



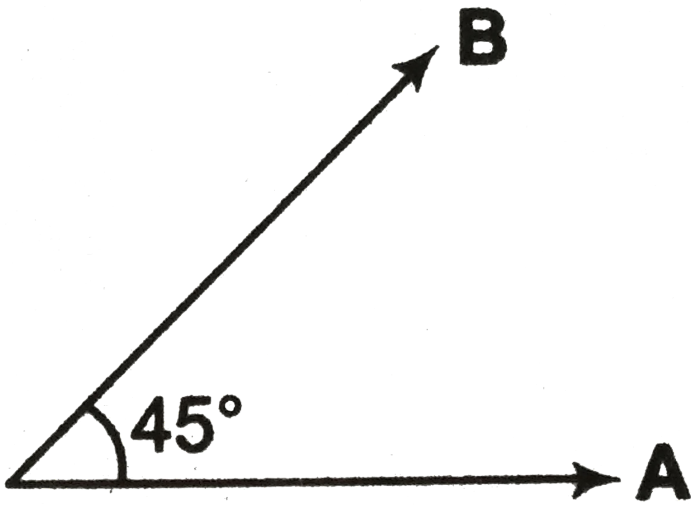
## PHYSICS

### BOOKS - DC PANDEY ENGLISH

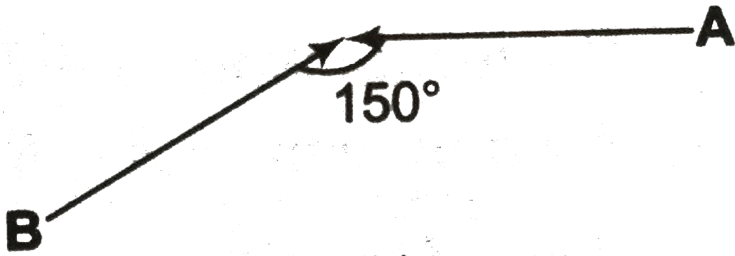
#### Vectors

#### Solved Examples

1. In the shown fig . 5.12 (a) , (b) and (c) , find the angle between  $A$  and  $B$  .

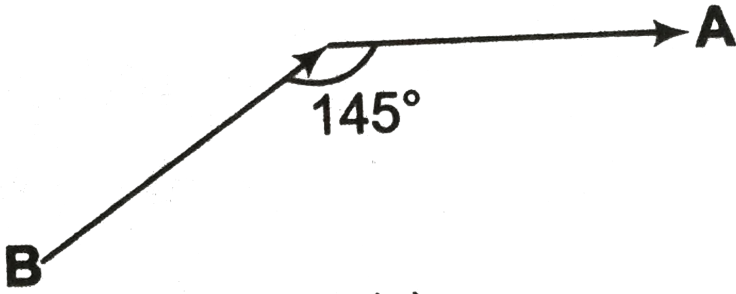


(a)



(b)

(b)



(c)



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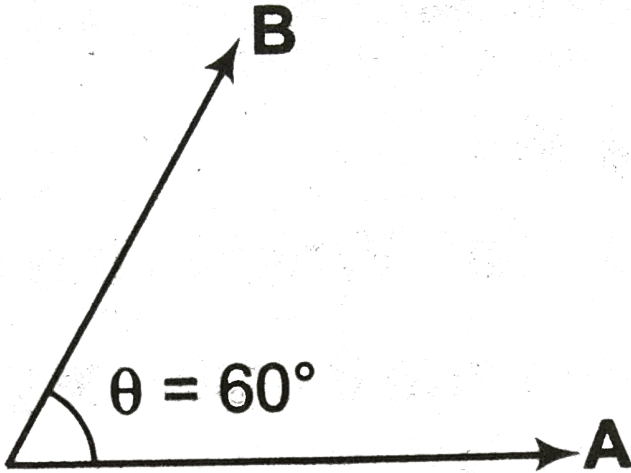
2. What is the angle between  $a$  and  $-\frac{3}{2}a$ .



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3. Find  $A+B$  and  $A-B$  in the diagram shown in figure.

Given  $A=4$  units and  $B=3$  units.



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4. A force  $F$  has magnitude of  $15N$ . Direction of  $F$  is at  $37^\circ$  from negative x-axis towards positive y-axis.

Represent  $F$  in terms of  $\hat{i}$  and  $\hat{j}$ .



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5. Find magnitude and direction of a vector,

$$A = (6\hat{i} - 8\hat{j}).$$



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6. Resolve a weight of 10N in two directions which are parallel and perpendicular to a slope inclined at  $30^\circ$  to the horizontal.



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7. Resolve horizontally and vertically a force  $f = 8 \text{ N}$  which makes an angle of  $45^\circ$  with the horizontal.

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8. Obtain the magnitude of  $2A - 3B$  if

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

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9. Work done by a force  $F$  on a body is  $W = F \cdot s$ , where  $s$  is the displacement of body. Given that under a force

$$F = (2\hat{i} + 3\hat{j} + 4\hat{k}) \text{ N a body is displaced from}$$

position vector  $r_1 = (2\hat{i} + 3\hat{j} + \hat{k})$  m to the position vector  $r_2 = (\hat{i} + \hat{j} + \hat{k})$  m. Find the work done by this force.

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10. Find the angle between two vectors  $A = 2\hat{i} + \hat{j} - \hat{k}$  and  $B = \hat{i} - \hat{k}$ .

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11. Prove that the vectors  $A = 2\hat{i} - 3\hat{j} + \hat{k}$  and  $B = \hat{i} + \hat{j} + \hat{k}$  are mutually perpendicular.

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12. Show that the vector  $A = (\hat{i}) - (\hat{j}) + 2\hat{k}$  is parallel to a vector  $B = 3\hat{i} - 3\hat{j} + 6\hat{k}$ .



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13. Let a force  $F$  be acting on a body free to rotate about a point  $O$  and let  $r$  the position vector of any point  $P$  on the line of action of the force. Then torque ( $\tau$ ) of this force about point  $O$  is defined as  $\tau = r \times F$

Given,

$F = (2\hat{i} + 3\hat{j} - \hat{k})N$  and  $r = (\hat{i} - \hat{j} + 6\hat{k})m$  Find

the torque of this force.



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14. Find component of vector  $A + B$  along (i) x-axis, (ii) C.

Given  $A = \hat{i} - 2\hat{j}$ ,  $B = 2\hat{i} + 3\hat{k}$  and  $C = \hat{i} + \hat{j}$ .



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15. Find the angle that the vector  $A = 2\hat{i} + 3\hat{j} - \hat{k}$  makes with y-axis.



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16. If a and b are the vectors AB and BC determined by the adjacent sides of a regular hexagon. What are the

vectors determined by the other sides taken in order?



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17. if  $a \times b = b \times c \neq 0$  with  $a \neq -c$  then show that  $a+c = kb$ , where  $k$  is scalar.



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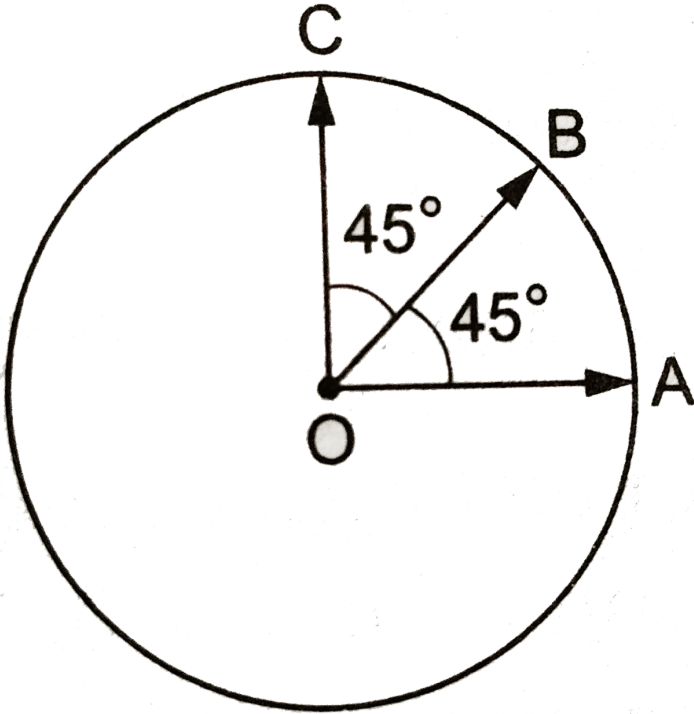
18. if  $A = 2\hat{i} - 3\hat{j} + 7\hat{k}$ ,  $B = \hat{i} + 2\hat{j}$  and  $C = \hat{j} - \hat{k}$ .

Find  $A(B \times C)$



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19. 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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20. Prove that  $|a \times b|^2 = a^2b^2 - (a \cdot b)^2$



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21. Show that the vectors

$$a = 3\hat{i} - 2\hat{j} + \hat{k}, b = \hat{i} - 3\hat{j} + 5\hat{k} \quad \text{and}$$

$$c = 2\hat{j} + \hat{j} - 4\hat{k} \text{ form a right angled triangle.}$$



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22. Let A, B and C be the unit vectors . Suppose that

$A \cdot B = A \cdot C = 0$  and the angle between B and C is  $\frac{\pi}{6}$  then

prove that  $A = \pm 2(B \times C)$

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23. A particle moves on a given straight line with a constant speed  $v$ . At a certain time it is at a point  $P$  on its straight line path.  $O$  is a fixed point. Show that  $\vec{OP} \times \vec{v}$  is independent of the position  $P$ ?

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24. Prove that the mid-point of the hypotenuse of right angled triangle is equidistant from its vertices.

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## Exercise 5 1

1. What is the angle between  $2a$  and  $4a$ ?



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2. What is the angle between  $3a$  and  $-5a$ ? What is the ratio of magnitude of two vectors?



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3. Two vectors have magnitudes 6 and 8 units, respectively. Find the magnitude of the resultant vector

if the angle between vectors is (a)  $60^\circ$  (b)  $90^\circ$  and ( c )  $120^\circ$  .



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4. Two vectors A and B have magnitudes 6 units and 8 units respectively. Find  $|A-B|$ , if the angle between two vectors is .(a)  $0^\circ$  (b)  $180^\circ$  (c)  $180^\circ$  (d)  $120^\circ$  .



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5. For what angle between A and B,  
 $|A + B| = |A - B|$  .



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## Exercise 5 2

1. Find magnitude and direction cosines of the vector,

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



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2. Resolve a force  $F = 10\text{N}$  along  $x$  and  $y$ -axes. Where this force vector in making an angle of  $60^\circ$  from negative  $x$ -axis towards negative  $y$ -axis?



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3. Find magnitude of  $A - 2B + 3C$ , where,

$$A = 2\hat{i} + 3\hat{j}, B = \hat{i} + \hat{j} \text{ and } C = \hat{k}.$$



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4. Find angle between  $A$  and  $B$  where, (a)

$$A = 2\hat{i} \text{ and } B = -6\hat{i} \quad (\text{b}) \quad A = 6\hat{j} \text{ and } B = -2\hat{k} \quad (\text{c})$$

$$A = (2\hat{i} + 3\hat{j}) \text{ and } B = 4\hat{k} \quad (\text{d}) \quad A = 4\hat{i} \text{ and}$$

$$B = (-3\hat{i} + 3\hat{j}).$$



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### Exercise 5.3

1. Cross product of two parallel or antiparallel vectors is a null vector. Is this statement true or false?

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2. Find the values of . (a)  $(4\hat{j}) \times (-6\hat{k})$  (b)  $(3\hat{j}) \cdot (-4\hat{j})$  (c)  $(2\hat{i}) - (-4\hat{k})$  .

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3. Two vectors A and B have magnitudes 2 units and 4 units respectively. Find A. B is angle between these two vectors is (a)  $0^\circ$  (b)  $60^\circ$  (c)  $90^\circ$  (d)  $120^\circ$  .

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4. Find  $(2A) \times (-3B)$ , if  $A = 2\hat{i} - \hat{j}$  and  $B = (\hat{j} + \hat{k})$



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Single Correct

1. which one of the following is a scalar quantity?

A. Dipole moment

B. Electric field

C. Acceleration

D. work

**Answer: D**



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2. Which one of the following is not the vector quantity?

A. Torque

B. Displacement

C. Velocity

D. Speed

**Answer: D**



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**3. Which one is a vector quantity?**

A. Time

B. Temperature

C. Magnetic flux

D. Magnetic field intensity

**Answer: D**



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4. Minimum number of vectors of unequal magnitudes which can give zero resultant are

A. two

B. three

C. four

D. more than four

**Answer: B**



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5. which one of the following statement is false ?

- A. A vector cannot be displaced from one point to another point
- B. Distance is a scalar quantity but displacement is a vector quantity
- C. Momentum force and torque are vector quantities
- D. Mass, speed and energy are scalar quantities

**Answer: A**



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6. what is the dot product of two vectors of magnitudes 3 and 5,if angle between them is  $60^\circ$  ?

A. 5.2

B. 7.5

C. 8.4

D. 8.6

**Answer: B**



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7. The forces, which meet at one point but their line of action do not lie in one plane, are called

- A. non coplanar non concurrent forces
- B. non coplanar concurrent forces
- C. coplanar concurrent forces
- D. coplanar non-concurrent forces

**Answer: B**



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8. A vector  $\vec{A}$  points vertically upward and  $\vec{B}$  points towards north. The vector product  $\vec{A} \times \vec{B}$  is

- A. along west
- B. along east
- C. zero
- D. vertically downward

**Answer: A**



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9. The magnitude of the vectors product of two vectors

$\left| \vec{A} \right|$  and  $\left| \vec{B} \right|$  may be

- A. greater than AB
- B. equal to AB
- C. less than AB
- D. equal to zero

**Answer: B::C::D**



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10. A force  $(3\hat{i} + 4\hat{j})$  newton acts on a body and displaces it by  $(3\hat{i} + 4\hat{j})$  metre. The work done by the force is

A. 5 J

B. 25 J

C. 10 J

D. 30 J

**Answer: B**



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11. The torque of force  $F = (2\hat{i} - 3\hat{j} + 4\hat{k})$  newton acting at the point  $r = (3\hat{i} + 2\hat{j} + 3\hat{k})$  metre about origin is (in N-m)

A.  $6\hat{i} - 6\hat{j} + 12\hat{k}$

B.  $17\hat{i} - 6\hat{j} - 13\hat{k}$

C.  $-6\hat{i} + 6\hat{j} - 12\hat{k}$

D.  $-17\hat{i} + 6\hat{j} + 13\hat{k}$

**Answer: B**



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12. If a unit vector is represented by  $0.5\hat{i} + 0.8\hat{j} + c\hat{k}$

the value of  $c$  is

A. 1

B.  $\sqrt{0.11}$

C.  $\sqrt{0.01}$

D. 0.39

**Answer: B**



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13. Two vectors of equal magnitudes have a resultant equal to either of them, then the angle between them will be

A.  $30^\circ$

B.  $120^\circ$

C.  $60^\circ$

D.  $150^\circ$

**Answer: B**



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

A. -1

B.  $\frac{1}{2}$

C.  $-\frac{1}{2}$

D. 1

**Answer: B**



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15. The angle between the two vectors

$$A = 3\hat{i} + 4\hat{j} + 5\hat{k} \text{ and } B = 3\hat{i} + 4\hat{j} - 5\hat{k} \text{ is}$$

A.  $60^\circ$

B.  $45^\circ$

C.  $90^\circ$

D.  $30^\circ$

**Answer: C**



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**16.** Maximum and minimum values of the resultant of two forces acting at a point are 7 N and 3 N respectively . The smaller force will be equal to

A. 5 N

B. 4 N

C. 2 N

D. 1 N

**Answer: C**



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17. 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. 0 (zero)

B. 1

C. 2

D. 3

**Answer: D**



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18. The (x,y,z) co -ordinates of two points A and B are give respectively as (0,3,- 1) and (-2,6,4) The displacement vector from A to B is given by

A.  $-2\hat{i} + 6\hat{j} + 4\hat{k}$

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

C.  $-2\hat{i} + 3\hat{j} + 5\hat{k}$

D.  $2\hat{i} - 3\hat{j} - 5\hat{k}$

**Answer: C**



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19. 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 is displaced parallel to itself

**Answer: D**



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20. Which of the sets given below may represent the magnitudes of three vectors adding to zero?

A. 2,4,8

B. 4,8,16

C. 1,2,1

D. 0.5, 1.2

**Answer: C**



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21. The resultant of  $\vec{A}$  and  $\vec{B}$  makes an angle  $\alpha$  with  $\vec{A}$  and  $\beta$  and  $\vec{B}$ ,

A.  $\alpha$  is always less than  $\beta$

B.  $\alpha < \beta$  if  $A < B$

C.  $\alpha < \beta$  if  $A > B$

D.  $\alpha < \beta$  if  $A = B$

**Answer: C**



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22. The angles which the vector  $A = 3\hat{i} + 6\hat{j} + 2\hat{k}$  makes with the co-ordinate axes are

A.  $\cos^{-1} \cdot \frac{3}{7}$ ,  $\cos^{-1} \cdot \frac{6}{7}$  and  $\cos^{-1} \cdot \frac{2}{7}$

B.  $\cos^{-1} \cdot \frac{4}{7}$ ,  $\cos^{-1} \cdot \frac{5}{7}$  and  $\cos^{-1} \cdot \frac{3}{7}$

C.  $\cos^{-1} \cdot \frac{3}{7}$ ,  $\cos^{-1} \cdot \frac{4}{7}$  and  $\cos^{-1} \cdot \frac{1}{7}$

D. None of these

**Answer: A**



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**23.** Unit vector parallel to the resultant of vectors

$A = 4\hat{j} - 3\hat{j}$  and  $B = 8\hat{j} + 8\hat{j}$  will be

A.  $\frac{24\hat{i} + 5\hat{j}}{13}$

B.  $\frac{12\hat{i} + 5\hat{j}}{13}$

C.  $\frac{6\hat{i} + 5\hat{j}}{13}$

D. None of these

**Answer: B**



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24. The component of vector  $A = 2\hat{i} + 3\hat{j}$  along the vector  $\hat{i} + \hat{j}$  is

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

B.  $10\sqrt{2}$

C.  $5\sqrt{2}$

D. 5

**Answer: A**



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25. Two vectors  $A$  and  $B$  are such that  $A + B = C$  and  $A^2 + B^2 = C^2$ . If  $\theta$  is the angle between positive direction of  $A$  and  $B$ , then the correct statement is

A.  $\theta = \pi$

B.  $\theta = \frac{2\pi}{3}$

C.  $\theta = 0$

D.  $\theta = \frac{\pi}{2}$

**Answer: D**



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26. If  $|A \times B| = \sqrt{3}A \cdot B$ , then the value of  $|A+B|$  is

A.  $(A^2 + B^2 + AB)^{1/2}$

B.  $\left(A^2 + B^2 + \frac{AB}{\sqrt{3}}\right)^{1/2}$

C.  $(A + B)$

D.  $(A^2 + B^2 + \sqrt{3}AB)^{1/2}$

**Answer: A**



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27. If the angle between the vectors A and B is  $\theta$ , the value of the product  $(B \times A) \cdot A$  is equal to

A.  $BA^2 \cos \theta$

B.  $BA^2 \sin \theta$

C.  $BA^2 \sin \theta \cos \theta$

D. zero

**Answer: D**



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28. Given that  $P = 12$ ,  $Q = 5$  and  $R = 13$  also  $P+Q=R$ , then the angle between  $P$  and  $Q$  will be

A.  $\pi$

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

C. zero

D.  $\frac{\pi}{4}$

**Answer: B**



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**29.** Given that  $P+Q+R= 0$ . Two out of the three vectors are equal in magnitude. The magnitude fo the third vector is  $s\sqrt{2}$  times that of the other two. Which of the following can be the angles between these vectors?

A.  $90^\circ, 135^\circ, 135^\circ$

B.  $45^\circ, 45^\circ, 90^\circ$

C.  $30^\circ$ ,  $60^\circ$ ,  $90^\circ$

D.  $45^\circ$ ,  $90^\circ$ ,  $135^\circ$

**Answer: A**



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**30.** The angles between  $P+Q$  and  $P-Q$  will be

A.  $90^\circ$

B. between  $0^\circ$  and  $180^\circ$

C.  $180^\circ$  only

D. None of these

**Answer: B**



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31. The value of  $n$  so that vectors  $2\hat{i} + 3\hat{j} - 2\hat{k}$ ,  $5\hat{i} + n\hat{j} + \hat{k}$  and  $-\hat{i} + 2\hat{j} + 3\hat{k}$  may be coplanar will be

A. 18

B. 28

C. 9

D. 36

**Answer: A**



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32. If  $a$  and  $b$  are two vectors, then the value of  $(a + b) \times (a - b)$  is

A.  $2(b \times a)$

B.  $-2(b \times a)$

C.  $b \times a$

D.  $a \times b$

**Answer: A**



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33. The resultant of two forces  $3P$  and  $2P$  is  $R$ . If the first force is doubled then resultant is also doubled. The angle between the two forces is

A.  $60^\circ$

B.  $120^\circ$

C.  $30^\circ$

D.  $135^\circ$

**Answer: B**



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**34.** The resultant of two forces, one double the other in magnitude is perpendicular to the smaller of the two forces. The angle between the two forces is

A.  $120^\circ$

B.  $60^\circ$

C.  $90^\circ$

D.  $150^\circ$

**Answer: A**



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35. Three vectors satisfy the relation  $A \cdot B = 0$  and  $A \cdot C = 0$

then  $A$  is parallel to

A.  $C$

B.  $B$

C.  $B \times C$

D.  $B \cdot C$

**Answer: C**



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**36.** The sum of two forces at a point is 16N. if their resultant is normal to the smaller force and has a magnitude of 8N, then two forces are

A. 6N, 10N

B. 8N, 8N

C. 4N, 12N

D. 2N, 14N

**Answer: A**



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37. The sum of two vectors A and B is at right angles to their difference. Then

A.  $A=B$

B.  $A=2B$

C.  $B=2A$

D. A and B have the same direction

**Answer: A**



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38. Let  $\vec{C} = \vec{A} + \vec{B}$  then

A.  $|C|$  is always greater than  $|A|$

B. it is possible to have  $|C| < |A|$  and  $|C| < |B|$

C.  $C$  is always equal to  $A+B$

D.  $C$  is never equal to  $A+B$

**Answer: B**



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**39.** Let the angle between two nonzero vector

$\vec{A}$  and  $\vec{B}$  is  $120^\circ$  and its resultant be  $\vec{C}$ .

A.  $C$  must be equal to  $|A-B|$

B.  $C$  must be less than  $|A-B|$

C. C must be greater than  $|A-B|$

D. C may be equal to  $|A-B|$

**Answer: C**



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**Subjective**

1. If  $a = 2\hat{i} + 3\hat{j} + 4\hat{k}$  and  $b = 4\hat{i} + 3\hat{j} + 2\hat{k}$ , find the angle between a and b.



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2. The vectors  $\vec{A}$  has a magnitude of 5 unit  $\vec{B}$  has a magnitude of 6 unit and the cross product of  $\vec{A}$  and  $\vec{B}$  has a magnitude of 15 unit. Find the angle between  $\vec{A}$  and  $\vec{B}$ .



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3. Suppose  $\vec{a}$  is a vector of magnitude 4.5 unit due north. What is the vector (a)  $3\vec{a}$  (b)  $-4\vec{a}$ ?



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4. Two vectors have magnitudes 3 unit and 4 unit respectively. What should be the angel between them if the magnitude of the resultant is (a). 1 unit (b). 5 unit and (c). 7 unit.



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5. The work done by a force  $\vec{F}$  during a displacement  $\vec{r}$  is given by  $\vec{F} \cdot \vec{r}$ . Suppose a force of 12 N acts on a particle in vertically upward direction and the particle is displaced through 2.0 m in vertically downward direction. Find the work done by the force during this displacement.



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6. If  $\vec{A}$ ,  $\vec{B}$ ,  $\vec{C}$  are mutually perpendicular show that  $\vec{C} \times (\vec{A} \times \vec{B}) = 0$ . Is the converse true?



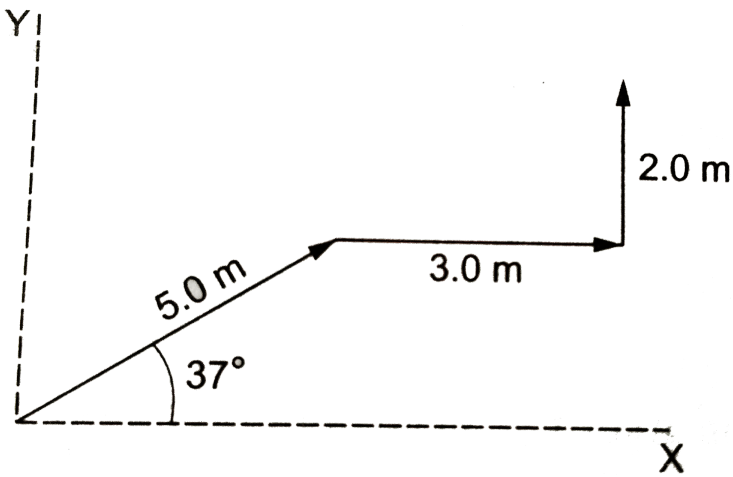
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7. Prove that  $\vec{A} \cdot (\vec{A} \times \vec{B}) = 0$



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8. Find the resultant of the three vectors shown in figure (2W1).



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9. Given an example for which

$$\vec{A} \cdot \vec{B} = \vec{C} \cdot \vec{B} \text{ but } \vec{A} \neq \vec{C}.$$



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10. Obtain the angle between  $A+B$  and  $A-B$  if

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



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11. Deduce the condition for the vectors

$$2\hat{i} + 3\hat{j} - 4\hat{k} \text{ and } 3\hat{i} - \alpha\hat{j} + b\hat{k} \text{ to be parallel.}$$



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12. Find the area of the parallelogram whose sides are

$$\text{represented by } 2\hat{i} + 4\hat{j} - 6\hat{k} \text{ and } \hat{i} + 2\hat{k}.$$



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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  $A = 2\hat{i} - 3\hat{j} + 7\hat{k}$ ,  $B = \hat{i} + 2\hat{j}$  and  $C = \hat{j} - \hat{k}$ .

Find  $A(B \times C)$



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**15.** The x and y-components of vector A are 4 m and 6 m respectively. The x and y-components of vector A + B are 10 m and 9 m respectively. Calculate for the vector B the following:

- (a) its x and y-components
- (b) its length
- (c) the angle it makes with x-axis.



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**16.** Three vectors which are coplanar with respect to a certain rectangular co-ordinate system are given by

$$a = 4\hat{i} - \hat{j}, b = -3\hat{i} + 2\hat{j} \text{ and } c = -3\hat{j}$$

Find

(a)  $a + b + c$

(b)  $a + b - c$

(c) Find the angle between  $a + b + c$  and  $a + b - c$



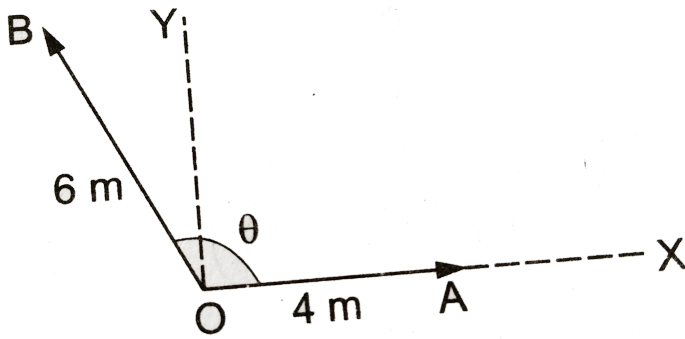
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17. Let  $\vec{A}$  and  $\vec{B}$  be the two vectors of magnitude 10 unit each. If they are inclined to the X-axis at angles  $30^\circ$  and  $60^\circ$  respectively, find the resultant.



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18. The resultant of vectors  $\vec{OA}$  and  $\vec{OB}$  is perpendicular to  $\vec{OA}$ . Find the angle AOB.



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19. 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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20. If two vectors are  $A = 2\hat{i} + \hat{j} - \hat{k}$  and  $B = \hat{j} - 4\hat{k}$ . By calculation,



prove  $\mathbf{A} \times \mathbf{B}$  is perpendicular to both  $\mathbf{A}$  and  $\mathbf{B}$ .



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21. The resultant of two vector  $\mathbf{A}$  and  $\mathbf{B}$  is at right angles to  $\mathbf{A}$  and its magnitude is half of  $\mathbf{B}$ . Find the angle between  $\mathbf{A}$  and  $\mathbf{B}$ .



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22. Four forces of magnitude  $P$ ,  $2P$ ,  $3P$  and  $4P$  act along the four sides of a square  $ABCD$  in cyclic order. Use the vector method to find the magnitude of resultant force.

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23. If  $P + Q = R$  and  $P - Q = S$ , prove that

$$R^2 + S^2 = 2(P^2 + Q^2)$$

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24. In an  $\triangle ABC$  as shown in Fig. 2. (2) .71 (a) prove

that 
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}.$$

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Example

1. check Wether the vector  $\left( \frac{\hat{i}}{\sqrt{2}} + \frac{\hat{j}}{\sqrt{2}} \right)$  is a unit vector or not .

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2. Find the unit vector of  $4\hat{i} - 3\hat{j} + \hat{k}$ .

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3. If vector  $\hat{i} - 3\hat{j} + 5\hat{k}$  and  $\hat{i} - 3\hat{j} - a\hat{k}$  are equal vector then find the value of a.

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4. 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 to  $\vec{A}$ .



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5. Two forces whose magnitudes are in the ratio 3:5 give a resultant of 28N. If the angle of their inclination is  $60^\circ$ , find the magnitude of each force.



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6. A boy walks 4m east and then 3m south. Find the displacement of the boy.

A. 7

B. 1

C. 5

D. 12

**Answer: 3**



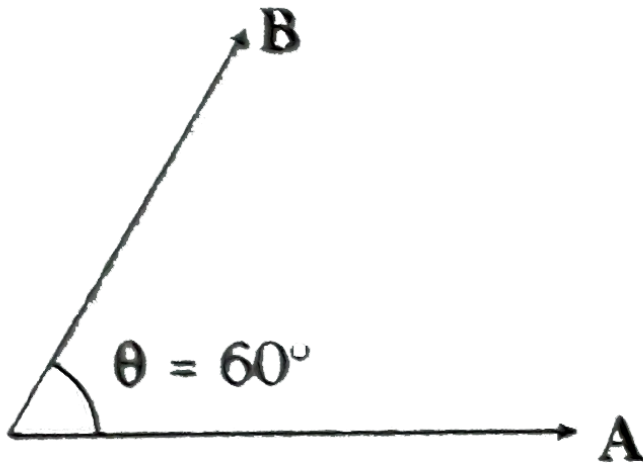
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7. If  $A=B+C$  have scalar magnitudes of 5,4,3 units respectively , then find the angle between A and C.



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8. Find the sum of vector A and B as shown in the figure ,also find the direction of sum vector. Given  $A=4$ unit and  $B=3$  unit .



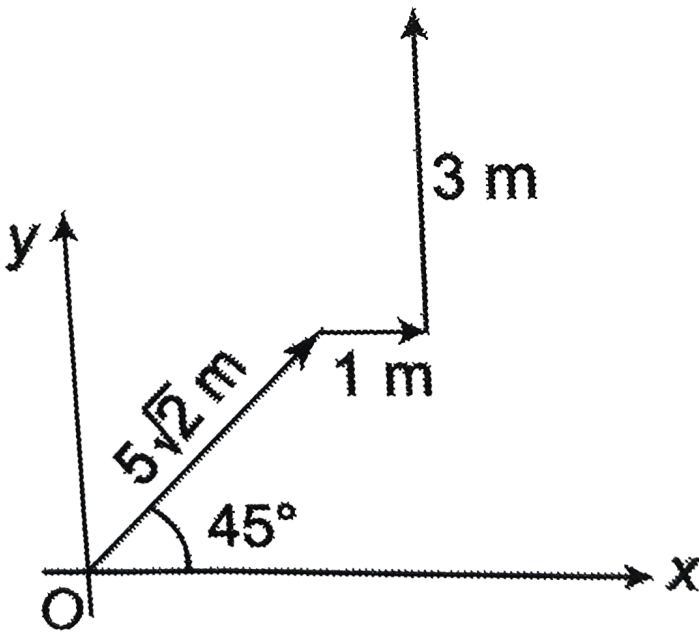
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9. Two equal vector have a resultant equal to either of them, then the angle between them will be:



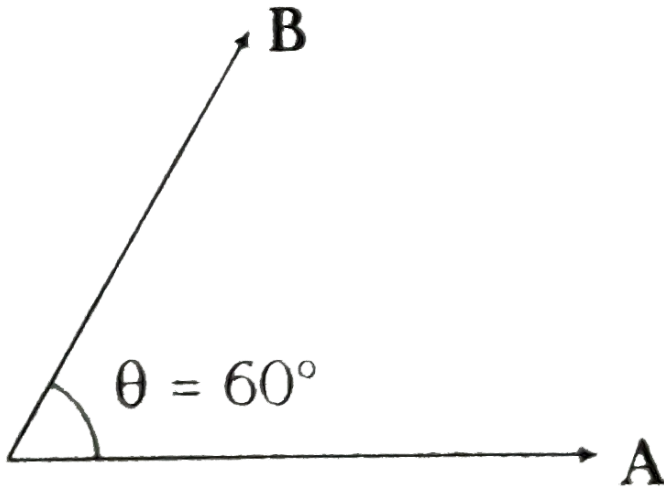
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10. Find the resultant of three vectors shown in the figure.



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11. Find the subtraction of vector A and B as shown in the figure , also find the direction of subtraction vector ,Given A=4 unit and b=3 unit .



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12. Obtain the magnitude of  $2A - 3B$  if

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





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13. If  $a$  and  $b$  are the vectors  $AB$  and  $BC$  determined by the adjacent sides of a regular hexagon. What are the vectors determined by the other sides taken in order?



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14. The initial and final position vector for a particle are  $(-3m)\hat{i} + (2m)\hat{j} + (8m)\hat{k}$  and  $(9m)\hat{i} + (2m)\hat{j} + (-8m)\hat{k}$  respectively, find the displacement of the particle.



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15. If  $|\vec{P} + \vec{Q}| = |\vec{P} - \vec{Q}|$ , find the angle between  $\vec{P}$  and  $\vec{Q}$ .

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16. A vector is given by  $\vec{A} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ . Find the magnitude of  $\vec{A}$ , unit vector along  $\vec{A}$  and angles made by  $\vec{A}$  with coordinate axes.

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17. Resolve a weight of 10N in two directions which are parallel and perpendicular to a slope inclined at  $30^\circ$  to

the horizontal.



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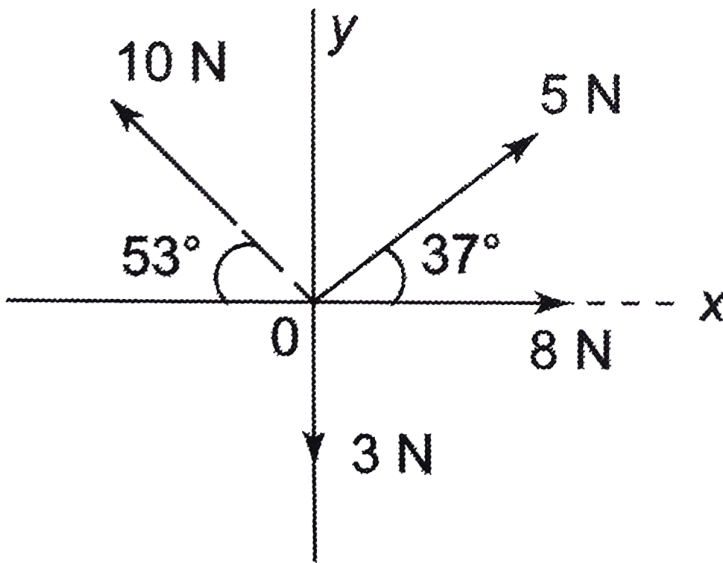
**18.** Resolve horizontally and vertically a force  $F = 8N$  which makes an angle of  $45^\circ$  with the horizontal.



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**19.** Find the resultant of the following forces.

$$\left[ \sin 37^\circ = \frac{3}{5}, \cos 37^\circ = \frac{4}{5}, \sin 53^\circ = \frac{4}{5}, \cos 53^\circ = \frac{3}{5} \right]$$



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20. Find the angle that the vector  $A = 2\hat{i} + 3\hat{j} - \hat{k}$  makes with y-axis.

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21. If a particle moves from the point  $A(1, 2, 3)$  to the point  $B(4, 6, 9)$ , its displacement vector be



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22. Prove that the quadrilateral formed by joining the mid-points of the pairs of consecutive sides of a quadrilateral is a parallelogram.



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23. Find component of vector  $A + B$  along (i) x-axis, (ii)  $C$ .

Given  $A = \hat{i} - 2\hat{j}$ ,  $B = 2\hat{i} + 3\hat{k}$  and  $C = \hat{i} + \hat{j}$ .

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24. Work done by a force  $F$  on a body is  $W = F \cdot s$ , where  $s$  is the displacement of body. Given that under a force  $F = (2\hat{i} + 3\hat{j} + 4\hat{k})$  N a body is displaced from position vector  $r_1 = (2\hat{i} + 3\hat{j} + \hat{k})$  m to the position vector  $r_2 = (\hat{i} + \hat{j} + \hat{k})$  m. Find the work done by this force.

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25. Find the angle between two vector  $A = 2\hat{i} + \hat{j} - \hat{k}$  and  $B = \hat{i} - \hat{k}$ .

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26. Prove that the vectors  $A = 2\hat{i} - 3\hat{j} + \hat{k}$  and  $B = \hat{i} + \hat{j} + \hat{k}$  are mutually perpendicular.

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27. Find the (i) Scalar component and (ii) vector component of  $A = 3\hat{i} + 4\hat{j} + 5\hat{k}$  on  $B = \hat{i} + \hat{j} + \hat{k}$ .

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28. Show that the vectors

$$a = 3\hat{i} - 2\hat{j} + \hat{k}, b = \hat{i} - 3\hat{j} + 5\hat{k} \quad \text{and}$$

$$c = 2\hat{i} + \hat{j} - 4\hat{k} \text{ form a right angled triangle.}$$



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29. Prove that the mid-point of the hypotenuse of right angled triangle is equidistant from its vertices.



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30. Find the projection of

$$\vec{a} = 2\hat{i} - \hat{j} + \hat{k} \text{ and } \vec{b} = \hat{i} - 2\hat{j} + \hat{k}.$$





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**31.** Let a force  $F$  be acting on a body free to rotate about a point  $O$  and let  $r$  the position vector of any point  $P$  on the line of action of the force. Then torque ( $\tau$ ) of this force about point  $O$  is defined as  $\tau = r \times F$

Given,

$$F = (2\hat{i} + 3\hat{j} - \hat{k})N \text{ and } r = (\hat{i} - \hat{j} + 6\hat{k})m \text{ Find}$$

the torque of this force.



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**32.** Find a unit vector  $\hat{C} = A \times B$  is a vector perpendicular to both  $A$  and  $B$  Hence, a unit vector  $\hat{n}$

perpendicular to A and B can be Written as

$$\hat{n} = \frac{C}{|A \times B|} = \frac{A \times B}{|A \times B|}$$

$$\begin{aligned} \text{Here, } A \times B &= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & 1 \\ 1 & -1 & 1 \end{vmatrix} \\ &= \hat{i}(3 + 1) + \hat{j}(1 - 2) + \hat{k}(-2 - 3) \\ &= 4\hat{i} - \hat{j} - 5\hat{k} \end{aligned}$$

$$\text{Further, } |A \times B| = \sqrt{(4)^2 + (-1)^2 + (-5)^2} = \sqrt{42}$$

$$\therefore \text{ the desired unit vector is } \hat{n} = \frac{A \times B}{|A \times B|}$$

$$\text{or } \hat{n} = \frac{1}{\sqrt{42}} (4\hat{i} - \hat{j} + 5\hat{k})$$



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33. Show that the vector  $A = (\hat{i}) - (\hat{j}) + 2\hat{k}$  is parallel to a vector  $B = 3\hat{i} - 3\hat{j} + 6\hat{k}$ .



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34. Prove that  $|a \times b|^2 = a^2b^2 - (a \cdot b)^2$



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35. A particle moves on a given straight line with a constant speed  $v$ . At a certain time it is at a point  $P$  on its straight line path.  $O$  is a fixed point. Show that  $\vec{OP} \times \vec{v}$  is independent of the position  $P$ ?



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36. if  $a \times b = b \times c \neq 0$  with  $a \neq -c$  then show that  $a+c = kb$ , where  $k$  is scalar.

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37. Let  $A, B$  and  $C$  be the unit vectors . Suppose that  $A \cdot B = A \cdot C = 0$  and the angle between  $B$  and  $C$  is  $\frac{\pi}{6}$  then prove that  $A = \pm 2(B \times C)$

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38. The diagonals of a parallelogram are  $2\hat{i}$  and  $2\hat{j}$ .  
What is the area of the parallelogram





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39. If  $a = 3\hat{i} + \hat{j} - 4\hat{k}$ ,  $b = 6\hat{i} + 5\hat{j} - 2\hat{k}$ , then find the area of a triangle whose adjacent sides are determined by  $a$  and  $b$ .



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40. The adjacent sides of a parallelogram is given by two vector  $A$  and  $B$  where  $A = 5\hat{i} - 4\hat{j} + 3\hat{k}$  and  $B = 3\hat{i} - 2\hat{j} + \hat{k}$  Calculate the area of parallelogram .



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## Check Point 2 1

1. Which is not a vector quantity?

A. Current

B. Displacement

C. Velocity

D. Acceleration

**Answer: A**



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2. Pressure is

A. Scalar

B. vector

C. both (a) and (b)

D. none of these

**Answer: A**



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3. Which one of the following is not the vector quantity?

A. Torque

B. Displacement

C. Dipole moment

D. Electric flux

**Answer: D**



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4. Which of the following is a vector?

A. Pressure

B. Displacement

C. Moment of inertia

D. none of these



**Answer: D**



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**5. Surface area is**

A. Scalar

B. vector

C. Neither scalar nor vector

D. both (a) and (b)

**Answer: A**



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6. Which is a vector quantity?

A. Angular momentum

B. Work

C. Potential energy

D. Electirc current

**Answer: A**



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7. Which one is a vector quantity?

A. Work

B. momentum

C. time

D. Speed

**Answer: B**



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**8. Which is a vector quantity?**

A. Work

B. power

C. Torque

D. Gravitational constant

**Answer: C**



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9. 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.

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

B.  $-4\hat{i} + 2\hat{j} + 5\hat{k}$

C.  $4\hat{i} - 2\hat{j} + 5\hat{k}$

D.  $-4\hat{i} - 2\hat{j} - 5\hat{k}$

**Answer: A**



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10. A vector multiplied by the number 0, results into

A. 0

B. A

C. O

D.  $\hat{A}$

Answer: C



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11. Which of the following represents a unit vector ?

A.  $\frac{|A|}{A}$

B.  $\frac{A}{|A|}$

C.  $\frac{A}{A}$

D.  $\frac{|A|}{|A|}$

**Answer: B**



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12. Unit vector does not have any

A. direction

B. magnitude

C. unit

D. All of these

**Answer: C**



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**13.** If  $\hat{i}$  and  $\hat{j}$  are unit vectors along X-and Y-axis respectively, then what is the magnitude and direction of  $\hat{i} + \hat{j}$  and  $\hat{i} - \hat{j}$ ?

A. 2

B. 0

C.  $\sqrt{2}$

D. 4

**Answer: C**



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14. The unit vector along  $\hat{i} + \hat{j}$  is

A.  $\hat{k}$

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

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

D.  $\frac{\hat{i} + \hat{j}}{2}$



**Answer: C**



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**15.** What happens, when we multiply a vector by  $(-2)$

- A. direction reverses and unit changes
- B. direction reverses and magnitude gets changes
- C. direction remains unchanged and unit changes
- D. none of the above

**Answer: B**



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## Check Point 2 2

1.  $\vec{A} + \vec{B}$  can also be written as

A. A-B

B. B-A

C. B+A

D. B-A

**Answer: C**



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2. If  $P + Q = 0$ . Then which of the following is necessarily true?

A.  $P=0$

B.  $P=-Q$

C.  $Q=0$

D.  $P=Q$

**Answer: B**



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3. Two vector having magnitude 8 and 10 can maximum and minimum value of magnitude of their resultant as

A. 12,6

B. 10,3

C. 18,2

D. none of these

**Answer: C**



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4.  $\vec{P} + \vec{Q}$  is a unit vector along x-axis. If

$\vec{P} = \hat{i} - \hat{j} + \hat{k}$ , then what is  $\vec{Q}$ ?

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

B.  $\hat{j} - \hat{k}$

C.  $\hat{i} + \hat{j} + \hat{k}$

D.  $\hat{j} + \hat{k}$

**Answer: B**



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5. For the resultant of two vectors to be maximum , what must be the angle between them ?



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6. What are the minimum number of forces (all numerically equal) whose vector sum can be zero ?

A. Two

B. Three

C. Four

D. Any

**Answer: B**



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7. Given that  $P + Q + R = 0$ . Which of the following statement is true?

A.  $|P| + |Q| = |R|$

B.  $|P + Q| = |R|$

C.  $|P| - |Q| = |R|$

D.  $|P - Q| = |R|$

**Answer: B**



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8.  $\vec{A} = 2\hat{i} + \hat{j}$ ,  $B = 3\hat{j} - \hat{k}$  and  $\vec{C} = 6\hat{i} - 2\hat{k}$ .

value of  $\vec{A} - 2\vec{B} + 3\vec{C}$  would be

A.  $20\hat{i} + 5\hat{j} + 4\hat{k}$

B.  $20\hat{i} - 5\hat{j} - 4\hat{k}$

C.  $4\hat{i} + 5\hat{j} + 20\hat{k}$

D.  $5\hat{i} + 4\hat{j} + 10\hat{k}$

**Answer: B**



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9. If  $\vec{A} = 4\hat{i} - 3\hat{j}$  and  $\vec{B} = 6\hat{i} + 8\hat{j}$  then magnitude and direction of  $\vec{A} + \vec{B}$  will be

A.  $5, \tan^{-1}(3/4)$

B.  $5\sqrt{5}, \tan^{-1}(1/2)$

C.  $10, \tan^{-1}(5)$

D.  $25, \tan^{-1}(3/4)$

**Answer: B**



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10. A truck travelling due to north at  $20\text{ms}^{-1}$  turns west and travels at the same speed. Find the change in its velocity.

A.  $40\text{ms}^{-1}N - W$

B.  $20\sqrt{2}\text{ms}^{-1}N - W$

C.  $40\text{ms}^{-1}S - W$

D.  $20\sqrt{2}\text{ms}^{-1}S - W$

**Answer: D**



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11. Resultant of two vectors A and B is given by

$|R| = \{|A| - |B|\}$ . angle between A and B will be

A.  $90^\circ$

B.  $180^\circ$

C.  $0^\circ$

D. none of these

**Answer: B**



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12. If  $|A|=2$  and  $|B|=4$  and angle between them is  $60^\circ$

then  $|A-B|$

A.  $\sqrt{13}$

B.  $3\sqrt{3}$

C.  $\sqrt{3}$

D.  $2\sqrt{3}$

**Answer: D**



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13. If  $A$  and  $B$  are two vectors such that  $|A+B|=2|A-B|$ . The angle between vectors  $A$  and  $B$  is

A.  $45^\circ$

B.  $60^\circ$

C.  $30^\circ$

D. data insufficient

**Answer: D**



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14. if  $P + Q = P - Q$ , then

A.  $P=0$

B.  $Q=0$

C.  $P=1$

D.  $|Q|=1$

**Answer: B**



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**15.** Position of a particle in a rectangular -co-ordinate  
(3, 2, 5). Then its position vector will be

A.  $3\hat{i} + 5\hat{j} + 2\hat{k}$

B.  $3\hat{i} + 2\hat{j} + 5\hat{k}$

C.  $5\hat{i} + 3\hat{j} + 2\hat{k}$

D. none of these

**Answer: B**



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**16.** If a particle moves from point  $P(2, 3, 5)$  to point  $Q(3, 4, 5)$ . Its displacement vector be

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

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

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

D.  $2\hat{i} + 4\hat{j} + 6\hat{k}$

**Answer: C**



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

A.  $45^\circ$

B.  $60^\circ$

C.  $90^\circ$

D.  $120^\circ$

**Answer: A**



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18. What vector must be added to the two vectors  $2\hat{i} - \hat{j} + 3\hat{k}$  and  $3\hat{i} - 2\hat{j} - 2\hat{k}$ , so that the resultant may be a unit vector along  $z$ -axis

A.  $5\hat{i} + \hat{k}$

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

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

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

**Answer: B**



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19. Three vector each of magnitude  $A$  are acting at a point such that angle between any two consecutive vectors in same plane is  $60^\circ$  The magniude of their resultant is

A.  $2A$

B.  $\sqrt{2}A$

C.  $\sqrt{3}A$

D.  $\sqrt{6}A$

**Answer: A**



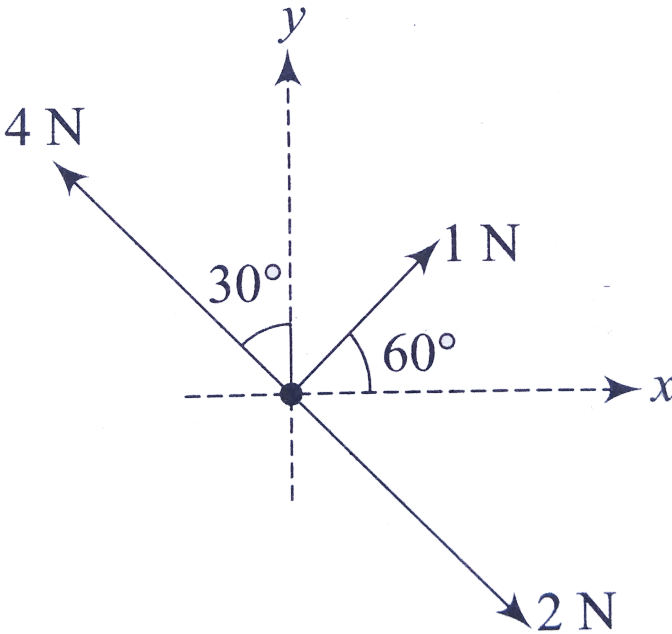
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20. Three forces acting on a body are shown in figure.

To have the resultant force only along the y-direction,

the magnitude of the minimum additional force

needed is



A.  $\frac{\sqrt{3}}{4} N$

B.  $\sqrt{3} N$

C.  $0.5N$

D.  $1.5N$

**Answer: C**



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### Check Point 2 3

1. The work done by a force  $F = (\hat{i} + 2\hat{j} + 3\hat{k})$  N ,to displace a body from position A to position B is [The position vector of A is  $r_1 = (2\hat{i} + 2\hat{j} + 3\hat{k})m$  The position vector of B is  $r_2 = (3\hat{i} + \hat{j} + 5\hat{k})m$  ]

A. 5 J

B. 3 J

C. 2 J

D. 10 J

**Answer: A**



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2. The condition  $(a \cdot b)^2 = a^2 b^2$  is satisfied when

A.  $a$  is parallel to  $b$

B.  $a \neq b$

C.  $a \cdot b = 1$

D.  $a \perp b$

**Answer: A**



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3. The modulus of the vector product of two vector is  $\frac{1}{\sqrt{3}}$  times their scalar product . The angle between vectors is

A.  $\frac{\pi}{6}$

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

C.  $\frac{\pi}{4}$

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

**Answer: A**



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

A.  $B$

B.  $C$

C.  $B \cdot C$

D.  $B \times C$

**Answer: D**



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5. what is the dot product of two vectors of magnitudes 3 and 5,if angle between them is  $60^\circ$  ?

A. 5.2

B. 7.5

C. 8.4

D. 8.6

**Answer: B**



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6. When  $A \cdot B = -|A||B|$ , then

- A. A and B are perpendicular to each other
- B. A and B act in the same direction
- C. A and B act in the opposite direction
- D. A and B can act in any in any direction

**Answer: C**



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7. The vector projection of a vector  $3\hat{i} + 4\hat{k}$  on y-axis is

- A. 5

B. 4

C. 3

D. Zero

**Answer: D**



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**8. In a clockwise system :-**

A.  $\hat{j} \times \hat{k} = \hat{i}$

B.  $\hat{k} \cdot \hat{i} = 1$

C.  $\hat{i} \cdot \hat{i} = 0$

D.  $\hat{j} \times \hat{j} = 1$

**Answer: A**



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9. If  $|A \times B| = \sqrt{3}A \cdot B$ , then the value of  $|A+B|$  is

A.  $\left( A^2 + B^2 + \frac{AB}{\sqrt{3}} \right)^{1/2}$

B.  $A+B$

C.  $(A^2 + B^2 + \sqrt{3}AB)^{1/2}$

D.  $(A^2 + B^2 + AB)^{1/2}$

**Answer: D**



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10. If  $|A| = 2$ ,  $|B| = 5$  and  $|A \times B| = 8$ . Angle between A and B is acute, then  $(A \cdot B)$  is

A. 6

B. 3

C. 4

D. 7

**Answer: A**



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11. 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.  $14\hat{i} - 38\hat{j} + 16\hat{k}$

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**



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12. What is the unit vector perpendicular to the following vectors  $2\hat{i} + 2\hat{j} - \hat{k}$  and  $6\hat{i} - 3\hat{j} + 2\hat{k}$

A.  $\frac{\hat{i} + 10\hat{j} - 18\hat{k}}{5\sqrt{17}}$

B.  $\frac{\hat{i} - 10\hat{j} + 18\hat{k}}{5\sqrt{17}}$

C.  $\frac{\hat{i} - 10\hat{j} - 18\hat{k}}{5\sqrt{17}}$

D.  $\frac{\hat{i} + 10\hat{j} + 18\hat{k}}{5\sqrt{17}}$

**Answer: C**



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13. The angle between vectors  $(A \times B)$  and  $(B \times A)$  is

A. Zero

B.  $\pi$

C.  $\frac{\pi}{4}$

D.  $\frac{\pi}{2}$

**Answer: B**



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14. What is the value of linear velocity, if

$$\vec{\omega} = 3\hat{i} - 4\hat{j} + \hat{k} \text{ and } \vec{r} = 5\hat{i} - 6\hat{j} + 6\hat{k}?$$



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15. Find the area of the parallelogram determined

$$A = 2\hat{i} + \hat{j} - 3\hat{k} \text{ and } B = 12\hat{j} - 2\hat{k}$$

A. 43

B. 56

C. 38

D. 74



**Answer: A**



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## Chapter Exercises

1. The vector quantity among the following is

A. mass

B. time

C. distance

D. displacement

**Answer: D**



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2. A vector is added to an equal and opposite vector of similar nature, forms a

- A. unit vector
- B. position vector
- C. null vector
- D. displacement vector

**Answer: C**



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3. Out of the following quantities, which is scalar?

A. Displacement

B. momentum

C. Potential energy

D. Torque

**Answer: C**



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4. Which of the following is a unit vector ?

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

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

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

D.  $\frac{1}{\sqrt{3}} (\hat{i} + \hat{j})$

**Answer: B**



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5. 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. none of the above

**Answer: A**



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6. The expression  $\left( \frac{1}{\sqrt{2}} \hat{i} + \frac{1}{\sqrt{2}} \hat{j} \right)$  is a

A. unit vector

B. null vector

C. vector of magnitude  $\sqrt{2}$

D. Scalar

**Answer: A**



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7. The position vector of a moving particle at time  $t$  is

$r = 3\hat{i} + 4t\hat{j} - t\hat{k}$  Its displacement during the time interval  $t = 1$  s to  $t=3$  s is

A.  $\hat{j} - \hat{k}$

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

C.  $9\hat{i} + 36\hat{j} - 27\hat{k}$

D. None of the above

**Answer: D**



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8. Vector  $P = 6\hat{i} + 4\sqrt{2}\hat{j} + 4\sqrt{2}\hat{k}$  makes angle from Z-axis equal to

A.  $\cos^{-1}\left(\frac{\sqrt{2}}{5}\right)$

B.  $\cos^{-1}(2\sqrt{2})$

C.  $\cos^{-1}\frac{2\sqrt{2}}{5}$

D. None of these

**Answer: C**



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9. Given :

$\vec{A} = \hat{i} + \hat{j} + \hat{k}$  and  $\vec{B} = -\hat{i} - \hat{j} - \hat{k}$  What is the angle between  $(\vec{A} - \vec{B})$  and  $\vec{A}$  ?

A.  $0^\circ$

B.  $180^\circ$

C.  $90^\circ$

D.  $60^\circ$

**Answer: A**



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10. Which of the following Statement is true?

A. When the coordiante axes are translated the component of a vector in a plane changes.

B. When the coording axces are rotated though some angle components of the vector change but vector 's magnitude remain constant.

C. Sum of a and b is R If the magnitude of a alone is increased angle between b and R decreases.

D. The cross product of  $3\hat{i}$  and  $4\hat{j}$  is 12.

**Answer: B**



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11. The component of vector  $A = 2\hat{i} + 3\hat{j}$  along the vector  $\hat{i} + \hat{j}$  is

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

B.  $4\sqrt{2}$

C.  $\frac{\sqrt{2}}{3}$

D. None of these

**Answer: A**



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12. A vector  $P = 3\hat{i} - 2\hat{j} + a\hat{k}$  is perpendicular to the vector  $Q = 2\hat{i} + \hat{j} - \hat{k}$ , The value of  $a$  is

A. 2

B. 1

C. 4

D. 3

**Answer: C**



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13. If three vector along coordinate axis represent the adjacent sides of a cube of length b, then the unit vector along its diaonal passing thourth the origin will be

A.  $\frac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{2}}$

B.  $\frac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{36}}$

C.  $\hat{i} + \hat{j} + \hat{k}$

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

**Answer: D**



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14. The angle between two vectors  $-2\hat{i} + 3\hat{j} + \hat{k}$  and  $\hat{i} + 2\hat{j} - 4\hat{k}$  is

A.  $45^\circ$

B.  $90^\circ$

C.  $30^\circ$

D.  $60^\circ$

**Answer: B**



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15. The angle between the vector  $2\hat{i} + \hat{j} + \hat{k}$  and  $\hat{j}$ ?

A.  $\frac{\pi}{6}$

B.  $\frac{\pi}{4}$

C.  $\frac{\pi}{3}$

D. None of these

**Answer: B**



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**16.** What is the angle between  $\hat{i} + \hat{j} + \hat{k}$  and  $\hat{j}$ ?

A.  $\frac{\pi}{6}$

B.  $\frac{\pi}{4}$

C.  $\frac{\pi}{3}$

D. none of these

Answer: D



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17. Which of the following is the unit vector perpendicular to  $\vec{A}$  and  $\vec{B}$ ?

A.  $\frac{\hat{A} \times \hat{B}}{AB \sin \theta}$

B.  $\frac{\hat{A} \times \hat{B}}{AB \cos \theta}$

C.  $\frac{A \times B}{AB \sin \theta}$

D.  $\frac{A \times B}{AB \cos \theta}$

Answer: C



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18. If  $\frac{|a + b|}{|a - b|} = 1$ , then the angle between  $a$  and  $b$  is

A.  $0^\circ$

B.  $45^\circ$

C.  $90^\circ$

D.  $60^\circ$

**Answer: C**



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19. A man walk 20 m at an angle  $60^\circ$  north of east . How far towards east has he he travelled ?

A. 10 m

B. 20 m

C.  $20\sqrt{3}$  m

D.  $10\sqrt{3}$ m

**Answer: A**



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20. If  $A=B$  , then which of the following is not correct ?

A.  $\hat{A} = \hat{B}$

B.  $|A| = |B|$

C.  $A\hat{B} = B\hat{A}$

D.  $A + B = \hat{A} + \hat{B}$

**Answer: D**



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21. The area of the parallelogram represented by the vectors  $\vec{A} = 2\hat{i} + 3\hat{j}$  and  $\vec{B} = \hat{i} + 4\hat{j}$  is

A. 14 unit

B. 7.5 units

C. 10 unit

D. 5 units

**Answer: D**



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**22.** The forces, which meet at one point but their line of action do not lie in one plane, are called

A. non-coplanar non-concurrent forces

B. non-coplanar concurrent forces

C. coplanar concurrent forces

D. coplanar non-concurrent forces

**Answer: B**



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**23.** If the angle between two vectors  $A$  and  $B$  is  $120^\circ$ , then its resultant  $C$  will be

A.  $C = |A - B|$

B.  $C < |A - B|$

C.  $C > |A - B|$

D.  $C = |A + B|$

**Answer: C**



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24. The condition under which the vector  $(a+b)$  and  $(a-b)$  are parallel is

A.  $a \perp b$

B.  $|a| = |b|$

C.  $a \neq b$

D.  $A \parallel B$

**Answer: D**



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25. A body, under the action of a force  $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$ , acquires an acceleration of  $1\text{ms}^{-2}$ . The mass of this body must be.

A. 200 kg

B. 20kg

C.  $10\sqrt{2}\text{kg}$

D.  $6\sqrt{2}\text{kg}$

**Answer: C**



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

- A. are not equal to each other in magnitude
- B. are parallel
- C. are perpendicular
- D. are equal to each other in magnitude

**Answer: D**



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27. The resultant of  $\vec{a}$  and  $\vec{b}$  makes  $\alpha$  with  $\vec{a}$  and  $\beta$  with  $\vec{b}$ , then (a,b represent magnitudes of respective vectors) :

A.  $\alpha < \beta$

B.  $\alpha > \beta$  if  $A < B$

C.  $\alpha < \beta$  if  $A = B$

D.  $\alpha < \beta$  if  $A < B$

**Answer: B**



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**28.** Two equal vector have a resultant equal to either of them, then the angle between them will be:

A.  $60^\circ$

B.  $120^\circ$

C.  $90^\circ$

D.  $0^\circ$

**Answer: B**



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29. If A and B are Two non -zero vector having equal magnitude , the angle between the vector A and A-B is

A.  $0^\circ$

B.  $90^\circ$

C.  $180^\circ$

D. dependent on the orientation o fA and B

**Answer: D**



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30. The angle between  $\vec{A} = \hat{i} + \hat{j}$  and  $\vec{B} = \hat{i} - \hat{j}$  is

A.  $45^\circ$

B.  $90^\circ$

C.  $-45^\circ$

D.  $180^\circ$

**Answer: B**



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**31.** Five equal forces of  $10N$  each are applied at one point and all are lying one plane. If the angles between them are equal, the resultant force will be

A. zero

B. 10N

C. 20N

D.  $10\sqrt{2}N$

**Answer: A**



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32. Two vectors  $\vec{A}$  and  $\vec{B}$  inclined at an angle  $\theta$  have a resultant  $\vec{R}$  which makes an angle  $\alpha$  with  $\vec{A}$ . If the directions of  $\vec{A}$  and  $\vec{B}$  are interchanged, the resultant will have the same

A. magnitude the same

B. direction reverses and magnitude is doubled

C. magnitude as well as direction

D. Neither

**Answer: A**



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**33. What is correct ?**

A.  $|a - b| = |a| - |b|$

B.  $|a - b| \leq |a| - |b|$

C.  $|a - b| \geq |a| - |b|$

D.  $|a - b| > |a| - |b|$

**Answer: C**



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**34.** Resultant of which of a following may be equal to zero?

A.  $10N, 10N, 10N$

B.  $10N, 10N, 25N$

C.  $10N, 10N, 35N$

D. None of these

**Answer: A**



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35. A man first moves 3 m due east , then 6 m due north and finally 7 m due west , then the magnitude of the resultant displacement is (in metre)

A.  $\sqrt{16}$

B.  $\sqrt{24}$

C.  $\sqrt{52}$

D.  $\sqrt{94}$

**Answer: C**



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36. The resultant of two forces  $3P$  and  $2P$  is  $R$ . If the first force is doubled then resultant is also doubled. The angle between the two forces is

A.  $60^\circ$

B.  $120^\circ$

C.  $90^\circ$

D.  $180^\circ$

**Answer: B**



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37. Two forces 8 N and 12 act ay  $120^\circ$  The third force required to keep the body in equilibrium is

A. 4 N

B.  $4\sqrt{7}N$

C. 20 N

D. none of these

**Answer: B**



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38. If  $A \cdot B = 0$  and  $A \times B = 1$ , then A and B are

A. perpendicular unit vectors

B. paraellel unit vector

C. parallel

D. anti - parallel

**Answer: A**



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39.

If

$P + Q = R$  and  $|P| = |Q| = \sqrt{3}$  and  $|R| = 3$ ,

then the angle between P and Q is

A.  $\pi / 4$

B.  $\pi / 6$

C.  $\pi / 3$

D.  $\pi / 2$

**Answer: C**



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**40.** The component of a vector  $r$  along X-axis will have maximum value if

A.  $r$  is along positive Y-axis

B.  $r$  is along positive x-axis

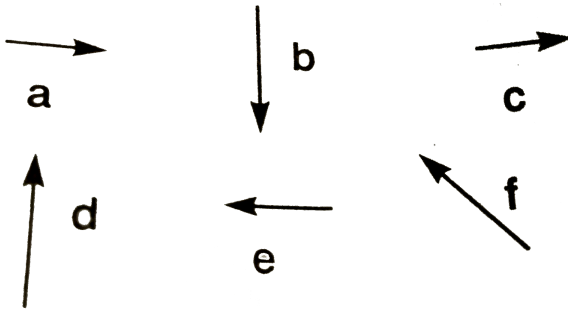
C.  $x$  makes an angle of  $45^\circ$  with the X-axis

D.  $r$  is along negative Y-axis

Answer: B

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41. Six vectors  $a$  to  $f$  have the magnitude and direction indicated in the figure. Which of the following statement is true ?



A.  $b + e = f$

B.  $b + c = f$

C.  $d + c = f$

D.  $d + e = f$

**Answer: D**



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**42.** A particle starting from the origin  $(0,0)$  moves in a straight line in  $(x, y)$  plane. Its coordinates at a later time are  $(\sqrt{3}, 3)$ . The path of the particle makes with the x-axis an angle of

A.  $30^\circ$

B.  $45^\circ$

C.  $60^\circ$

D.  $0^\circ$

**Answer: C**



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**43.** Consider a vector  $\vec{F} = 4\hat{i} - 3\hat{j}$ . Another vector that is perpendicular to  $\vec{F}$  is

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

B.  $6\hat{i}$

C.  $7\hat{k}$

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

**Answer: C**

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**44.** The angle between vectors  $(A \times B)$  and  $(B \times A)$  is

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**45.** The angle between vectors  $(A \times B)$  and  $(B \times A)$  is

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46. Unit vector perpendicular to vector

$A = -3\hat{i} - 2\hat{j} - 3\hat{k}$  and  $2\hat{i} + 4\hat{j} + 6\hat{k}$  is

A.  $\frac{3\hat{i} - 2\hat{k}}{\sqrt{13}}$

B.  $\frac{3\hat{k} - 2\hat{j}}{\sqrt{13}}$

C.

D.

**Answer: A**



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47. Unit vector parallel to the resultant of vector  $8\hat{i}$  and  $8\hat{j}$  will be

A.  $(24\hat{i} + 5\hat{j}) / 13$

B.  $(12\hat{i} + 5\hat{j}) / 13$

C.  $(6\hat{i} + 5\hat{j}) / 13$

D. None of these

**Answer: D**



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**48.** A force of  $5N$  acts on a particle along a direction making an angle of  $60^\circ$  with verticle. Its verticel components is

A. 10N

B. 3 N

C. 4 N

D. 2.5 N

**Answer: D**



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49. 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  $\vec{A}$ .

A.  $5\hat{i} + 20\hat{j}$

B.  $15\hat{i} + 10\hat{j}$

C.  $20\hat{i} + 15\hat{j}$

D.  $15\hat{i} + 20\hat{j}$

**Answer: D**



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50. The vector that must be added to the vector  $\hat{i} - 4\hat{j} + 2\hat{k}$  and  $3\hat{i} + 3\hat{j} - 7\hat{k}$  so that the resultant vector is a unit vector along the y-axis is

A.  $4\hat{i} + 2\hat{j} + 5\hat{k}$

B.  $-4\hat{i} + 2\hat{j} + 5\hat{k}$

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

D. Null vector

**Answer: B**



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51. A vector is represented by  $3\hat{i} + \hat{j} + 2\hat{k}$ . Its length in  $XY$  plane is

A. 2

B.  $\sqrt{14}$

C.  $\sqrt{10}$

D.  $\sqrt{5}$

**Answer: C**



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52. Let  $\vec{A} = \hat{i}A \cos \theta + \hat{j} \sin \theta$ , be any vector. Another vector  $\vec{B}$  which is normal to  $\vec{A}$  is :

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

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

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

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

**Answer: B**



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53. If two vectors  $2\hat{i} + 3\hat{j} - \hat{k}$  and  $-4\hat{i} - 6\hat{j} - \lambda\hat{k}$  are parallel to each other then value of  $\lambda$  be

A. 0

B. 2

C. 3

D. 4

**Answer: B**



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54. What is the angle between  $(\vec{P} + \vec{Q})$  and  $(\vec{P} \times \vec{Q})$ ?

A. Zero

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

C.  $\frac{\pi}{4}$

D.  $\pi$

**Answer: B**



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55. If a unit vector is represented by  $0.5\hat{i} + 0.8\hat{j} + c\hat{k}$ ,

then the value of  $c$  is

A. 1

B.  $\sqrt{0.11}$

C.  $\sqrt{0.01}$

D.  $\sqrt{0.39}$

**Answer: B**



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56. If  $A = a_1\hat{i} + b_1\hat{j}$  and  $B = a_2\hat{i} + b_2\hat{j}$  the condition that they are perpendicular to each other is

A.  $\frac{a_1}{b_1} = -\frac{b_2}{a_2}$

B.  $a_1b_1 = a_2b_2$

C.  $\frac{a_1}{b_1} = -\frac{b_1}{b_2}$

D. None of these

**Answer: A**



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57. For what value of  $x$  , will the two vector  $A = 2\hat{i} + 2\hat{j} - x\hat{k}$  and  $B = 2\hat{i} - \hat{j} - 3\hat{k}$  are perpendicular to each other ?

A.  $x = -2/3$

B.  $x = -3/2$

C.  $x = -4/3$

D.  $x = -2/3$

**Answer: A**



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58. A and B are two vector given by  $A = 2\hat{i} + 3\hat{j}$  and  $B = 2\hat{i} + 4\hat{j}$  The magnitude to the component of A along B is

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

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

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

D.  $\frac{5}{\sqrt{13}}$

**Answer: C**



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59. The value of  $x$  and  $y$  for which vector  $A = (6\hat{i} + x\hat{j} - 2\hat{k})$  and  $B = (5\hat{i} + 6\hat{j} - y\hat{k})$  may be parallel are

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

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

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

D.  $x = \frac{36}{5}, y = \frac{15}{4}$

**Answer: B**



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60. The angles which the vector  $A = 3\hat{i} + 6\hat{j} + 2\hat{k}$  makes with the co-ordinate axes are

A.  $\cos^{-1} \frac{3}{7}$   $\cos^{-1} \frac{6}{7}$  and  $\cos^{-1} \frac{2}{7}$

B.  $\cos^{-1} \frac{4}{7}$   $\cos^{-1} \frac{5}{7}$  and  $\cos^{-1} \frac{3}{7}$

C.  $\cos^{-1} \frac{3}{7}$   $\cos^{-1} \frac{4}{7}$  and  $\cos^{-1} \frac{1}{7}$

D. None of the above

**Answer: A**



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61. A particle is moving on a circular path with constant speed  $v$  then the change in its velocity after it has described an angle of  $60^\circ$  will be

A.  $v\sqrt{2}$

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

C.  $v\sqrt{3}$

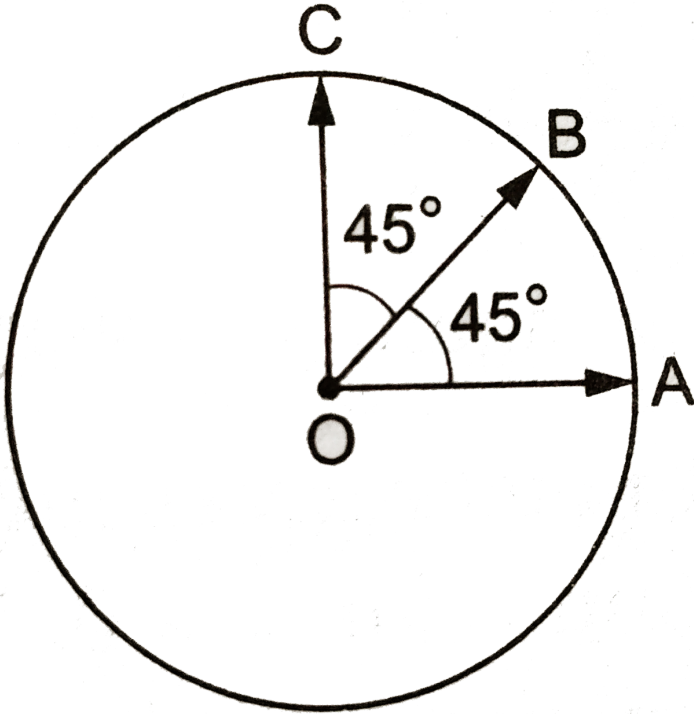
D.  $v$

**Answer: D**



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



A.  $2R$

B.  $R(1 + \sqrt{2})$

C.  $R\sqrt{2}$



D.  $R(\sqrt{2} - 1)$

**Answer: B**



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**63.** Resultant of two vector of equal magnitude A is

A.  $\sqrt{3}A$  at  $60^\circ$

B.  $\sqrt{2}A$  at  $90^\circ$

C.  $2A$  at  $120^\circ$

D.  $A$  at  $180^\circ$

**Answer: A,B**



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64. If  $a\hat{i} + b\hat{j}$  is a unit vector and it is perpendicular to  $\hat{i} + \hat{j}$ , then value of a and b is

A. 1,0

B. -2, 0

C. 0.5, -0.5

D. None of these

**Answer: D**



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65. If  $a + b + c = 0$ , then  $a \times b$  is equal to

A.  $b \times c$

B.  $c \times b$

C.  $a \times c$

D. None of these

**Answer: A**



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66. Consider a force vector  $F = \hat{i} + \hat{j} + \hat{k}$  Another vector perpendicular to F is

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

B.  $6\hat{i}$

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

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

**Answer: C**



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**67.** A vector perpendicular to both the vector  $2\hat{i} - 3\hat{j}$  and  $3\hat{i} - 2\hat{j}$  is

A.  $\hat{j} + 5\hat{k}$

B.  $\hat{j} - 5\hat{k}$

C.  $6\hat{k}$

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

**Answer: C**



**Watch Video Solution**

68. If  $\vec{A} = 4\hat{i} - 3\hat{j}$  and  $\vec{B} = 6\hat{i} + 8\hat{j}$  then magnitude and direction of  $\vec{A} + \vec{B}$  will be

A.  $5, \tan^{-1}(3/4)$

B.  $5\sqrt{5}, \tan^{-1}(1/2)$

C.  $10, \tan^{-1}(5)$

D.  $25, \tan^{-1}(3/4)$

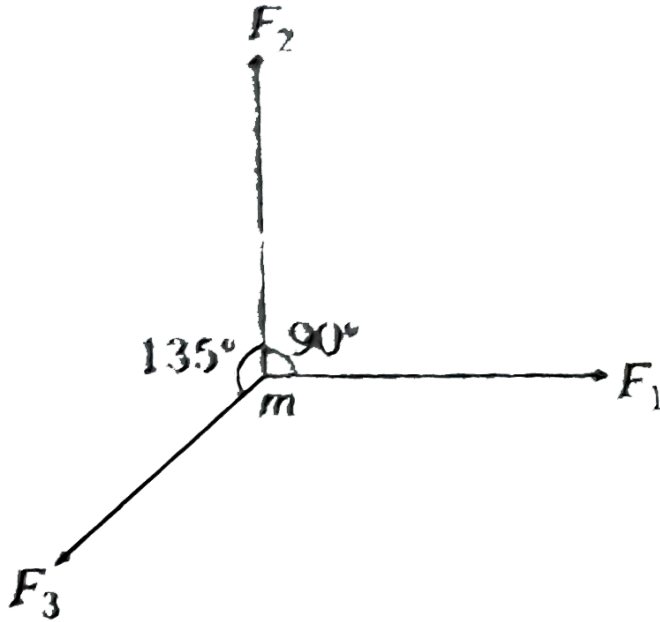
**Answer: B**



**Watch Video Solution**

**69.** When a force  $F$  acts on a body of mass  $m$  the acceleration produced in the body is  $a$ . If three equal forces  $F_1 = F_2 = F_3 = F$  act on the same body as

shown in figure the acceleration produced is



- A.  $(\sqrt{2} - 1)a$
- B.  $(\sqrt{2} + 1)a$
- C.  $\sqrt{2}a$
- D.  $a$

**Answer: A**



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70. Obtain the magnitude and direction cosines of vector  $(A - B)$ , if

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

A.  $0, \frac{1}{\sqrt{5}}, \frac{-2}{\sqrt{5}}$

B.  $0, \frac{2}{\sqrt{5}}, \frac{1}{\sqrt{5}}$

C.  $0, 0, \frac{1}{\sqrt{5}}$

D. None of these

**Answer: A**



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71. Two vectors having equal magnitudes  $A$  make an angle  $\theta$  with each other. Find the magnitude and direction of the resultant.

A.  $2A \cos \frac{\theta}{2}$ , along bisector

B.  $A \cos \frac{\theta}{2}$ , at  $45^\circ$  from on a vector

C.  $2A \cos \frac{\theta}{2}$ , along bisector

D.  $A \cos \frac{\theta}{2}$ , along bisector

**Answer: A**



**Watch Video Solution**

72. 12 coplanar non collinear forces (all of equal magnitude) maintain a body in equilibrium, then angle between any two adjacent forces is

A.  $15^\circ$

B.  $30^\circ$

C.  $45^\circ$

D.  $60^\circ$

**Answer: B**



**Watch Video Solution**

73. 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 two having equal magnitude. Then angle between vectors are given by

A.  $30^\circ, 60^\circ, 90^\circ$

B.  $45^\circ, 45^\circ, 90^\circ$

C.  $90^\circ, 135^\circ, 45^\circ$

D.  $90^\circ, 135^\circ, 135^\circ$

**Answer: D**



**Watch Video Solution**

74. Two vectors  $A$  and  $B$  are such that  $A + B = C$  and  $A^2 + B^2 = C^2$ . If  $\theta$  is the angle between positive direction of  $A$  and  $B$ , then the correct statement is

A.  $\theta = \pi$

B.  $\theta = \frac{2\pi}{3}$

C.  $\theta = 0$

D.  $\theta = \frac{\pi}{2}$

**Answer: D**



**Watch Video Solution**

75. Given  $A = 3\hat{i} + 4\hat{j}$  and  $B = 6\hat{i} + 8\hat{j}$  which of the following statement is correct ?

A.  $A \times B = 0$

B.  $\frac{|A|}{|B|} = \frac{1}{2}$

C.  $|A| = 15$

D.  $A \cdot |B| = 48$

**Answer: A,B**



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76. If a vector  $\vec{A}$  make angles  $\alpha, \beta$  and  $\gamma$ , respectively, with the  $X, Y$  and  $Z$  axes, then  $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma =$

A. 0

B. 1

C. 2

D. 3

**Answer: C**



**Watch Video Solution**

77. If vector A and B have an angle  $\theta$  between them, then value of  $|\hat{A} - \hat{B}|$  will be ,

A.  $2 \cos \frac{\theta}{2}$

B.  $2 \tan \frac{\theta}{2}$

C.  $2 \sin \frac{\theta}{2}$

D. None of these

**Answer: C**



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78. A particle undergoes three successive displacements given by  $s_1 = \sqrt{2}$  m north - east ,  $s_2 = 2$  m due south and  $s_3 = 4m, 30^\circ$  north of west , then magnitude of net displacement is

A.  $\sqrt{14 + 4\sqrt{3}}$

B.  $\sqrt{14 - 4\sqrt{3}}$

C.  $\sqrt{4}$

D. None of these

**Answer: B**



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79. The resultant of A and B is  $R_1$ . On reversing the vector B, the resultant  $R_2$  what is the value of  $R_1^2 + R_2^2$ ?

A.  $A^2 + B^2$

B.  $A^2 - B^2$

C.  $2(A^2 + B^2)$

D.  $2(A^2 - B^2)$

**Answer: C**



**Watch Video Solution**

**80.** If the sum of two unit vectors is a unit vector, then magnitude of difference is-

A.  $\sqrt{2}$

B.  $\sqrt{3}$

C.  $1/\sqrt{2}$

D.  $\sqrt{5}$

**Answer: B**



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**81.** The sum of two vectors A and B is at right angles to their difference. Then

A.  $A=B$

B.  $A=2B$

C.  $B=2A$

D. None of these

**Answer: A**



**Watch Video Solution**

**82.** A vector having magnitude 30 unit makes equal angles with each of X,Y, and Z -axes The components of vector along each of X,Y,and Z -axes are

A.  $10\sqrt{3}$  unit

B.  $20\sqrt{3}$  unit

C.  $15\sqrt{3}$  unit

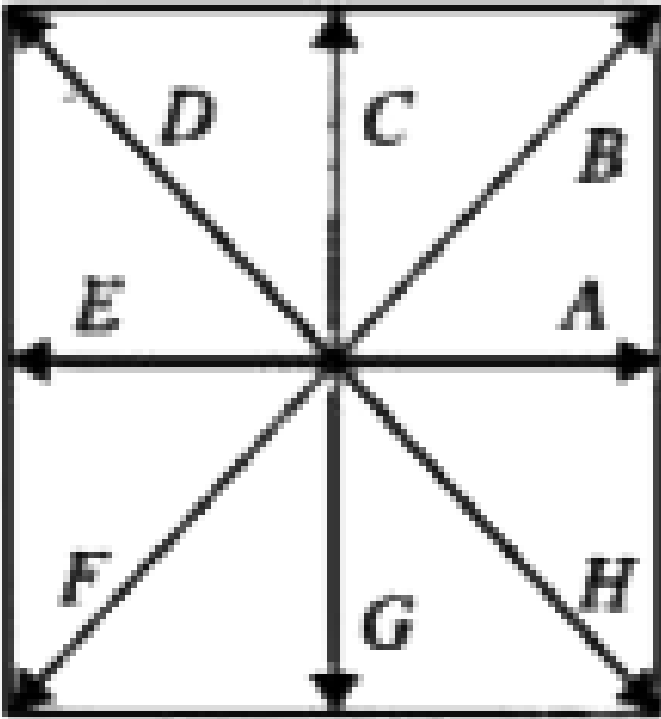
D. 10 unit

**Answer: A**



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83. A number of vectors are as shown in .They can be combined in various ways , like  $\vec{A} + \vec{C} = \vec{B}$  . What is the value of (a)  $\vec{E} + \vec{C}$  (b)  $\vec{A} + \vec{F}$  (c )  $\vec{A} + \vec{D}$  (d)  $\vec{E} + \vec{A}$  (e)  $\vec{A} - \vec{B}$  .



A. AO

B. 2AO

C. 4AO

D. 6AO

**Answer: D**



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**84.** If  $\hat{A}$  is a unit vector in a given direction then the

value of  $\hat{A} \cdot \frac{d\hat{A}}{dt}$  is

A. 0

B. 1

C.  $\frac{1}{2}$

D. 2

**Answer: A**



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**85.** If  $F_1$  and  $F_2$  are two vectors of equal magnitudes  $F$  such that  $|F_1 \cdot F_2| = |F_1 \times F_2|$ , then  $|F_1 + F_2|$  equals to

A.  $\sqrt{(2 + \sqrt{2})} F$

B.  $2F$

C.  $F\sqrt{2}$

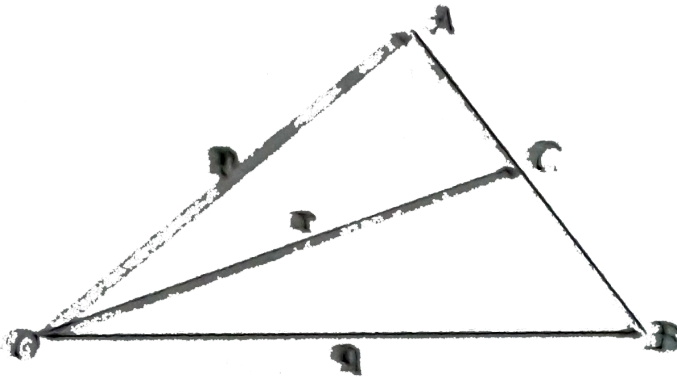
D. None of these

Answer: A



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86. Figure show's three vectors  $p, q$  and  $r$  where  $C$  is the mid - point of  $AB$  Then which of the following relation is correct ?



A.  $p + q = 2r$

B.  $p + q = r$



C.  $p - q = 2r$

D.  $p - q = r$

**Answer: A**



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**87.** What is the angle between  $P$  and  $Q$  the cross product of  $(P + Q)$  and  $(P - Q)$ ?

A.  $90^\circ$

B.  $\tan^{-1}(p/Q)$

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

D.  $0^\circ$

**Answer: A**



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**88.** The resultant of two vectors  $\vec{P}$  and  $\vec{Q}$  is  $\vec{R}$ . If  $\vec{Q}$  is doubled then the new resultant vector is perpendicular to  $\vec{P}$ . Then magnitude of  $\vec{R}$  is :-

A. P

B.  $(P + Q)$

C. Q

D.  $(P - Q)$

**Answer: C**



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89. The angle between the vector  $\vec{A}$  and  $\vec{B}$  is  $\theta$ . Find the value of triple product  $\vec{A} \cdot (\vec{B} \times \vec{A})$ .

A.  $a^2 B$

B. zero

C.  $A^2 B \sin \theta$

D.  $A^2 B \cos \theta$

**Answer: B**



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**90.** The sum of the magnitudes of two forces acting at a point is 18 and the magnitude of their resultant is 12. If the resultant is at  $90^\circ$  with the force of smaller magnitude, What are the magnitudes of forces?

A. 12,6

B. 14,4

C. 5,13

D. 10,8

**Answer: C**



**Watch Video Solution**

91. A vector  $\vec{a}$  is turned without a change in its length through a small angle  $d\theta$ . Find the value of  $|\Delta \vec{a}|$

A. 0

B.  $a \cdot d\theta$

C. 0

D. None of these

**Answer: B**



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92. A force  $F = -k\hat{i} + x\hat{j}$  where  $k$  is a positive constant, acts on a particle moving in the  $xy$  plane. Starting from the origin, the particle is taken along the positive  $x$  - axis to the point  $(a,0)$  and then parallel to the  $y$ -axis to the point  $(a,a)$  the total work done by the force on the particle is

A.  $-2Ka^2$

B.  $2Ka^2$

C.  $-Ka^2$

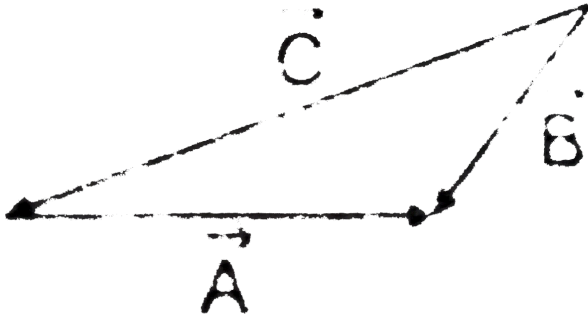
D.  $Ka^2$

**Answer: C**



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93. For the figure shown



A.  $X = A + B - C + D$

B.  $Y = B + C - A$

C.  $Z = B + C$

D.  $W = A + B$

**Answer: B,C**



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94. If  $a$  and  $b$  are two vectors, then the value of

$(a + b) \times (a - b)$  is

A.  $2(b \times a)$

B.  $-2(b \times a)$

C.  $b \times a$

D.  $b \times a$

**Answer: A**



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95. Given that  $\vec{A} + \vec{B} = \vec{C}$  and that  $\vec{C}$  is perpendicular to  $\vec{A}$ . Further if  $|\vec{A}| = |\vec{C}|$ , then what is the angle between  $\vec{A}$  and  $\vec{B}$

A.  $\frac{\pi}{4}$

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

C.  $\frac{3\pi}{4}$

D.  $\pi$

**Answer: C**



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96. The resultant of two forces, one double the other in magnitude, is perpendicular to the smaller of the two forces. The angle between the two forces is

A.  $120^\circ$

B.  $135^\circ$

C.  $90^\circ$

D.  $150^\circ$

**Answer: A**



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97. If  $A + B = C$ ,  $|A| = 2|B|$  and  $B \cdot C = 0$ , then

A.  $|A + B| = |A + B|$

B.  $|A + C| = B$

C.  $A \cdot B < 0$

D.  $A \cdot C$  may be zero

**Answer: C**



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98. Two unit vector when added give a unit vector .

Then choose the correct statement.

A. magnitude of their difference is  $\sqrt{3}$

B. Magnitude of their difference is 1

C. Angle between the vectors is  $90^\circ$

D. Angle between the sum and the difference of the two vectors is  $90^\circ$

**Answer: D,A**



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**99.** Which one of the following statement is true?

A. A scalar quantity is the one that is conserved In a process

B. A scalar quantity is the one that can never take negative values

C. A scalar quantity is the one that does not vary from one point to another in space

D. A scalar quantity has the same value for observers with different orientation of the axes.

**Answer: D**

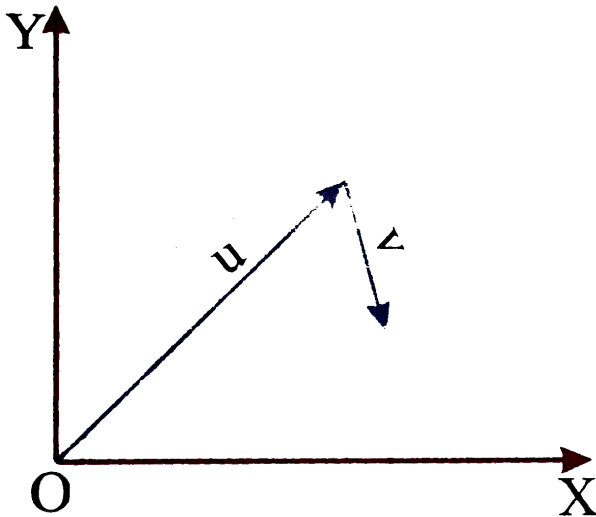


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**100.** Figure shows the orientation of two vectors  $u$  and  $v$  in the  $XY$  plane.

if  $\vec{u} = a\hat{i} + b\hat{j}$  and  $\vec{v} = p\hat{i} + q\hat{j}$

which of the following is correct?



- A. a and p are positive while b and q are negative
- B. a, p and b are positive while q is negative
- C. a, q and b are positive while p is negative
- D. a, b, p and q are all positive

**Answer: B**



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**101.** The velocity of a particle is  $v = 6\hat{i} + 2\hat{j} - 2\hat{k}$  The component of the velocity parallel to vector  $a = \hat{i} + \hat{j} + \hat{k}$  in vector form is

A.  $6\hat{i} + 2\hat{j} + 2\hat{k}$

B.  $2\hat{i} + 2\hat{j} + 2\hat{k}$

C.  $\hat{i} + \hat{j} + \hat{k}$

D.  $6\hat{i} + 2\hat{j} + 2\hat{k}$

**Answer: B**



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102. The resultant  $R$  of vector  $P$  and  $Q$  is perpendicular to  $P$  and  $R=P$  both, then angle between  $|P|$  and  $|Q|$  is

A.  $45^\circ$

B.  $135^\circ$

C.  $120^\circ$

D. All of these

Answer: B



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103.

The

value

of

$$\hat{i} \times (\hat{i} \times a) + \hat{j} \times (\hat{j} \times a) + \hat{k} \times (\hat{k} \times a) \text{ is}$$

A.  $a$ B.  $a \times \hat{k}$ C.  $-2a$ D.  $-a$ **Answer: C****Watch Video Solution**

104. What is the angle between  $\vec{P}$  and the resultant of  $(\vec{P} + \vec{Q})$  and  $(\vec{P} - \vec{Q})$ ?

A. zero

B.  $\tan^{-1}(p/Q)$

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

D.  $\tan^{-1}(P - Q)/(P + Q)$

**Answer: A**



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**105.** If  $a_1$  and  $a_2$  are two non-collinear unit vectors and if  $|a_1 + a_2| = \sqrt{3}$ , then value of  $(a_1 - a_2) \cdot (2a_1 - a_2)$  is

A. 2

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

C.  $\frac{1}{2}$

D. 1

**Answer: B**



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**106.** There are  $n$  coplanar vectors each of magnitude  $m$  and each vector is inclined to the preceding vector at an angle  $2\pi/n$ . Then the magnitude of their resultant is

A.  $\frac{V}{N}$

B.  $V$

C. zero

D.  $\frac{N}{V}$

**Answer: C**



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**107.** Three equal masses of 1 kg each are placed at the vertices of an equilateral triangle and other particle of mass 2kg is placed on centroid of triangle which is at a distance of  $\sqrt{2}$  m from each of the vertices of the triangle .The force in newton , acting on the particle of mass 2 kg is

A. 2

B. 1

C. 1

D. Zero

**Answer: D**



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**108.** At what angle must the two forces  $(x+y)$  and  $(x-y)$  act so that the resultant may be  $\sqrt{x^2 + y^2}$  ?

A.  $\cos^{-1} \left[ -\frac{x^2 + y^2}{2(x^2 - y^2)} \right]$

B.  $\cos^{-1} \left[ -\frac{-2x^2 - y^2}{(x^2 + y^2)} \right]$

C.  $\cos^{-1} \left[ -\frac{x^2 + y^2}{(x^2 - y^2)} \right]$

D.  $\cos^{-1} \left[ -\frac{x^2 - y^2}{(x^2 + y^2)} \right]$

**Answer: A**



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## Assertion And Reason

1. Assertion ( $A$ ): Galvanized iron is protected from Rusting.

Reason ( $R$ ):  $Zn$  is less reactive than  $Fe$ .

(a) If both ( $A$ ) and ( $R$ ) are correct, and ( $R$ ) is the correct explanation of ( $A$ ).

(b) If both  $(A)$  and  $(R)$  are correct, but  $(R)$  is not the correct explanation of  $(A)$ .

(c) If  $(A)$  is correct, but  $(R)$  is incorrect.

(d) If  $(A)$  is incorrect,  $(R)$  is correct.

A. If both Assertion and Reason are correct but Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false

D. If Assertion is false but Reason is true

**Answer: A**

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2. Assertion ( $A$ ):  $Cu$  gets readily corroded in acidic aqueous solution.

Reason ( $R$ ): Free energy of the process is positive.

(a) If both ( $A$ ) and ( $R$ ) are correct, and ( $R$ ) is the correct explanation of ( $A$ ).

(b) If both ( $A$ ) and ( $R$ ) are correct, but ( $R$ ) is not the correct explanation of ( $A$ ).

(c) If ( $A$ ) is correct, but ( $R$ ) is incorrect.

(d) If both ( $A$ ) and ( $R$ ) are incorrect.

A. If both Assertion and Reason are correct but

Reason is the correct explanation of Assertion.



B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false

D. If Assertion is false but Reason is true

**Answer: C**



**Watch Video Solution**

3. Assertion - Vector addition of two vector is always greater than their vector subtraction.

Reason At  $\theta = 90^\circ$  , addition and subtraction of two vector are equal .

A. If both Assertion and Reason are correct but

Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but

Reason is not the correct explanation of

Assertion.

C. If Assertion is true but Reason is false

D. If Assertion is false but Reason is true

**Answer: D**



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4. Assertion -Magnitude of vector product of two vectors may be greater than , equal to or less than the scalar product .

Reason At  $\theta = 45^\circ$  two are equal .

A. (A) If both Assertion and Reason are correct but

Reason is the correct explanation of Assertion.

B. (B) If both Assertion and Reason are correct but

Reason is not the correct explanation of

Assertion.

C. (C) If Assertion is true but Reason is false

D. (D) If Assertion is false but Reason is true

Answer: B



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5. Assertion: Angle between  $\hat{i} + \hat{j}$  and  $\hat{i}$  is  $45^\circ$ .

Reason:  $\hat{i} + \hat{j}$  is equally inclined to both  $\hat{i}$  and  $\hat{j}$  and the angle between  $\hat{i}$  and  $\hat{j}$  is  $90^\circ$ .

A. If both Assertion and Reason are correct but

Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but

Reason is not the correct explanation of

Assertion.

C. If Asserion is true but Reason is false

D. If Asserion is false but Reason is true

**Answer: B**



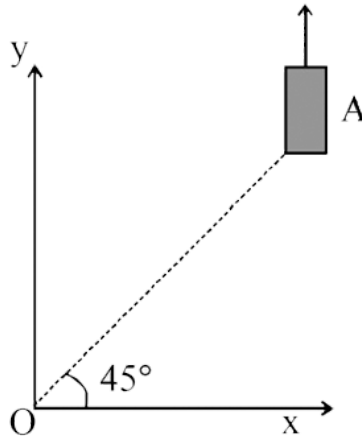
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6. On a frictionless horizontal surface , assumed to be the  $x - y$  plane , a small trolley  $A$  is moving along a straight line parallel to the  $y -$  axis ( see figure) with a constant velocity of  $(\sqrt{3} - 1)m/s$  . At a particular instant , when the line  $OA$  makes an angle of  $45^\circ$  with the  $x -$  axis , a ball is thrown along the surface from the origin  $O$ . Its velocity makes an angle  $\phi$  with

the  $x$  – axis and it hits the trolley .

(a) The motion of the ball is observed from the frame of the trolley . Calculate the angle  $\theta$  made by the velocity vector of the ball with the  $x$  – axis in this frame .

(b) Find the speed of the ball with respect to the surface , if  $\phi = (4\theta) / (3)$ .



A. If both Assertion and Reason are correct but

Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false

D. If Assertion is false but Reason is true

**Answer: D**



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7. Assertion - Component of A along B is equal to component of B along A.

Reason value of component is always less than the magnitude of vector .

A. If both Assertion and Reason are correct but

Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but

Reason is not the correct explanation of

Assertion.

C. If Assertion is true but Reason is false

D. If Assertion is false but Reason is true

**Answer: D**



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8. Assertion  $(A+B)(A-B)$  is always positive.

Reason this is positive if  $|A| > |B|$

A. If both Assertion and Reason are correct but

Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but

Reason is not the correct explanation of

Assertion.

C. If Assertion is true but Reason is false

D. If Assertion is false but Reason is true

**Answer: D**



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9. Assertion:  $\vec{A} \times \vec{B}$  is perpendicular to both  $\vec{A} - \vec{B}$  as well as  $\vec{A} + \vec{B}$

Reason:  $\vec{A} + \vec{B}$  as well as  $\vec{A} - \vec{B}$  lie in the plane containing  $\vec{A}$  and  $\vec{B}$ , but  $\vec{A} \times \vec{B}$  lies perpendicular to the plane containing  $\vec{A}$  and  $\vec{B}$ .

A. If both Assertion and Reason are correct but

Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but

Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false

D. If Assertion is false but Reason is true

**Answer: A**

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**10.** Assertion If angle between  $a$  and  $b$  is  $30^\circ$ . Then angle between  $2a$  and  $-\frac{b}{2}$  will be  $150^\circ$

Reason Sign of dot product of two vectors tells you whether angle between two vectors is acute or obtuse.

A. If both Assertion and Reason are correct but

Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false

D. If Assertion is false but Reason is true

**Answer: B**



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11. Assertion -  $(A \times B) \cdot (B \times A)$  is  $-a^2 B^2 \sin^2 \theta$  Here  $\theta$  is the angle between A and B.

Reason  $(A \times B)$  and  $(B \times A)$  are two anti-parallel

vectors provided A and B are neither parallel nor anti - parallel .

A. If both Assertion and Reason are correct but Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false

D. If Assertion is false but Reason is true

**Answer: B**



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12. Assertion - If  $|A| = |B|$ , then  $(A + B)$ ,  $(A - B)$  and  $(A \times B)$  are three mutually perpendicular vectors .

Reason - Dot Product of a null vector with any other vector is always zero .

A. If both Assertion and Reason are correct but

Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but

Reason is not the correct explanation of

Assertion.

C. If Assertion is true but Reason is false

D. If Assertion is false but Reason is true

**Answer: B**



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13. If  $\vec{a}$  and  $\vec{b}$  are two unit vectors and  $\theta$  is the angle between them, then the unit vector along the angular bisector of  $\vec{a}$  and  $\vec{b}$  will be given by

A. If both Assertion and Reason are correct but

Reason is the correct explanation of Assertion.

B. If both Assertion and Reason are correct but

Reason is not the correct explanation of

Assertion.

C. If Assertion is true but Reason is false

D. If Assertion is false but Reason is true

**Answer: C**



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**14.** Assertion - If  $\theta$  be the angle between  $A$  and  $B$  then

$$\tan \theta = \frac{A \times B}{AB}$$

Reason -  $A \times B$  is perpendicular to  $AB$ .

A. If both Assertion and Reason are correct but

Reason is the correct explanation of Assertion.



B. If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.

C. If Assertion is true but Reason is false

D. If both Assertion and Reason are false.

**Answer: D**



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**Match The Columns**

1. For component of a vector  $A = (3\hat{i} + 4\hat{j} - 5\hat{k})$ ,

match the following table

Table-1	Table-2
(A) Along y-axis	(P) 5 unit
(B) Along another vector $(2\hat{i} + \hat{j} + 2\hat{k})$	(Q) 4 unit
(C) Along $(6\hat{i} + 8\hat{j} - 10\hat{k})$	(R) Zero
(D) Along another vector $(-3\hat{i} - 4\hat{j} + 5\hat{k})$	(S) None



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2. Two vector A and B have rqual magnitude x .Angle between tjem is  $60^\circ$  Then match the following two

columns.

Column I

Column II

- |                    |                             |
|--------------------|-----------------------------|
| (A) $ A+B $        | (P) $\frac{\sqrt{3}}{2}x^2$ |
| (B) $ A - B $      | (Q) $x$                     |
| (C) $A \cdot B$    | (r) $\sqrt{3}x$             |
| (D) $ A \times B $ | (s) None                    |



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3. Vector A is pointing eastwards and vector B northwards .if  $|A| = |B|$  then match the following two columns.

Column I

Column II

- |  |                        |
|--|------------------------|
| (A) $(A + B)$                          | (P) north -east        |
| (B) $(A - B)$                          | (Q) Vertically upwards |
| (C) $(A \times B)$                     | (r) south-east         |
| (D) $(A \times B) \times (A \times B)$ | (s) None               |



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4. A vector has a magnitude  $x$  . If it is rotated by an angle  $\theta$  then magnitude of change in vector is  $nx$ .

Match the following two columns.

Column I

Column II

(A)  $\theta = 60^\circ$

(P)  $n = \sqrt{3}$

(B)  $\theta = 90^\circ$

(Q)  $n = 1$

(C)  $\theta = 120^\circ$

(R)  $n = \sqrt{2}$

(D)  $\theta = 180^\circ$

(S)  $n = 2$



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5. If  $\theta$  is the angle between two vectors A and B , then match the following two columns.

Column I

Column II

(A)  $A \cdot B = |A \times B|$

(P)  $\theta = 90^\circ$

(B)  $A \cdot B = B^2$

(Q)  $\theta = 0^\circ$  or  $180^\circ$

(C)  $|A + B| = |A - C|$

(r)  $A = B$

(D)  $|A \times B| = AB$

(s) None



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## Medical Enrances Gallery

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

A.  $90^\circ$

B.  $45^\circ$

C.  $180^\circ$

D.  $0^\circ$

**Answer: A**



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

A.  $1/2$

B.  $-1$

C.  $-1/2$

D.  $1$

**Answer: C**



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3. The angle  $\theta$  between the vector  $p = \hat{i} + \hat{j} + \hat{k}$  and unit vector along X-axis is

A.  $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

B.  $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$

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

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

**Answer: A**



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4. Consider three vectors  $A = \hat{i} + \hat{j} - 2\hat{k}$ ,

$B = \hat{i} + \hat{j} + 2\hat{k}$  and  $2\hat{i} - 3\hat{j} + 4\hat{k}$  A vector X of the

from  $\alpha A + \beta B$  ( $\alpha$  and  $\beta$  are numbers) is

perpendicular to C. The ratio of  $\alpha$  and  $\beta$  is

A. 1:1

B. 2:1

C. -1:1

D. 3:1

**Answer: A**



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5. Two equal vector have a resultant equal to either of them, then the angle between them will be:

A.  $90^\circ$

B.  $60^\circ$

C.  $120^\circ$

D.  $0^\circ$

**Answer: C**



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6. Which of the following is not a cloning vector ?

A. Weight

B. Nuclear spin

C. Momentum

D. Potential energy

**Answer: D**



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7. The scalar product of two vectors

$A = 2\hat{i} + 2\hat{j} - \hat{k}$  and  $B = -\hat{j} + \hat{k}$ , is given by

A.  $A \cdot B = 3$

B.  $A \cdot B = 4$

C.  $A \cdot B = -4$

D.  $A \cdot B = -3$

**Answer: D**



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**8.** If  $A \cdot B = A \times B$ , then angle between  $A$  and  $B$  is

A.  $45^\circ$

B.  $30^\circ$

C.  $60^\circ$

D.  $90^\circ$

Answer: A



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

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

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

**Answer: D**



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