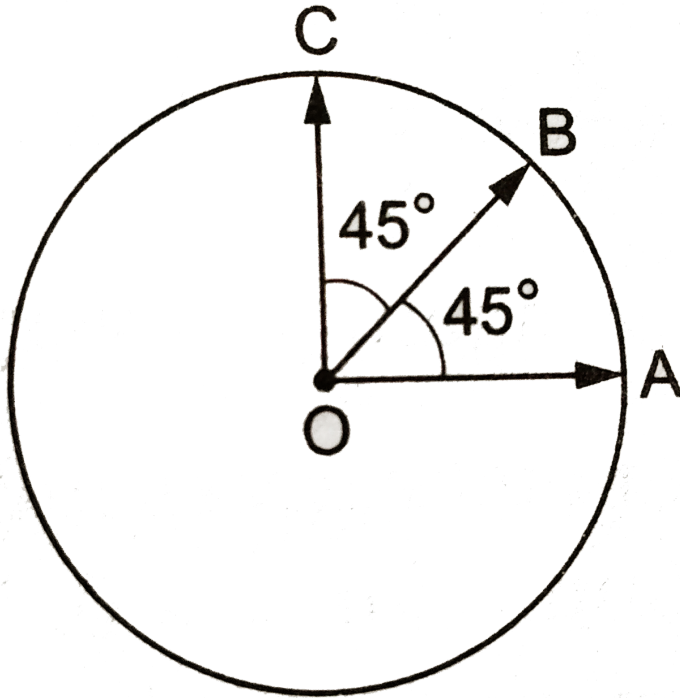




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10. Find the resultant of the three vectors  $\vec{OA}$ ,  $\vec{OB}$  and  $\vec{OC}$  shown in figure. Radius of

the circle is R.



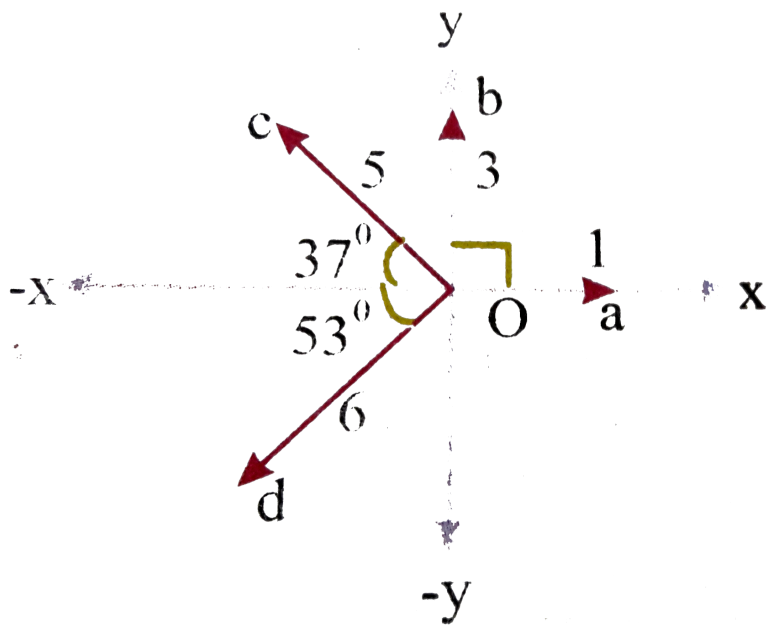
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**11.** Vector  $\vec{A}$  is  $2\text{cm}$  long and is  $60^\circ$  above the x-axis in the first quadrant. Vector  $\vec{B}$  is  $2\text{cm}$  long and is  $60^\circ$  below the x-axis in the fourth quadrant. The sum  $\vec{A} + \vec{B}$  is a vector of magnitudes



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**12.** Find the resultant of the vectors shown in fig by the component method.



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**13.** If vectors  $A$  and  $B$  be respectively equal to  $3\hat{i} - 4\hat{j} + 5\hat{k}$  and  $2\hat{i} + 3\hat{j} - 4\hat{k}$ . Find the unit vector parallel to  $A + B$



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14. If  $\vec{A} = 3\hat{i} + 4\hat{j}$  and  $\vec{B} = 7\hat{i} + 24\hat{j}$ , find a vector having the same magnitude as  $\vec{B}$  and parallel and same direction as  $\vec{A}$ .



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15. The resultant of two vectors  $\vec{A}$  and  $\vec{B}$  is perpendicular to  $\vec{A}$  and equal to half of the magnitude of  $\vec{B}$ . Find angle between  $\vec{B}$  and  $\vec{B}$  ?



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16. If  $2\hat{i} - 3\hat{j} + 4\hat{k}$  and  $3\hat{i} + \lambda\hat{j} + \mu\hat{k}$  be collinear vectors, then find the values of  $\lambda$  and  $\mu$ .



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17. Find the angle between two vectors

$$\hat{A} = 2\hat{i} + \hat{j} - \hat{k} \text{ and } \hat{B} = \hat{i} - \hat{k}$$



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18. If  $\hat{a}_1$  and  $\hat{a}_2$  are two non collinear unit vectors inclined at  $60^\circ$  to each other then the value of  $(\hat{a}_1 - \hat{a}_2) \cdot (2\hat{a}_1 + \hat{a}_2)$  is



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19. If  $\vec{a}$  and  $\vec{b}$  are two unit vectors such that  $\vec{a} + 2\vec{b}$  and  $5\vec{a} - 4\vec{b}$  are perpendicular to each other, then the angle between  $\vec{a}$  and  $\vec{b}$  is



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20. If  $\vec{F} = \hat{i} + 2\hat{j} - 3\hat{k}$  and  $\vec{r} = 2\hat{i} - \hat{j} + \hat{k}$   
find  $\vec{r} \times \vec{F}$



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21. Find the components of a vector  
 $A = 2\hat{i} + 3\hat{j}$  along the directions of  
 $\hat{i} + \hat{j}$  and  $\hat{i} - \hat{j}$ .



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22. Find the unit vector perpendicular to ltr.

$$\vec{A} = 3\hat{i} + 2\hat{j} - \hat{k} \text{ and } \vec{B} = \hat{i} - \hat{j} + \hat{k}$$



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23. Find the angle between the diagonals of a cube with edges of length "a".



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1. Of the following the vector quantity is

A. Time

B. Electric Current

C. Velocity of light

D. Gravitational force

**Answer: D**



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2. Of the following the scalar quantity is

A. Temperature

B. Moment of force

C. Moment of couple

D. Magnetic moment

**Answer: A**



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**3. Choose the correct statement**

- A. Temperature is a scalar but temperature gradient is a vector
- B. Velocity of a body is a vector but velocity of light is a scalar
- C. Electric intensity and Electric current density are vectors
- D. All the above

**Answer: D**



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4. Choose the false statement:

A. Electric current is a vector because it has both magnitude and directions

B. Time is a vector which has direction always in the forward direction.

C. All quantities having magnitude and direction are vector quantities

D. All the above

**Answer: D**





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5. Which of the following units could be associated with a vector quantity?

A. newton/metre

B. newton metre/second

C.  $\text{kg m}^2 \text{s}^{-2}$

D. newton second

**Answer: D**



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6. A vector is not changed if

- A. it is rotated through an arbitrary angle
- B. it is multiplied by an arbitrary scalar
- C. it is cross multiplied by a unit vector
- D. it slides parallel to itself.

**Answer: D**



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7. Which of the following is meaningful?

A. vector/vector

B. scalar/Vector

C. Scalar+Vector

D. Vector/Scalar

**Answer: D**



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8. Choose the correct statement



A. Scalar+vector=scalar/vector

B.  $\frac{\text{vector}}{\text{vector}} = \text{scalar}$

C. Scalar/vector=scalar (Or) vector

D. vector-vector=vector.

**Answer: D**



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9. If the angle between  $\vec{a}$  and  $\vec{b}$  is  $\frac{\pi}{3}$ , then angle between  $2\vec{a}$  and  $-3\vec{b}$  is :

A.  $\frac{\dot{2}}{3}$

B.  $\frac{2.}{3}$

C.  $\frac{\dot{2}}{6}$

D.  $\frac{5.}{3}$

**Answer: B**



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**10.** If component of one vector in the direction of another vector is zero, then those two vectors

- A. are parallel to each other
- B. are perpendicular to each other
- C. are opposite to each other
- D. are coplanar vectors.

**Answer: B**



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**11. The component of a vector is**

- A. always less than its magnitude

B. always greater than its magnitude

C. always equal to its magnitude

D. less than or equal to its magnitude '

**Answer: D**



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**12.** The horizontal component of the weight of a body of mass  $m$  is

A.  $mg$

B.  $\frac{mg}{2}$

C. zero

D. infinity

**Answer: C**



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**13.** Cross product of vectors obeys

A. commutative law

B. associative law

C. distributive law

D. all the above

**Answer: C**



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**14.** Distributive law is obeyed by

A. scalar product

B. vector product

C. both

D. none

**Answer: C**



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**15. Choose the false statement.**

A. Scalar product and vector product obey commutative law

B. Scalar product does not obey distributive law where as vector product

obeys commutative law

C. Scalar product and vector product obey

associative law

D. All the above

**Answer: D**



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**16.** Three vectors satisfy the relation  $A \cdot B = 0$  and  $A \cdot C = 0$  then A is parallel to



A.  $\vec{C}$

B.  $\vec{B}$

C.  $\vec{B} \times \vec{C}$

D.  $\vec{B} \cdot \vec{C}$

**Answer: C**



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17. Let  $\vec{F}$  be a force acting on a particle having position vector  $\vec{r}$ . Let  $\vec{\tau}$  be the torque of this force about the origin then

A.  $\vec{r} \cdot \vec{\Gamma} = 0$  and  $\vec{F} \cdot \vec{\Gamma} = 0$

B.  $\vec{r} \cdot \vec{\Gamma} = 0$  but  $\vec{F} \cdot \vec{\Gamma} \neq 0$

C.  $\vec{r} \cdot \vec{\Gamma} \neq 0$  but  $\vec{F} \cdot \vec{\Gamma} = 0$

D.  $\vec{r} \cdot \vec{\Gamma} \neq 0$  and  $\vec{F} \cdot \vec{\Gamma} \neq 0$

**Answer: A**



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18.  $\left(\vec{A} \times \vec{B}\right) + \left(\vec{B} \times \vec{A}\right)$  is equal to

A. 2AB

B.  $A^2 B^2$

C. zero

D. null vector

**Answer: D**



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19. If  $\vec{C} = \vec{A} \times \vec{B}$ , then  $\vec{C}$  is

A. parallel to  $\vec{A}$

B. parallel to  $\vec{B}$

C. perpendicular to  $\vec{A}$  and parallel to  $\vec{B}$

D. perpendicular to both  $\vec{A}$  and  $\vec{B}$

**Answer: D**



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20. If  $\vec{A}$  and  $\vec{B}$  are two vectors, then which of the following is wrong?

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

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

$$\text{C. } \vec{A} \times \vec{B} = \vec{B} \times \vec{A}$$

$$\text{D. } \vec{A} \times \vec{B} = -\vec{B} \times \vec{A}$$

**Answer: C**



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21. The angle between  $(\vec{A} \times \vec{B})$  and  $(\vec{B} \times \vec{A})$  is (in radian)

A.  $\pi/2$

B.  $\pi$

C.  $\pi/4$

D. zero

**Answer: B**



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22. If none of the vectors  $\vec{A}$ ,  $\vec{B}$  and  $\vec{C}$  are zero and if  $\vec{A} \times \vec{B} = 0$  and  $\vec{B} \times \vec{C} = 0$  the value of  $\vec{A} \times \vec{C}$  is

A. unity

B. zero

C.  $B^2$

D.  $AC \cos(\theta)$

**Answer: B**



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**23. Choose the false statement**

A. A vector having zero magnitude can have a direction

B. If  $\vec{A} \times \vec{B} = \vec{0}$ , then either  $\vec{A}$  or  $\vec{B}$  or

both must have zero magnitude

C. The component of a vector is a vector

D. All the above

**Answer: D**



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24. If  $\vec{A}$ ,  $\vec{B}$  and  $\vec{C}$  are coplanar vectors, then

A.  $\left( \vec{A} \cdot \vec{B} \right) \times \vec{C} = 0$



B.  $\left(\vec{A} \times \vec{B}\right)\vec{C} = 0$

C.  $\left(\vec{A} \cdot \vec{B}\right)\vec{C} = 0$

D. all the above are true

**Answer: B**



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25. If  $\vec{A}$  along North and  $\vec{B}$  vertically upward then the directions of  $\vec{A} \times \vec{B}$  is along

A. west

B. south

C. east

D. vertically downwards

**Answer: C**



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**26.** The angle between

$$\left(\vec{A} + \vec{B}\right) \& \left(\vec{A} \times \vec{B}\right)$$

A. 0

B.  $\pi / 4$

C.  $\pi / 2$

D.  $\pi$

**Answer: C**



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27. The position vector  $\vec{r}$  and linear momentum  $\vec{p}$  and  $\vec{r} = \hat{i}$  and  $\vec{p} = 4\hat{j}$  the angular momentum vector is perpendicular to

A. x-axis

B. y-axis

C. z-axis

D. xy-plane

**Answer: D**



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**28.** The vector area of triangle whose sides are

$\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  is

$$\text{A. } \frac{1}{2} \left| \vec{b} \times \vec{c} + \vec{c} \times \vec{a} + \vec{a} \times \vec{b} \right|$$

$$\text{B. } \frac{1}{2} \left| \vec{b} \times \vec{c} + \vec{c} \times \vec{a} + \vec{b} \right|$$

$$\text{C. } \frac{1}{3} \left| \vec{b} \times \vec{c} + \vec{c} \times \vec{a} + \vec{b} \right|$$

$$\text{D. } \frac{1}{2} \left| -\vec{b} \times \vec{c} + \vec{c} \times \vec{a} + \vec{b} \right|$$

**Answer: A**



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**29.** Set the following vectors in the increasing order to their magnitude.

(i)  $3\hat{i} + 4\hat{j}$  (ii)  $2\hat{i} + 4\hat{j} + 6\hat{k}$  (iii)  $2\hat{i} + 2\hat{j} + 2\hat{k}$

A. a,b,c

B. c,a,b

C. a,c,b

D. b,c,a

**Answer: B**



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**30.** Arrangement the vectors additions so that their magnitude are in the increasing order.

A. Two vector  $\vec{A}$  and  $\vec{B}$  are parallel

B. Two vectors  $\vec{A}$  and  $\vec{B}$  are antiparallel

C. Two vectors  $\vec{A}$  and  $\vec{B}$  making an angle  
 $60^\circ$

D. Two vectors  $\vec{A}$  and  $\vec{B}$  are perpendicular

**Answer: A**



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31. Arrange the vector subtractions so that their magnitude are in decreasing order. If the two vectors  $\vec{A}$  and  $\vec{B}$  are acting at an angle  $\left(\left|\vec{A}\right| > \left|\vec{B}\right|\right)$ . (a)  $60^\circ$  (b)  $90^\circ$  (c)  $180^\circ$  (d)  $120^\circ$

A. a,b,c

B. c,b,a

C. c,d,b,a

D. a,c,b

**Answer: C**





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32. Set the angles made by following vectors with x-axis in the increasing order.

(a)  $3\hat{i} + 4\hat{j}$  (b)  $4\hat{i} + 3\hat{j}$  (c)  $\hat{i} + \hat{j}$

A. a,b,c

B. c,b,a

C. b,c,a

D. a,c,b

**Answer: C**



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**33.** Arrange the dot products in increasing order

(a)  $\vec{A}$  and  $\vec{B}$  are parallel

(b)  $\vec{A}$  and  $\vec{B}$  are making an angle  $60^\circ$

(c)  $\vec{A}$  and  $\vec{B}$  making an angle  $180^\circ$

A. c,b,a

B. a,b,c

C. b,c,a

D. c,a,b

**Answer: A**



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**34.** Arrange the magnitude of cross products in the decreasing order.

(a)  $\vec{A}$  and  $\vec{B}$  making angle zero

(b)  $\vec{A}$  and  $\vec{B}$  making angle  $30^\circ$

(c)  $\vec{A}$  and  $\vec{B}$  making angle  $120^\circ$

A. a,b,c

B. b,c,a

C. c,a,b

D. c,b,a

**Answer: D**



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**Level I C W**

1. If  $\vec{A} = 3\hat{i} - 4\hat{j}$  and  $\vec{B} = -\hat{i} - 4\hat{j}$ ,  
calculate the direction of  $\vec{A} + \vec{B}$

A.  $\tan^{-1}(4)$  with positive X-axis in clockwise

B.  $\tan^{-1}(4)$  with X-axis in clockwise

C.  $\tan^{-1}(4)$  with positive X-axis in anticlockwise

D.  $\tan^{-1}(4)$  with negative X-axis in anticlockwise

**Answer: A**



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2. Two vectors are given by

$\vec{a} = 2\vec{b} - \vec{c} = 0$  then third vector  $\vec{c}$  is

A.  $4\hat{i} - 9\hat{j} - 13\hat{k}$

B.  $-4\hat{i} - 9\hat{j} + 13\hat{k}$

C.  $4\hat{i} - 9\hat{j} - 13\hat{j}$

D.  $2\hat{i} - 3\hat{j} + 13\hat{k}$

**Answer: A**



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3. The vector sum of two vectors of magnitudes 10 units and 15 units can never be

A. 28units

B. 22units

C. 18units

D. 8units

**Answer: A**



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4. The car makes a displacement of 100m towards east and then 200m towards north. Find the magnitude and direction of the resultant.

A. 223.7m,  $\tan^{-1}(2)$ , *N* of E

B. 223.7m,  $\tan^{-1}(2)$ , *E* of N

C. 300m,  $\tan^{-1}(2)$ , N of E

D. 100m,  $\tan^{-1}(2)$ , N of E

**Answer: A**



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5. If a vector has an x-component of -250units and a y-component of 40.0 units, then the magnitude and direction of this vector is

A.  $5\sqrt{89}$  units,  $\sin^{-1}\left(\frac{5}{\sqrt{89}}\right)$  with +ve-x-axis

B.  $5\sqrt{89}$  units,  $\cos^{-1}\left(\frac{5}{\sqrt{89}}\right)$  with -ve-x-axis

C. 45 units,  $\cos^{-1}\left(\frac{-5}{9}\right)$  with x-axis

D. 45 units,  $\sin^{-1}\left(\frac{-5}{9}\right)$  with x-axis

**Answer: B**



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6. A force of 10N is resolved into the perpendicular components. If the first component makes  $30^\circ$  with the force, the magnitudes of the components are

A. 5N, 5N

B.  $5\sqrt{2}N, 5N$

C.  $5\sqrt{3}N, 5N$

D.  $10N, 10\sqrt{3}N$

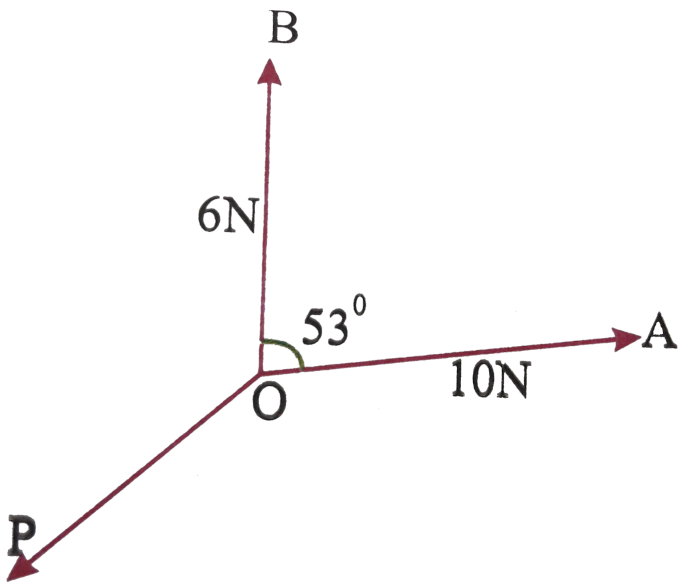
**Answer: C**



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7. If the system is in equilibrium

( $\cos 53^\circ = 3/5$ ), then the value of 'P' is



A. 16N

B. 4N

C.  $\sqrt{208}N$

D.  $\sqrt{232}N$

**Answer: C**



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8. Two billiard balls are moving on a table and the component velocities along the length and breadth are  $5,5 \text{ ms}^{-1}$  for one ball  $2\sqrt{3}2\text{ms}^{-1}$  for the other ball the angle between the motion of balls is

A.  $30^\circ$

B.  $60^\circ$

C.  $40^\circ$

D.  $15^\circ$

**Answer: D**



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9. If  $\vec{A} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ , its components in YZ-plane and ZX-plane are respectively

A.  $\sqrt{13}$  and 5

B. 5 and  $2\sqrt{5}$

C.  $2\sqrt{5}$  and  $\sqrt{13}$

D.  $\sqrt{13}$  and  $\sqrt{29}$

**Answer: B**



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**10.** A car weighing 100kg is on a slope that makes an angle  $30^\circ$  with the horizontal. The component of car's weight parallel to the slope is ( $g = 10ms^{-2}$ )

A. 500N

B. 1000N

C. 15,000N

D. 20,000N

**Answer: A**



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**11.** A room has dimensions  $3m \times 4m \times 5m$ . A fly starting at one corner ends up at the diametrically opposite corner. The magnitude of the displacement of the fly is



A. 12m

B. 60m

C.  $2\sqrt{5}m$

D.  $5\sqrt{2}m$

**Answer: D**



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12. If  $\vec{P} = \hat{i} + 2\hat{j} + 6\hat{k}$ , its direction cosines are

A.  $\frac{1}{41}$ ,  $\frac{2}{41}$  and  $\frac{6}{41}$

B.  $\frac{1}{\sqrt{41}}$ ,  $\frac{2}{\sqrt{41}}$  and  $\frac{6}{\sqrt{41}}$

C.  $\frac{3}{\sqrt{41}}$ ,  $\frac{8}{\sqrt{41}}$  and  $\frac{7}{\sqrt{41}}$

D. 1,2 and 6

**Answer: B**



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**13.** The value of 'm', if  $\hat{i} + 2\hat{j} - 3\hat{k}$  is parallel to  $3\hat{i} + m\hat{j} - 9\hat{k}$  is

A. 12

B. 9

C. 6

D. 3

**Answer: C**



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**14.** A force  $2\hat{i} + \hat{j} - \hat{k}$  newton acts on a body which is initially at rest. If the velocity of the

body at the end of 20 seconds is

$4\hat{i} + 2\hat{j} + 2\hat{k} \text{ms}^{-1}$ , the mass of the body

A. 20kg

B. 15kg

C. 10kg

D. 5kg

**Answer: C**



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15. When a force vector  $\vec{F} = (\hat{i} + 2\hat{j} + \hat{k})\text{N}$  acts on a body and produces a displacement of  $\vec{S} = (4\hat{i} + \hat{j} + 7\hat{k})\text{ m}$ , then the work done is

A. 9J

B. 13J

C. 5J

D. 1J

**Answer: B**



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16. The angle between the two vectors

$$\vec{A} = \hat{i} + 2\hat{j} - \hat{k} \text{ and } \vec{B} = -\hat{i} + \hat{j} - 2\hat{k} \text{ is}$$

A.  $90^\circ$

B.  $30^\circ$

C.  $45^\circ$

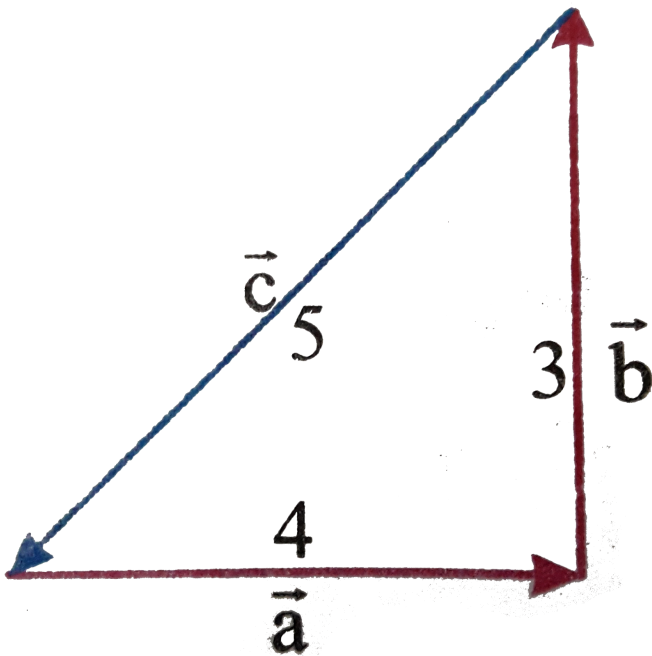
D.  $60^\circ$

**Answer: D**



**Watch Video Solution**

17. In a right angled triangle the three vectors  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  add to zero. Then  $\vec{a} \cdot \vec{b}$  is



A.  $-9$

B. +9

C. 0

D. -3

**Answer: C**



**Watch Video Solution**

**18.** A vector parallel to the vector  $(\hat{i} + 2\hat{j})$  and having magnitude  $3\sqrt{5}$  units is

A.  $3\hat{i} + 6\hat{j}$



B.  $6\hat{i} - 3\hat{j}$

C.  $4\hat{i} - 2\hat{j}$

D.  $\hat{i} - 2\hat{j}$

**Answer: A**



**Watch Video Solution**

19. If  $\vec{A} = 2\hat{i} + 3\hat{j}$  and  $\vec{B} = 2\hat{j} + 3\hat{k}$  the component of  $\vec{B}$  along  $\vec{A}$  is

A. 6

B.  $\frac{1}{6}$

C.  $\frac{6}{13}$

D.  $\frac{6}{\sqrt{13}}$

**Answer: D**



**Watch Video Solution**

20. if the vectors  $P = \alpha\hat{i} + \alpha\hat{j} + 3\hat{k}$  and  $Q = \alpha\hat{i} - 2\hat{j} - \hat{k}$  are perpendicular to each other, then the positive value of  $\alpha$  is

A. Zero

B. 1

C. 2

D. 3

**Answer: D**



**Watch Video Solution**

**21.** A force of  $2\hat{i} + 3\hat{j} + 2\hat{k}N$  acts on a body for 4 and produces a displacement of  $3\hat{i} + 4\hat{j} + 5\hat{k}$  m calculate the power?

A. 5W

B. 6W

C. 7W

D. 9W

**Answer: C**



**Watch Video Solution**

22. If  $\theta$  is the angle between unit vectors  $\vec{A}$  and  $\vec{B}$ , then  $\frac{\left(1 - \vec{A} \cdot \vec{B}\right)}{1 + \vec{A} \cdot \vec{B}}$  is equal to

A.  $\tan^2(\theta/2)$

B.  $\sin^2(\theta/2)$

C.  $\cot^2(\theta/2)$

D.  $\cos^2(\theta/2)$

**Answer: A**



**Watch Video Solution**

23. Find the torque of a force

$\vec{F} = 3\hat{i} + 2\hat{j} + \hat{k}$  acting at the point

$\vec{r} = 8\hat{i} + 2\hat{j} + 3\hat{k}$  about origin

A.  $14\hat{i} - 38\hat{j} + 3\hat{k}$

B.  $4\hat{i} + 4\hat{j} + 6\hat{k}$

C.  $-14\hat{i} + 38\hat{j} - 16\hat{k}$

D.  $-4\hat{i} - 17\hat{j} + 22\hat{k}$

**Answer: D**



**Watch Video Solution**

24. The area of the triangle whose adjacent sides are represented by the vector  $(4\hat{i} + 3\hat{j} + 4\hat{k})$  and  $5\hat{i}$  in sq. units is

A. 25

B. 12.5

C. 50

D. 45

**Answer: B**



**Watch Video Solution**

25. The magnitude of scalar and vector products of two vectors are  $48\sqrt{3}$  and 144 respectively. What is the angle between the two vectors?

A.  $30^\circ$

B.  $45^\circ$

C.  $60^\circ$

D.  $90^\circ$



**Answer: C**



**Watch Video Solution**

**26.** The diagonals of a parallelogram are

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

what is the area of the parallelogram?

A. 4 units

B. 7 units

C.  $\sqrt{5}$  units

D.  $\sqrt{8}$  units

**Answer: C**



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**27.** Deduce the condition for the vectors  $2\hat{i} + 3\hat{j} - 4\hat{k}$  and  $3\hat{i} - a\hat{j} + b\hat{k}$  to be parallel.

A.  $a = -9/2, b = -6$

B.  $a = -6, b = -9/2$

C.  $a = 4, b = 5$

D.  $a = 8, b = 2$

**Answer: A**



**Watch Video Solution**

**Level II C W**

1. A man travels 1 mile due east. Then 5 miles due south, then 2 miles due east and finally 9 miles due north. His displacement is

A. 3 miles

B. 5 miles

C. 4 miles

D. between 5 and 9 miles

**Answer: B**



**Watch Video Solution**

2. Three forces

$$\vec{F}_1 = a(\hat{i} - \hat{j} + \hat{k}), \vec{F}_2 = 2\hat{i} - 3\hat{j} + 4\hat{k}$$

and  $\vec{F}_3 = 8\hat{i} - 7\hat{j} + 6\hat{k}$  act simultaneously

on a particle. If the particle is in equilibrium,

the value of  $\alpha$  is

A. 10

B.  $-10$

C. 8

D. 2

**Answer: B**



**Watch Video Solution**

**3.** If a particle is displaced from  $(0,0,0)$  to a point in  $XY$ -plane which is at a distance of 4 units in a direction making an angle clock wise

$60^\circ$  with the negative x-axis. What is the final position vector of the particle?

A.  $-2\hat{i} + 2\sqrt{3}\hat{j}$

B.  $2\hat{i} + 2\sqrt{3}\hat{j}$

C.  $2\hat{j} + 2\sqrt{3}\hat{k}$

D.  $\sqrt{3}\hat{j} + 2\hat{k}$

**Answer: A**



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4. Cosines of angles made by a vector with X,Y axes are  $3/5\sqrt{2}$ ,  $4/5\sqrt{2}$  respectively. If the magnitude of the vector is  $10\sqrt{2}$  then that vector is

A.  $8\hat{i} + 6\hat{j} - 10\hat{k}$

B.  $6\hat{i} - 8\hat{j} - 10\hat{k}$

C.  $-6\hat{i} - 8\hat{j} + 10\hat{k}$

D.  $6\hat{i} + 8\hat{j} + 10\hat{k}$

**Answer: D**



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5. If a vector  $\vec{A}$  makes angles  $45^\circ$  and  $60^\circ$  with x and y axis respectively then the angle made by it with z-axis is

A.  $30^\circ$

B.  $60^\circ$

C.  $90^\circ$

D.  $120^\circ$

**Answer: B**







6. A vector  $\vec{B}$  which has a magnitude 8.0 is added to a vector  $\vec{A}$  which lies along the x-axis. The sum of these two vector is a third vector which lies along the y-axis and has a magnitude that is twice the magnitude of  $\vec{A}$ . Find the magnitude of  $\vec{A}$

A.  $\frac{6}{\sqrt{5}}$

B.  $\frac{8}{\sqrt{5}}$

C.  $\frac{12}{\sqrt{5}}$

D.  $\frac{16}{\sqrt{5}}$

**Answer: B**



**Watch Video Solution**

7. If  $\vec{V} = 3\hat{i} + 4\hat{j}$  then, with what scalar 'C' must it be multiplied so that  $|CV| = 7.5$

A. 0.5

B. 2.5

C. 1.5

D. 3.5

**Answer: C**



**Watch Video Solution**

**8.** Find the angle between the diagonals of a cube with edges of length "a".

A.  $\sin^{-1}(1/3)$

B.  $\cos^{-1}(1/3)$

C.  $\tan^{-1}(1/3)$

$$D. \cot^{-1}(1/3)$$

**Answer: B**



**Watch Video Solution**

9. The angle made by the vector  $\vec{A} = 2\hat{i} + 3\hat{j}$

with Y-axis is

A.  $\tan^{-1}\left(\frac{3}{2}\right)$

B.  $\tan^{-1}\left(\frac{2}{3}\right)$

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

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

**Answer: B**



**Watch Video Solution**

**10.** If  $l_1, m_1, n_1$  and  $l_2, m_2, n_2$  are the directional cosines of two vectors and  $\theta$  is the angle between them, then their value of  $\cos \theta$  is

A.  $l_1 l_2 + m_1 m_2 + n_1 n_2$

B.  $l_1m_1 + m_1n_1 + n_1l_1$

C.  $l_2m_2 + m_2n_2 + n_2l_2$

D.  $m_1l_2 + l_2m_2 + n_1m_2$

**Answer: A**



**Watch Video Solution**

11. If  $\vec{A} + \vec{B} = \vec{C}$ , then magnitude of  $\vec{B}$  is

A.  $\vec{C} - \vec{A}$

B. C-A

$$C. \sqrt{\vec{C} \cdot \vec{B} - \vec{A} \cdot \vec{B}}$$

$$D. \sqrt{\vec{C} \cdot \vec{A} - \vec{B} \cdot \vec{A}}$$

**Answer: C**



**Watch Video Solution**

**12.** If  $\vec{a} = m\vec{b} + \vec{c}$ . The scalar  $m$  is

$$A. \frac{\vec{a} \cdot \vec{b} - \vec{b} \cdot \vec{c}}{b^2}$$

$$B. \frac{\vec{c} \cdot \vec{b} - \vec{a} \cdot \vec{c}}{a^2}$$

$$C. \frac{\vec{c} \cdot \vec{a} - \vec{b} \cdot \vec{c}}{c^2}$$

$$D. \frac{\vec{a} \cdot \vec{b} - \vec{b} \cdot \vec{c}}{a^2}$$

**Answer: A**



**Watch Video Solution**

**13.** Velocity and acceleration vectors of charged particle moving perpendicular to the direction of magnetic field at a given instant of time are  $\vec{v} = 2\hat{i} + c\hat{j}$  and  $\vec{a} = 3\hat{i} + 4\hat{j}$  respectively. Then that value of 'c' is



A. 3

B. 1.5

C.  $-1.5$

D.  $-3$

**Answer: C**



**Watch Video Solution**

**14.** Dot product is used in the determination of

(a) Work done by a force

(b) Power developed by an automobile moving with uniform velocity.

(c) The normal flux linked with a coil kept in magnetic field.

(d) The force acting on a conductor carrying current kept in a magnetic field

A. a,d are true

B. b,d are true

C. a,b,c are true

D. c,d are true

**Answer: C**



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15. The unit vectors perpendicular to

$\vec{A} = 2\hat{i} + 3\hat{j} + \hat{k}$  and  $\vec{B} = \hat{i} - \hat{j} + \hat{k}$  is

A.  $\frac{4\hat{i} - \hat{j} - 5\hat{k}}{\sqrt{42}}$

B.  $\frac{4\hat{i} - \hat{j} + 5\hat{k}}{\sqrt{42}}$

C.  $\frac{4\hat{i} + \hat{j} + 5\hat{k}}{\sqrt{42}}$

D.  $\frac{4\hat{i} + \hat{j} - 5\hat{k}}{\sqrt{42}}$

Answer: A





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16. the value of  $(\vec{A} + \vec{B}) \times (\vec{A} - \vec{B})$  is

A.  $(\vec{a} \times \vec{b})$

B.  $2(\vec{a} \times \vec{b})$

C.  $-2(\vec{a} \cdot \vec{b})$

D.  $-2(\vec{a} \times \vec{b})$

**Answer: D**



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1. If  $\vec{A} = 3\hat{i} - 4\hat{j}$  and  $\vec{B} = -\hat{i} - 4\hat{j}$ ,  
calculate the direction of  $\vec{A} - \vec{B}$ .

A. along positive x-axis

B. along negative x-axis

C. along positive y-axis

D. along negative y-axis

**Answer: A**



**Watch Video Solution**

2. The resultant of the forces  $\vec{F}_1 = 4\hat{i} - 3\hat{j}$  and  $\vec{F}_2 = 6\hat{i} + 8\hat{j}$  is

A.  $5\sqrt{5}$

B.  $10\hat{i} - 5\hat{j}$

C. 125

D.  $-2\hat{i} - 3\hat{j}$

**Answer: A**



**Watch Video Solution**

3. The vector sum of two vectors of magnitudes 10 units and 15 units can never be

A. 20 units

B. 22 units

C. 18 units

D. 3 units

**Answer: D**



**Watch Video Solution**

4. A car moves 40 m due east and turns towards north and moves 30 m then turns  $45^\circ$  east of north and moves  $20\sqrt{2}m$ . The net displacement of car is (east is taken positive x-axis, North as positive y-axis)

A.  $50\hat{i} + 60\hat{j}$

B.  $60\hat{i} + 50\hat{j}$

C.  $30\hat{i} + 40\hat{j}$

D.  $40\hat{j} + 30\hat{j}$

**Answer: B**







5. A bird moves in such a way that it has a displacement of 12 m towards east, 5 m towards north and 9m vertically upwards Find the magnitude of its displacement

A.  $5\sqrt{2}m$

B.  $5\sqrt{10}m$

C.  $5\sqrt{5}m$

D.  $5m$

**Answer: B**



**Watch Video Solution**

6. An aeroplane is heading north east at a speed of  $141.4\text{ms}^{-1}$ . The north ward component of its velocity is

A.  $141.4\text{ms}^{-1}$

B.  $100\text{ms}^{-1}$

C. zero

D.  $50\text{ms}^{-1}$

**Answer: B**



**Watch Video Solution**

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

**Answer: A**



**Watch Video Solution**

8. The vector parallel to  $4\hat{i} - 3\hat{j} + 5\hat{k}$  and whose length is the arithmetic mean of lengths of two vectors  $2\hat{i} - 4\hat{j} + 4\hat{k}$  and  $\hat{j} + \sqrt{6}\hat{j} + 3\hat{k}$  is

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

B.  $(4\hat{i} - 3\hat{j} + 5\hat{k}) / \sqrt{3}$

C.  $(4\hat{i} - 3\hat{j} + 5\hat{k}) / \sqrt{2}$

$$D. (4\hat{i} - 3\hat{j} + 5\hat{k}) / \sqrt{5}$$

**Answer: C**



**Watch Video Solution**

9. The direction cosines of a vector  $\vec{A}$  are

$$\cos \alpha = \frac{4}{5\sqrt{2}}, \cos \beta = \frac{1}{\sqrt{2}} \quad \text{and}$$

$$\cos \gamma = \frac{3}{5\sqrt{2}} \quad \text{then the vector } \vec{A} \text{ is}$$

A.  $4\hat{i} + \hat{j} + 3\hat{k}$

B.  $4\hat{i} + 5\hat{j} + 3\hat{k}$

C.  $4\hat{i} - 5\hat{j} - 3\hat{k}$

D.  $\hat{i} + 5\hat{j} - \hat{k}$

**Answer: B**



**Watch Video Solution**

10. Given two vectors  $\vec{A} = \hat{i} - 2\hat{j} - 3\hat{k}$  and  $\vec{B} = 4\hat{i} - 2\hat{j} + 6\hat{k}$ . The angle made by  $(\vec{A} + \vec{B})$  with the X-axis is

A.  $30^\circ$

B.  $45^\circ$

C.  $60^\circ$

D.  $90^\circ$

**Answer: B**



**Watch Video Solution**

**11.** To go from town A to town B a plane must fly about 1780 km at an angle of  $30^\circ$  west of north. How far West of A is B?

A. 1542km

B. 1452km

C. 1254km

D. 890 km

**Answer: D**



**Watch Video Solution**

**12.** A vector  $\hat{i} + \sqrt{3}\hat{j}$  rotates about its tail through an angle  $60^\circ$  in clockwise direction then the new vector is



A.  $\hat{i} + \sqrt{3}\hat{j}$

B.  $3\hat{i} - 4\hat{j}$

C.  $2\hat{j}$

D.  $2\hat{i}$

**Answer: D**



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13. If  $\vec{a} = 2\hat{i} + 6\hat{j} + m\hat{k}$  and  $\vec{b} = n\hat{i} + 18\hat{j} + 3\hat{k}$  are parallel to each other then values of m,n are

A. 1,6

B. 6,1

C.  $-1, 6$

D.  $-1, -6$

**Answer: A**



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**14.** A particle has an initial velocity  $(6\hat{i} + 8\hat{j})\text{ms}^{-1}$  and an acceleration of  $(0.8\hat{i} + 0.6\hat{j})\text{ms}^{-2}$ . Its speed after 10s is

A.  $20ms^{-1}$

B.  $7\sqrt{2}ms^{-1}$

C.  $10ms^{-1}$

D.  $14\sqrt{2}ms^{-1}$

**Answer: D**



**Watch Video Solution**

**15.** A motor boat is going in a river with a velocity  $\vec{V} = (4\hat{i} - 2\hat{j} + \hat{k})ms^{-1}$ . If the resisting force due to stream is

$\vec{F} = (5\hat{i} - 10\hat{j} + 6\hat{k}) N$ , then the power of the motor boat is

A. 100w

B. 50w

C. 46w

D. 23w

**Answer: C**



**Watch Video Solution**

16. The angle between the two vectors

$-2\hat{i} + 3\hat{j} - \hat{k}$  and  $\hat{i} + 2\hat{j} + 4\hat{k}$  is

A.  $0^\circ$

B.  $90^\circ$

C.  $180^\circ$

D.  $45^\circ$

**Answer: B**



**Watch Video Solution**

17. If a vector  $\vec{A} = 2\hat{i} + 2\hat{j} + 3\hat{k}$ , and  $\vec{B} = 3\hat{i} + 6\hat{j} + n\hat{k}$ , are perpendicular to each other then the value of 'n' is

A. 4

B. 12

C. 6

D. -6

**Answer: D**



**Watch Video Solution**

18. A vector parallel to the vector  $(\hat{i} + 2\hat{j})$  and having magnitude  $3\sqrt{5}$  units is

A.  $3\hat{i} + 6\hat{j}$

B.  $6\hat{i} - 3\hat{j}$

C.  $4\hat{i} - 2\hat{j}$

D.  $\hat{i} - 2\hat{j}$

**Answer: A**



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19. If  $\vec{A} = 5\hat{i} - 2\hat{j} + 3\hat{k}$  and

$\vec{B} = 2\hat{i} + \hat{j} + 2\hat{k}$ , component of  $\vec{B}$  along  $\vec{A}$

is

A.  $\frac{\sqrt{14}}{38}$

B.  $\frac{28}{\sqrt{38}}$

C.  $\frac{\sqrt{28}}{38}$

D.  $\frac{14}{\sqrt{38}}$

**Answer: D**



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20. If the vectors  $\vec{A} = a\hat{i} + \hat{j} - 2\hat{k}$  and  $\vec{B} = a\hat{i} - a\hat{j} + \hat{k}$  are perpendicular to each other then the positive value of 'a' is

A. Zero

B. 1

C. 2

D. 3

**Answer: C**



**Watch Video Solution**

21. When a force  $(8\hat{i} + 4\hat{j})$  newton displaces a particle through  $(3\hat{i} - 3\hat{j})$  metre, the power is 0.6W. The time of action of the force is

A. 20s

B. 7.2s

C. 72s

D. 2s

**Answer: A**



**Watch Video Solution**

22. If  $\vec{a}$  and  $\vec{b}$  are two unit vectors and the angle between them is  $60^\circ$  then

$$\frac{\left(1 + \vec{a} \cdot \vec{b}\right)}{\left(1 - \vec{a} \cdot \vec{b}\right)} \text{ is}$$

A. 2

B. 3

C. 0

D.  $1/2$

**Answer: B**



**Watch Video Solution**

23. If  $\vec{F} = 2\hat{i} + 3\hat{j} - \hat{k}$  and  $\vec{r} = \hat{i} - \hat{j} + 6\hat{k}$

find  $\vec{r} \times \vec{F}$

A.  $-17\hat{i} + 13\hat{j} + 5\hat{k}$

B.  $-17\hat{i} - 13\hat{j} - 5\hat{k}$

C.  $3\hat{i} + 4\hat{j} - 5\hat{k}$

D.  $-3\hat{i} - 4\hat{j} + 5\hat{k}$

**Answer: A**



**Watch Video Solution**

24. Two sides of a triangle are given by  $\hat{i} + \hat{j} + \hat{k}$  and  $-\hat{i} + 2\hat{j} + 3\hat{k}$ , then area of triangle is

A.  $\sqrt{26}$

B.  $\sqrt{26}/2$

C.  $\sqrt{46}$

D. 26

**Answer: B**



**Watch Video Solution**

**25.** The magnitude of scalar and vector products of two vectors are 144 and  $48\sqrt{3}$  respectively. What is the angle between the two vectors?

A.  $30^\circ$

B.  $45^\circ$

C.  $60^\circ$

D.  $90^\circ$

**Answer: A**



**Watch Video Solution**

**26.** Area of a parallelogram formed by vectors

$(3\hat{i} - 2\hat{j} + \hat{k})m$  and  $(\hat{i} + 2\hat{j} + 3\hat{k})$  m as

adjacent sides is

A.  $3\sqrt{8}m^2$

B.  $24m^2$

C.  $8\sqrt{3}m^2$

D.  $4\sqrt{3}m^2$

**Answer: C**



**Watch Video Solution**

**27.** Find the value of  $x$  and  $y$  for which vectors

$$\vec{A} = 6\hat{i} + x\hat{j} - 2\hat{k} \quad \text{and} \quad \vec{B} = 5\hat{i} - 6\hat{j} - y\hat{k}$$

may be parallel

A.  $x = 0, y = \frac{2}{3}$



$$\text{B. } x = \frac{-36}{5}, y = \frac{5}{3}$$

$$\text{C. } x = \frac{-15}{3}, y = \frac{23}{5}$$

$$\text{D. } x = \frac{36}{3}, y = \frac{15}{14}$$

**Answer: B**



**Watch Video Solution**

**Level II H W**

1. A particle has a displacement of 12 m towards east then 5 m forwards north and

then 6 m vertically upwards the resultant displacement is nearly

A. 10.4m

B. 12.19m

C. 14.32m

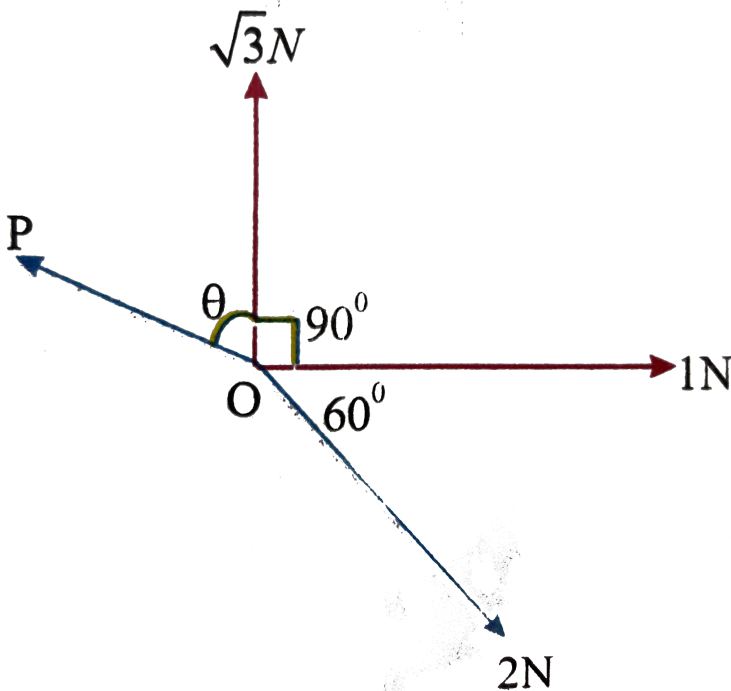
D. 13.06m

**Answer: C**



**Watch Video Solution**

2. Four co-planar concurrent forces are acting on a body as shown in the figure to keep it in equilibrium. The the values of  $P$  and  $\theta$  are.



A.  $P = 4N, \theta = 0^\circ$

B.  $P = 2N, \theta = 90^\circ$

C.  $P = 2N, \theta = 0^\circ$

D.  $P = 4N, \theta = 90^\circ$

**Answer: B**



**Watch Video Solution**

3. O is a point on the ground chosen as origin.

A boy first suffers a displacement of  $10\sqrt{2}$  m

North-East, next 10 m north and finally  $10\sqrt{2}$

North-West. How far is it from the origin.

A. 30n north

B. 30 m south

C. 30 m west

D. 30 m east

**Answer: A**



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4. If the two directional cosines of a vector are  $\frac{1}{\sqrt{2}}$  and  $\frac{1}{\sqrt{3}}$  then the value of third

directional cosine is

A.  $\frac{1}{\sqrt{6}}$

B.  $\frac{1}{\sqrt{5}}$

C.  $\frac{1}{\sqrt{7}}$

D.  $\frac{1}{\sqrt{10}}$

**Answer: A**



**Watch Video Solution**

5. A force  $\vec{F} = 3\hat{i} + c\hat{j} + 2\hat{k}N$  acting on a particle causes a displacement  $\vec{S} = -4\hat{i} + 2\hat{j} - 3\hat{k}m$ . if the workdone is 6 joule, the value of c is

A. 0

B. 1

C. 12

D. 6

**Answer: C**



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6. If  $\vec{a}$  and  $\vec{b}$  are two unit vectors such that  $\vec{a} + 2\vec{b}$  and  $5\vec{a} - 4\vec{b}$  are perpendicular to each other, then the angle between  $\vec{a}$  and  $\vec{b}$  is

A.  $120^\circ$

B.  $90^\circ$

C.  $60^\circ$

D.  $45^\circ$



**Answer: C**



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7. If  $\vec{A} = 9\hat{i} - 7\hat{j} + 5\hat{k}$  and  $\vec{B} = 3\hat{i} - 2\hat{j} - 6\hat{k}$  then the value of  $(\vec{A} + \vec{B}) \cdot (\vec{A} - \vec{B})$  is

A. 206

B. 128

C. 106

D.  $-17$

**Answer: C**



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**8.** The work done by a force  $2\hat{i} - \hat{j} + 5\hat{k}$  when it displaces the body from a point  $(7, 2, 5)$  is

A. 5units

B. 7units

C. 1units

D. 15 units

**Answer: A**



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9. The component of  $\vec{A}$  along  $\vec{B}$  is  $\sqrt{3}$  times that of the component of  $\vec{B}$  along  $\vec{A}$ . Then

A:B is

A.  $1 : \sqrt{3}$

B.  $\sqrt{3} : 1$

C.  $2: \sqrt{3}$

D.  $\sqrt{3}: 2$

**Answer: B**



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10. If  $\vec{A} = (2\hat{i} + 3\hat{j})$  and  $\vec{B} = (\hat{i} - \hat{j})$  then component of  $\vec{A}$  perpendicular to vector  $\vec{B}$  and in the same plane is

A.  $\frac{5}{2}(\hat{i} + \hat{j})$

B.  $\frac{5}{\sqrt{2}} (\hat{i} + \hat{j})$

C.  $\frac{\sqrt{5}}{2} (\hat{i} + \hat{j})$

D.  $\frac{5}{\sqrt{2}} (\hat{i} + \hat{k})$

**Answer: A**



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11. If  $\vec{A} + \vec{B} = \vec{R}$  and  $2\vec{A} + \vec{B}$  is perpendicular to  $\vec{B}$  then

A.  $A=R$

B.  $B=2R$

C.  $B=R$

D.  $B=A$

**Answer: A**



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12. If  $\vec{A} = \frac{1}{\sqrt{2}}\cos\theta\hat{i} + \frac{1}{\sqrt{2}}\sin\theta\hat{j}$ , what will be the unit vector perpendicular to  $\vec{A}$ .

A.  $\cos\theta\hat{i} + \sin\theta\hat{j}$

B.  $-\cos \theta \hat{i} + \sin \theta \hat{j}$

C.  $\frac{\cos \theta \hat{i} + \sin \theta \hat{j}}{\sqrt{2}}$

D.  $\sin \theta \hat{i} - \cos \theta \hat{j}$

**Answer: D**



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13.  $(\hat{i} + \hat{j}) \times (\hat{i} - \hat{j}) =$

A.  $-2\hat{k}$

B.  $2\hat{k}$

C. zero

D.  $2\hat{i}$

**Answer: A**



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**14.** The diagonals of a parallelogram are

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

what is the area of the parallelogram?

A. 2 units



B. 4 units

C.  $\sqrt{5}$  units

D.  $\frac{\sqrt{5}}{2}$  units

**Answer: D**



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