VECTORS

1. A vector may change if -

(1) frame of reference is translated

(2) vector is rotated

(3) frame of reference is rotated

(4) vector is translated parallel to itself

2. Let $\vec{A}=\frac{1}{\sqrt{2}}\cos\theta\hat{i}+\frac{1}{\sqrt{2}}\sin\theta\hat{j}$ be any vector. What will be the unit vector $\hat{n}$ in the direction of $\vec{A}$?

(1) $\cos\theta\hat{i}+\sin\theta\hat{j}$

(2) $-\cos\theta\hat{i}-\sin\theta\hat{j}$

(3) $1/\sqrt{2}(\cos\theta\hat{i}+\sin\theta\hat{j})$

(4) $1/\sqrt{2}(\cos\theta\hat{i}-\sin\theta\hat{j})$

3. Which of the following statement(s) is correct?

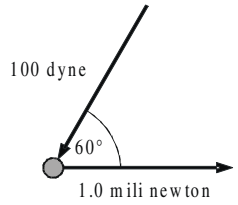
(1) The unit vector of velocity and force may be same.

(2) The angle between two unit vectors is always 90°.

(3) The unit vector of velocity is always perpendicular to acceleration.

(4) The difference between magnitudes of two unit vector is equal to magnitude of difference of two unit vectors.

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

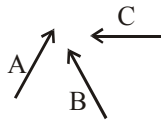


(1) $\sqrt{3}$ (2) $\sqrt{2}$ (3) 1 (4) 2

5. The ratio of maximum and minimum magnitudes of the resultant of two vector $\vec{a}$ and $\vec{b}$ is 3 : 1. Now $|\vec{a}|$ is equal to :

(1) $|\vec{b}|$ (2) $2|\vec{b}|$ (3) $3|\vec{b}|$ (4) $4|\vec{b}|$

6. Consider three vector $\vec{A},\vec{B}$ and $\vec{C}$ as shown in figure. Choose the incorrect statement ?



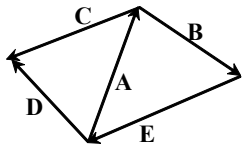
(1) $\vec{A}+\vec{B}$ can be in the direction ↑

(2) $\vec{A}+\vec{B}+\vec{C}$ can be in the direction ↖

(3) $\vec{A}-\vec{B}$ can be in the direction →

(4) $\vec{A}+\vec{B}-\vec{C}$ can be in the direction ↓

7. For figure the correct relation is :-



(1) $\vec{A}+\vec{B}+\vec{E}=\vec{0}$ (2) $\vec{C}-\vec{D}=\vec{A}$

(3) $\vec{B}+\vec{E}-\vec{C}=\vec{D}$ (4) all of the above

8. Vector $\vec{R}$ is the resultant of the vectors $\vec{A}$ and $\vec{B}$. Ratio of minimum value of $|\vec{R}|$ and maximum value of $|\vec{R}|$ is $\frac{1}{4}$. Then $\frac{|\vec{A}|}{|\vec{B}|}$ may be:-

(1) $\frac{4}{1}$ (2) $\frac{2}{1}$ (3) $\frac{3}{5}$ (4) $\frac{1}{4}$

9. A particle is given successive displacements. Which of the following sets of displacements could be capable of returning the particle to its initial position?

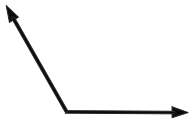
(1) 10 m, 8m, 6 m, 30 m

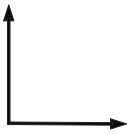
(2) 20 m, 10 m, 6m, 50 m

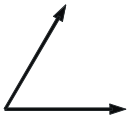
(3) 65m, 15 m, 45 m, 30 m

(4) 100 m, 18m, 22 m, 32 m

10. Refer the following arrangements consisting of two vectors of same magnitude. Arrange them in ascending order of resultant magnitudes.

(I) 

(II) 

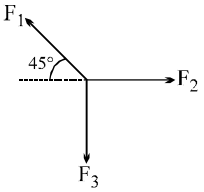
(III) 

(IV) 

(1) I, II, III, and IV (2) IV, III, II and I

(3) II, IV, III and I (4) II, I, III and IV

11. Three forces $\vec{F}_1$, $\vec{F}_2$ and $\vec{F}_3$ are represented as shown. Each of them is of equal magnitude.



List–I (Combination)	List–II (Approximate Direction)
(P) $\vec{F}_1+\vec{F}_2+\vec{F}_3$	(1) 
(Q) $\vec{F}_1-\vec{F}_2+\vec{F}_3$	(2) 
(R) $\vec{F}_1-\vec{F}_2-\vec{F}_3$	(3) 
(S) $\vec{F}_2-\vec{F}_1-\vec{F}_3$	(4) 

Code :

(1) P-1, Q-2, R-3, S-4 (2) P-2, Q-1, R-4, S-3

(3) P-2, Q-3, R-1, S-4 (4) P-4, Q-1, R-2, S-3

12. The initial and final velocities of an object are as shown in figure (a). Which arrows shown in figure (b) can represent change in velocity vector?

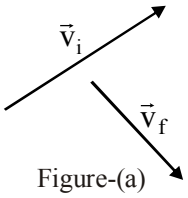


Figure-(a)

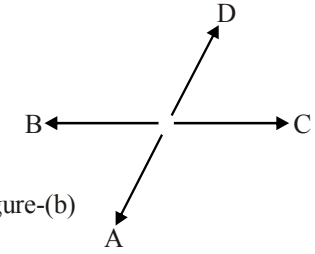
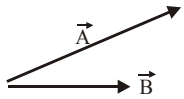


Figure-(b)

(1) A (2) B (3) C (4) D

13. Two vectors $\vec{A}$ & $\vec{B}$ have magnitudes 2 & 1 respectively. If the angle between $\vec{A}$ & $\vec{B}$ is 60°, which of the following vectors may be equal to $\frac{\vec{A}}{2}-\vec{B}$.



(1)  (2) 

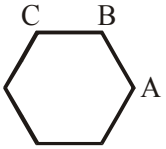
(3)  (4)

14. A particle moves on a circular path of radius R. Find magnitude of its displacement during an interval in which it covers angular displacement θ.

(1) Rθ (2) R sinθ

(3) $2R\cos\frac{\theta}{2}$ (4) $2R\sin\frac{\theta}{2}$

15. Newton approximated motion in a circle as a series of linear motions, as in the polygon below.



If we assume the particle moves at constant speed v_A from A to B, and at constant speed v_B from B to C, the direction of the change in velocity, $\Delta\vec{v}$, at point B, is shown by the arrow:-

(1)  (2) 

(3)  (4) 

16. The position vectors of two balls are given by

$\vec{r}_1 = 2(m)\hat{i} + 7(m)\hat{j}$

$\vec{r}_2 = -2(m)\hat{i} + 4(m)\hat{j}$

What will be the distance between the two balls?

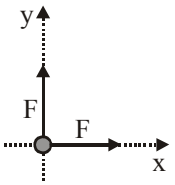
(1) 7 m (2) 5 m (3) 4 m (4) 3 m

17. If $\vec{a} = 2\hat{i} + \sqrt{5}\hat{j}$ & $\vec{b} = 5\hat{i} + \sqrt{5}\hat{j} + 4\hat{k}$, then find a vector of same magnitude as $\vec{a}$ and parallel to vector $\vec{a} - \vec{b}$:-

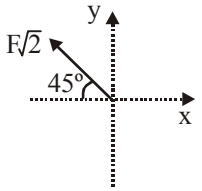
(1) $\frac{7\hat{i} + 2\sqrt{5}\hat{j} + 4\hat{k}}{3}$ (2) $-3\hat{i} - 4\hat{k}$

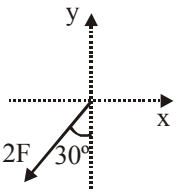
(3) $\frac{-9\hat{i} - 12\hat{k}}{5}$ (4) $9\hat{i} + 12\hat{k}$

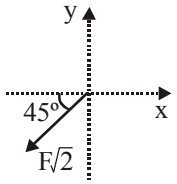
18. Two forces are simultaneously applied on an object.

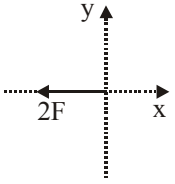


What third force would make the net force to point downwards?

(1) 

(2) 

(3) 

(4) 

19. Two vector $\vec{a} = 3\hat{i} + 8\hat{j} - 2\hat{k}$ and $\vec{b} = 6\hat{i} + 16\hat{j} + x\hat{k}$ are such that the component of $\vec{b}$ perpendicular to $\vec{a}$ is zero. Then the value of x will be :-

(1) 8 (2) – 4 (3) +4 (4) –8

20. Two forces each of magnitude 5N is applied on block. One force is acting towards East and the other acting along 74° North of East. The resultant of the two forces is of magnitude :-

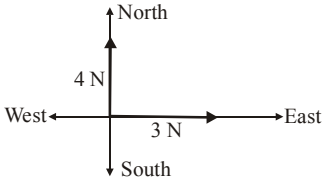
(1) 6 N (2) 10 N

(3) 8 N (4) 12 N

21. Position of a particle at t = 0 is (2, 3, 0). It starts moving with a speed of 10 m/s in direction 37° north of west. Its position after t = 1 sec is (Take North as positive y-axis and East as positive x-axis) :-

(1) (6, 11) (2) (–4, 11) (3) (–8, 6) (4) (–6, 9)

22. Two forces (shown in figure) act on a body simultaneously. Among the given options which force when added will give resultant in North-East direction ?



(1) 1 N in North direction

(2) 1 N in East direction

(3) 3 N in West direction

(4) 1 N in North-East direction

23. For the given vector $\vec{A} = 3\hat{i} - 4\hat{j} + 10\hat{k}$, the ratio of magnitude of its component on the x-y plane and the component on z–axis is

(1) 2 (2) $\frac{1}{2}$

(3) 1 (4) None of these

24. If $\vec{A}$ vector makes angle 90° & 30° with the x and y axis respectively then angle it makes with the z axis can be :

(1) 120° (2) 30° (3) 45° (4) 90°

25. What is the length of projection of $\vec{A} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ on xy plane?

(1) 5 (2) 3 (3) $5\sqrt{2}$ (4) 4

26. A vector $\vec{A}$ is rotated through an angle $\pi/2$, the magnitude of new vector is -

(1) 2A (2) A

(3) A/2 (4) Zero

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

(1) 0 (2) 1 (3) 2 (4) 3

28. Three concurrent forces of the same magnitude are in equilibrium. What is the angle between the forces and the name of triangle formed by the forces as sides :-

(1) 60°, 60°, 60° & an equilateral triangle

(2) 120°, 120°, 120° & an equilateral triangle

(3) 120°, 30°, 30° & an isosceles triangle

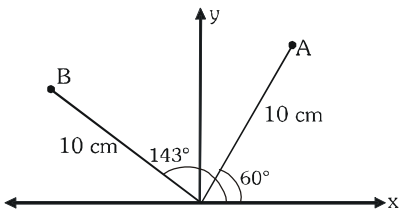
(4) 90°, 60°, 30° & a right angled triangle

29. θ_x and θ_y are the angles made by a vector $\vec{A}$ with positive x and positive y-axis respectively. Which set of θ_x and θ_y is not possible?

(1) 60°, 60° (2) 45°, 60°

(3) 30°, 45° (4) 30°, 65°

30. Refer the given figure and identify incorrect statement



(1) Distance of A from x-axis is $5\sqrt{3}$ cm.

(2) Distance of B from x-axis is 6 cm.

(3) Distance of A from y-axis is 5 cm.

(4) Distance of B from y-axis is 6 cm.

31. $\vec{a}$ = 5 units due South-West

$\vec{b}$ = 5 units due 53° North of East

$\vec{c}$ = 10 units due 37° South of East

Then which of the following is incorrect :

(1) $\vec{a} + \vec{b} = -2\hat{i} - \hat{j}$ (2) $\vec{a} \cdot \vec{b} = -\frac{35}{\sqrt{2}}$

(3) $\vec{b} \cdot \vec{c} = 0$ (4) $\vec{b} + \vec{c} = 11\hat{i} - 2\hat{j}$

32. The angle between two vectors

$\vec{R} = -\hat{i} + \frac{1}{3}\hat{j} + \hat{k}$ and $\vec{S} = x\hat{i} + 3\hat{j} + (x-1)\hat{k}$

(1) Is obtuse angle

(2) Is acute angle

(3) Is right angle

(4) Depends on x

33. If the angle between $\hat{a}$ & $\hat{b}$ is 60°, then which of the following vector(s) have magnitude one :-

(A) $\frac{\hat{a}+\hat{b}}{\sqrt{3}}$ (B) $\hat{a} - \hat{b}$

(C) $\hat{a}$ (D) $\hat{b}$

(1) Only C,D (2) Only B,C,D

(3) Only A,C,D (4) All

34. The dot product of two vectors of magnitudes 3 units and 5 units cannot be

(1) 2 (2) –2 (3) 20 (4) zero

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

(1) 45° (2) 60°

(3) $\cos^{-1}\left(\frac{1}{3}\right)$ (4) $\cos^{-1}\left(\frac{2}{7}\right)$

36. If $\vec{A}, \vec{B}$ and $\vec{C}$ are vectors having a unit magnitude. If $\vec{A}+\vec{B}+\vec{C}=\vec{0}$ then $\vec{A}.\vec{B}+\vec{B}.\vec{C}+\vec{C}.\vec{A}$ will be :-

(1) 1 (2) $-\frac{3}{2}$ (3) $-\frac{1}{2}$ (4) zero

37. If $\vec{A}=2\hat{i}+\hat{j}+\hat{k}$ and $\vec{B}=\hat{i}+2\hat{j}+2\hat{k}$, find the magnitude of component of $\left(\vec{A}+\vec{B}\right)$ along $\vec{B}$:

(1) 4 unit **(2)** 5 unit

(3) 6 unit (4) 7 unit

38. The adjacent sides of a parallelogram are represented by co-initial vectors $2\hat{i}+3\hat{j}$ and $\hat{i}+4\hat{j}$. The area of the parallelogram is-

(1) 5 units along z-axis
(2) 5 units in x-y plane
(3) 3 units in x-z plane
(4) 3 units in y-z plane

39. For a right handed coordinate system, positive x-axis is towards right of you and positive z-axis is upward then positive y-axis will be :

(1) In front of you

(2) At back of you

(3) Towards left

(4) Downwards

40. If a =2, b =5 and $|\vec{a}\times\vec{b}|$ = 8 then $\vec{a}\cdot\vec{b}$ is

(1) 6 (2) 12 (3) 9 (4) 4

41. The sum of magnitudes of two forces acting at a point is 16N. If their resultant is normal to the smaller force and has a magnitude of 8N. Then the forces are-

(1) 6N, 10N (2) 8N, 8N

(3) 4N, 12N (4) 2N, 14N

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	2	1	1	3	2	4	1	3	3	1	3	1	2	4	2	2	3	2	2	3
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	4	2	2	1	1	2	3	2	3	4	1	3	4	3	2	2	2	1	1	1
Que.	41																			
Ans.	1																			