PREVIOUS EXAMS QUESTIONS EXERCISE–I

1. If $\vec{F} = (60\hat{i} + 15\hat{j} - 3\hat{k})$ N and $\vec{v} = (2\hat{i} - 4\hat{j} + 5\hat{k})$ m/s, then instantaneous power is : **[AIPMT 2000]**
(1) 195 watt (2) 45 watt.
(3) 75 watt (4) 100 watt

2. The angle between vectors $(\vec{A}\times\vec{B})$ and $(\vec{B}\times\vec{A})$ is **[CMC Ludhiana 2000]**
(1) π rad (2) $\frac{\pi}{2}$ rad
(3) $\frac{\pi}{4}$ rad (4) zero

3. The unit vector parallel to the resultant of the vectors $\vec{A} = 4\hat{i}+3\hat{j}+6\hat{k}$ and $\vec{B} = -\hat{i}+3\hat{j}-8\hat{k}$ is :
(1) $\frac{1}{7}\left[3\hat{i}+6\hat{j}-2\hat{k}\right]$ **[EAMCET 2000]**
(2) $\frac{1}{7}\left[3\hat{i}+6\hat{j}+2\hat{k}\right]$
(3) $\frac{1}{49}\left[3\hat{i}+6\hat{j}+2\hat{k}\right]$
(4) $\frac{1}{49}\left[3\hat{i}+6\hat{j}-2\hat{k}\right]$

4. A vector $\vec{A}$ points vertically upward and $\vec{B}$ points towards north. The vector product $\vec{A}\times\vec{B}$ is **[UPSEAT 2000]**
(1) zero
(2) along west
(3) along east
(4) vertically downward

5. Which of the following sets of concurrent forces may be in equilibrium ? **[KCET 2000]**
(1) F_1 = 3N, F_2 = 5N, F_3 = 1N
(2) F_1 = 3N, F_2 = 5N, F_3 = 9N
(3) F_1 = 3N, F_2 = 5N, F_3 = 6N
(4) F_1 = 3N, F_2 = 5N, F_3 =15N

6. Two vectors of equal magnitude have a resultant equal to either of them in magnitude . The angle between them is : **[AIIMS 2001]**
(1) 60° (2) 90°
(3) 105° (4) 120°

7. A force of $(3\hat{i}+4\hat{j})$ newton acts on a body and displaces it by $(3\hat{i}+4\hat{j})$ metre. The work done by the force is : **[AIIMS 2001]**
(1) 10J (2) 12J
(3) 19J (4) 25J

8. The vector $\vec{P} = a\hat{i}+a\hat{j}+3\hat{k}$ and $\vec{Q} = a\hat{i}-2\hat{j}-\hat{k}$ are perpendicular to each other. The positive value of a is: **[EAMCET 1998, AIIMS 2002]**
(1) 3 (2) 2
(3) 1 (4) zero

9. The vector sum of two forces is perpendicular to their vector difference. In that case, the force :
(1) Are equal to each other. **[AIPMT 2003]**
(2) Are equal to each other in magnitude.
(3) Are not equal to each other in magnitude.
(4) Cannot be predicted.

10. If three vectors satisfy the relation $\vec{A}.\vec{B} = 0$ and $\vec{A}.\vec{C} = 0$, then $\vec{A}$ can be parallel to **[KCET 2003]**
(1) $\vec{C}$ (2) $\vec{B}$
(3) $\vec{B}\times\vec{C}$ (4) $\vec{B}.\vec{C}$

11. The direction of the angular velocity vector is along :
(1) the tangent to the circular path **[AIIMS 2004]**
(2) the inward radius
(3) the outward radius
(4) the axis of rotation

12. What is the projection of $3\hat{i}+4\hat{k}$ on the y-axis ?
(1) 3 (2) 4 **[RPMT 2004]**
(3) 5 (4) zero

13. If a vector $(2\hat{i}+3\hat{j}+8\hat{k})$ is perpendicular to the vector $(4\hat{j}-4\hat{i}+\alpha\hat{k})$, then the value of α is :
(1) –1 (2) 1/2 **[AIPMT 2005]**
(3) –1/2 (4) 1

14. Square of the resultant of two forces of equal magnitude is equal to three times the product of their magnitude. The angle between them is
(1) 0° (2) 45° **[KCET 2005]**
(3) 60° (4) 90°

15. The vectors $\vec{A}$ and $\vec{B}$ are such that $|\vec{A}+\vec{B}| = |\vec{A}-\vec{B}|$. The angle between vectors $\vec{A}$ and $\vec{B}$ is - **[RPMT 1999, AIPMT 2006]**

(1) 90° (2) 60° (3) 75° (4) 45°

16. If $|\vec{A} \times \vec{B}| = \sqrt{3}\ \vec{A}.\vec{B}$, then the value of $|\vec{A} + \vec{B}|$ is: **[AIPMT 2007]**

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

(3) $(A^2 + B^2 + \sqrt{3}\ AB)^{1/2}$ (4) $(A^2+B^2+AB)^{1/2}$

17. If $|\vec{A} \times \vec{B}| = |\vec{A}.\vec{B}|$, then the angle between $\vec{A}$ and $\vec{B}$ will be : **[AMU 2007]**

(1) 30° (2) 45°

(3) 60° (4) 75°

18. A unit radial vector $\hat{r}$ makes agles of $\alpha = 30°$ relative to the x-axis, $\beta = 60°$ ralative to the y-axis, and $\gamma = 90°$ relative to the z-axis. The vector $\hat{r}$ can be written as : **[AMU 2008]**

(1) $\frac{1}{2}\hat{i} + \frac{\sqrt{3}}{2}\hat{j}$ (2) $\frac{\sqrt{3}}{2}\hat{i} + \frac{1}{2}\hat{j}$

(3) $\frac{\sqrt{2}}{3}\hat{i} + \frac{1}{\sqrt{3}}\hat{j}$ (4) None of these

19. If $\hat{i}, \hat{j}$ and $\hat{k}$ represent unit vectors along the x, y and z-axes respectively, then the angle θ between the vectors $(\hat{i} + \hat{j} + \hat{k})$ and $(\hat{i} + \hat{j})$ is equal to : **[AMU 2009]**

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

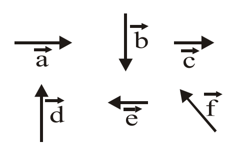
(3) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (4) 90°

20. Find the torque of a force $\vec{F} = -3\hat{i} + \hat{j} + 5\hat{k}$ acting at the point $\vec{r} = 7\hat{i} + 3\hat{j} + \hat{k}$ **[AIIMS 2009]**

(1) $14\hat{i} - 38\hat{j} + 16\hat{k}$ (2) $4\hat{i} + 4\hat{j} + 6\hat{k}$

(3) $-14\hat{i} + 38\hat{j} - 16\hat{k}$ (4) $-21\hat{i} + 3\hat{j} - 5\hat{k}$

21. Six vectors, $\vec{a}$ through $\vec{f}$ have the magnitudes and directions indicated in the figure. Which of the following statements is true ? **[AIPMT 2010]**



(1) $\vec{b} + \vec{e} = \vec{f}$ (2) $\vec{b} + \vec{c} = \vec{f}$

(3) $\vec{d} + \vec{c} = \vec{f}$ (4) $\vec{d} + \vec{e} = \vec{f}$

BRAIN TEASERS — EXERCISE -II

1. The angle that the vector $\vec{A}=2\hat{i}+3\hat{j}$ makes with y-axis is :

(1) $\tan^{-1}(3/2)$ (2) $\tan^{-1}(2/3)$

(3) $\sin^{-1}(2/3)$ (4) $\cos^{-1}(3/2)$

2. Which one of the following statement is false :

(1) Mass, speed and energy are scalars

(2) Momentum, force and torque are vectors

(3) Distance is a scalar while displacement is a vector

(4) A vector has only magnitude where as a scalar has both magnitude and direction

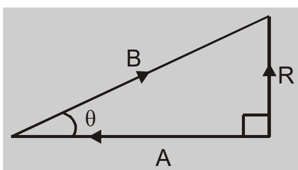
3. In vector diagram shown in figure where ($\vec{R}$) is the resultant of vectors ($\vec{A}$) and ($\vec{B}$). If $R=\frac{B}{\sqrt{2}}$, the value of angle θ is :

(1) 30°

(2) 45°

(3) 60°

(4) 75°



4. If $\hat{n}$ is a unit vector in the direction of the vector $\vec{A}$, then :-

(1) $\hat{n}=\frac{\vec{A}}{|\vec{A}|}$ (2) $\hat{n}=\vec{A}|\vec{A}|$

(3) $\hat{n}=\frac{|\vec{A}|}{\vec{A}}$ (4) $\hat{n}=\hat{n}\times\vec{A}$

5. Two vectors $\vec{A}$ and $\vec{B}$ lie in a plane, another vector $\vec{C}$ lies outside this plane, then the resultant of these three vectors i.e. $\vec{A}+\vec{B}+\vec{C}$:

(1) Can be zero

(2) Cannot be zero

(3) Lies in the plane containing $\vec{A}$ & $\vec{B}$

(4) Lies in the plane containing $\vec{B}$ & $\vec{C}$

6. Given that $\vec{P}+\vec{Q}=\vec{P}-\vec{Q}$. This can be true when :

(1) $\vec{P}=\vec{Q}$

(2) $\vec{Q}=\vec{0}$

(3) Neither $\vec{P}$ nor $\vec{Q}$ is a null vector

(4) $\vec{P}$ is perpendicular to $\vec{Q}$

7. The resultant of $\vec{A}$ and $\vec{B}$ makes an angle α with $\vec{A}$ and β with $\vec{B}$, then :

(1) $\alpha<\beta$ (2) $\alpha<\beta$ if $A<B$

(3) $\alpha<\beta$ if $A>B$ (4) $\alpha<\beta$ if $A=B$

8. Vector $\vec{P}$ makes angle α, β and γ 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

9. The direction cosines of a vector $\hat{i}+\hat{j}+\sqrt{2}\,\hat{k}$ are :-

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

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

10. Two vectors $\vec{A}$ and $\vec{B}$ are such that $\vec{A}+\vec{B}=\vec{C}$ and $A^2+B^2=C^2$. Which of the following statements, is correct:-

(1) $\vec{A}$ is parallel to $\vec{B}$

(2) $\vec{A}$ is anti-parallel to $\vec{B}$

(3) $\vec{A}$ is perpendicular to $\vec{B}$

(4) $\vec{A}$ and $\vec{B}$ are equal in magnitude

11. A vector perpendicular to $(4\hat{i}-3\hat{j})$ may be :

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

(3) $6\hat{i}$ (4) $3\hat{i}-4\hat{j}$

12. Area of a parallelogram, whose diagonals are $3\hat{i}+\hat{j}-2\hat{k}$ and $\hat{i}-3\hat{j}+4\hat{k}$ will be :

(1) 14 unit (2) $5\sqrt{3}$ unit

(3) $10\sqrt{3}$ unit (4) $20\sqrt{3}$ unit

13. If $\vec{A}=3\hat{i}+4\hat{j}$ and $\vec{B}=6\hat{i}+8\hat{j}$ and A and B are the magnitudes of $\vec{A}$ and $\vec{B}$, then which of the following is not true ?

(1) $\vec{A}\times\vec{B}=\vec{0}$ (2) $\frac{A}{B}=\frac{1}{2}$

(3) $\vec{A}.\vec{B}=48$ (4) $A=5$

14. A force $(3\hat{i}+2\hat{j})$N displaces an object through a distance $(2\hat{i}-3\hat{j})$m. The work done is :

(1) zero (2) 12 J

(3) 5 J (4) 13 J

15. A vector $\vec{F}_1$ is along the positive X-axis. If its vector product with another vector $\vec{F}_2$ is zero then $\vec{F}_2$ may be :

(1) $4\hat{j}$ (2) $-(\hat{i}+\hat{j})$

(3) $(\hat{i}+\hat{k})$ (4) $(-4\hat{i})$

16. If $\hat{i}$, $\hat{j}$ and $\hat{k}$ are unit vectors along X, Y & Z axis respectively, then tick the wrong statement :

(1) $\hat{i}.\hat{i}=1$ (2) $\hat{i}\times\hat{j}=\hat{k}$

(3) $\hat{i}.\hat{j}=0$ (4) $\hat{i}\times\hat{k}=-\hat{i}$

17. Two vectors $\vec{P}$ and $\vec{Q}$ are inclined to each other at angle θ. Which of the following is the unit vector perpendicular to $\vec{P}$ and $\vec{Q}$?

(1) $\frac{\vec{P}\times\vec{Q}}{P.Q}$ (2) $\frac{\hat{P}\times\hat{Q}}{\sin\theta}$

(3) $\frac{\hat{P}\times\hat{Q}}{PQ\sin\theta}$ (4) $\frac{\hat{P}\times\vec{Q}}{PQ\sin\theta}$

18. The magnitude of the vector product of two vectors $\vec{A}$ and $\vec{B}$ may not be :

(1) Greater than AB (2) Less than AB

(3) Equal to AB (4) Equal to zero

19. If $\vec{P}\times\vec{Q}=\vec{R}$, then which of the following statements is not true :

(1) $\vec{R}\perp\vec{P}$ (2) $\vec{R}\perp\vec{Q}$

(3) $\vec{R}\perp(\vec{P}+\vec{Q})$ (4) $\vec{R}\perp(\vec{P}\times\vec{Q})$

20. The vector $\vec{B}=5\hat{i}+2\hat{j}-S\hat{k}$ is perpendicular to the vector $\vec{A}=3\hat{i}+\hat{j}+2\hat{k}$ if S =

(1) 1 (2) 4.7

(3) 6.3 (4) 8.5

21. Electro motive force (EMF) is :

(1) scalar

(2) vector

(3) neither scalar nor vector

(4) none of these

22. A physical quantity which has a direction :

(1) must be a vector

(2) may be a vector

(3) must be a scalar

(4) none of the above

23. Which of the following physical quantities is an axial vector ?

(1) displacement (2) force

(3) velocity (4) torque

24. The minimum number of vectors of equal mangitude required to produce a zero resultant is :

(1) 2 (2) 3

(3) 4 (4) more than 4

25. How many minimum number of coplanar vectors having different magnitudes can be added to give zero resultant:-

(1) 2 (2) 3 (3) 4 (4) 5

26. How many minimum number of vectors in different planes can be added to give zero resultant:-

(1) 2 (2) 3

(3) 4 (4) 5

27. What is the maximum number of components into which a vector can be split ?

(1) 2 (2) 3

(3) 4 (4) Infinite

28. What is the maximum number of rectangular components into which a vector can be split in its own plane ?

(1) 2 (2) 3

(3) 4 (4) Infinite

29. What is the maximum number of rectangular components into which a vector can be split in space ?

(1) 2 (2) 3

(3) 4 (4) Infinite

30. The vector sum of the forces of 10 newton and 6 newton can be :

(1) 2N (2) 8N

(3) 18N (4) 20N

31. Vector sum of two forces of 10N and 6N cannot be :

(1) 4N (2) 8N

(3) 12N (4) 2N

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

(1) $\hat{k}$ (2) $\hat{i}+\hat{j}$

(3) $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$ (4) $\frac{\hat{i}+\hat{j}}{2}$

33. What is the projection of $\vec{A}$ on $\vec{B}$?

(1) $\vec{A}.\vec{B}$ (2) $\vec{A}.\hat{B}$

(3) $\vec{B}.\vec{A}$ (4) $\hat{A}.\hat{B}$

34. What is the angle between $\vec{A}$ and the resultant of $\left(\vec{A}+\vec{B}\right)$ and $\left(\vec{A}-\vec{B}\right)$?

(1) 0° (2) $\tan^{-1}\left(\frac{A}{B}\right)$

(3) $\tan^{-1}\left(\frac{B}{A}\right)$ (4) $\tan^{-1}\left(\frac{A-B}{A+B}\right)$

35. The angle between vectors $(\hat{i}+\hat{j})$ and $(\hat{i}+\hat{k})$ is :

(1) 90^0 (2) 180^0

(3) 0^0 (4) 60^0

36. The angle between two vectors given by $(6\hat{i}+6\hat{j}-3\hat{k})$ and $(7\hat{i}+4\hat{j}+4\hat{k})$ is :

(1) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (2) $\cos^{-1}\left(\frac{5}{\sqrt{3}}\right)$

(3) $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$ (4) $\sin^{-1}\left(\frac{\sqrt{5}}{3}\right)$

37. Which of the following vector identities is false ?

(1) $\vec{P}+\vec{Q}=\vec{Q}+\vec{P}$

(2) $\vec{P}+\vec{Q}=\vec{Q}\times\vec{P}$

(3) $\vec{P}.\vec{Q}=\vec{Q}.\vec{P}$

(4) $\vec{P}\times\vec{Q}\neq\vec{Q}\times\vec{P}$

38. If the vectors $\left(\hat{i}+\hat{j}+\hat{k}\right)$ and $3\hat{i}$ form two sides of a triangle, then area of the triangle is :

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

(3) $\frac{3}{\sqrt{2}}$ unit (4) $3\sqrt{2}$ unit

39. Which of the following pair of forces will never give resultant force of 2 N :

(1) 2 N and 2 N (2) 1 N and 1 N

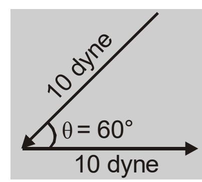
(3) 1 N and 3 N (4) 1 N and 4 N

40. If $\hat{n}=a\hat{i}+b\hat{j}$ is perpendicular to the vector $\left(\hat{i}+\hat{j}\right)$, then the value of a and b may be :

(1) 1, 0 (2) –2, 0

(3) 3, 0 (4) $\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}$

41. Two forces, each numerically equal to 10 dyne are acting as shown in the following figure.
Their resultant is :



(1) 10 dyne

(2) 20 dyne

(3) $10\sqrt{3}$ dyne

(4) 5 dyne

42. What is the component of $(3\hat{i}+4\hat{j})$ along $(\hat{i}+\hat{j})$?

(1) $\frac{1}{2}\left(\hat{j}+\hat{i}\right)$ (2) $\frac{3}{2}\left(\hat{j}+\hat{i}\right)$

(3) $\frac{5}{2}\left(\hat{j}+\hat{i}\right)$ (4) $\frac{7}{2}\left(\hat{j}+\hat{i}\right)$

43. If $\vec{A}+\vec{B}=\vec{C}$ and $A+B=C$, then the angle between $\vec{A}$ and $\vec{B}$ is :

(1) 0 (2) $\frac{\pi}{4}$

(3) $\frac{\pi}{2}$ (4) π

44. If $\vec{A}+\vec{B}$ is a unit vector along x-axis and $\vec{A}=\hat{i}-\hat{j}+\hat{k}$, then what is $\vec{B}$?

(1) $\hat{j}+\hat{k}$ (2) $\hat{j}-\hat{k}$

(3) $\hat{i}+\hat{j}+\hat{k}$ (4) $\hat{i}+\hat{j}-\hat{k}$

45. What is the value of $(\vec{A}+\vec{B})\bullet(\vec{A}\times\vec{B})$?

(1) 0 (2) $A^2 - B^2$

(3) $A^2 + B^2 + 2AB$ (4) none of these

46. If $\vec{A}\times\vec{B}=\vec{0}$ and $\vec{B}\times\vec{C}=\vec{0}$, then the angle between $\vec{A}$ and $\vec{C}$ may be :

(1) zero (2) $\frac{\pi}{4}$

(3) $\frac{\pi}{2}$ (4) none of these

47. The resultant of $\vec{A}$ and $\vec{B}$ is perpendicular to $\vec{A}$. What is the angle between $\vec{A}$ and $\vec{B}$?

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

(3) $\sin^{-1}\left(\frac{A}{B}\right)$ (4) $\sin^{-1}\left(-\frac{A}{B}\right)$

48. The resultant of $\vec{A}$ & $\vec{B}$ is $\vec{R}_1$. On reversing the vector $\vec{B}$, the resultant becomes $\vec{R}_2$. What is the value of $R_1^2+R_2^2$?

(1) $A^2 + B^2$ (2) $A^2 - B^2$

(3) $2(A^2 + B^2)$ (4) $2(A^2 - B^2)$

49. Given that A = B. What is the angle between $(\vec{A}+\vec{B})$ and $(\vec{A}-\vec{B})$?

(1) 30^0 (2) 60^0

(3) 90^0 (4) 180^0

50. The angle between the two vectors $\vec{A}=3\hat{i}+4\hat{j}+5\hat{k}$ and $\vec{B}=3\hat{i}+4\hat{j}-5\hat{k}$ will be :

(1) zero (2) 180°

(3) 90° (4) 45°

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

(1) non-coplanar and non-concurrent forces

(2) coplanar and non-concurrent forces

(3) non-coplanar and concurrent forces

(4) coplanar and concurrent forces

52. What happens, when we multiply a vector by (– 2) ?

(1) direction reverses and unit changes

(2) direction reverses and magnitude is doubled

(3) direction remains unchanged and unit changes

(4) none of these

53. If a unit vector is represented by $0.5\hat{i}-0.8\hat{j}+c\hat{k}$, then the value of 'c' is :

(1) 1 (2) $\sqrt{0.11}$

(3) $\sqrt{0.01}$ (4) $\sqrt{0.39}$

54. For a body, angular velocity $(\vec{\omega})=\hat{i}-2\hat{j}+3\hat{k}$ and radius vector $(\vec{r})=\hat{i}+\hat{j}+\hat{k}$, then its velocity is:

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

(2) $-5\hat{i}+2\hat{j}-3\hat{k}$

(3) $-5\hat{i}-2\hat{j}+3\hat{k}$

(4) $-5\hat{i}-2\hat{j}-3\hat{k}$

55. If $\vec{P}.\vec{Q}$ = PQ, then angle between $\vec{P}$ and $\vec{Q}$ is :

(1) 0° (2) 30°

(3) 45° (4) 60°

56. If the sum of two unit vectors is a unit vector, then the magnitude of their difference is :

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

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

57. The magnitudes of vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are respectively 12, 5 and 13 units and $\vec{A}+\vec{B}=\vec{C}$, then the angle between $\vec{A}$ and $\vec{B}$ is :

(1) 0 (2) 45°

(3) $\pi/2$ (4) $\pi/4$

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

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

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

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

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

59. Force 3N, 4N and 12N act at a point in mutually perpendicular directions. The magnitude of the resultant force is :

(1) 19 N (2) 13 N

(3) 11 N (4) 5 N

60. If vectors $\vec{P}$, $\vec{Q}$ and $\vec{R}$ have magnitudes 5, 12 and 13 units and $\vec{P}+\vec{Q}=\vec{R}$, the angle between $\vec{Q}$ and $\vec{R}$ is :

(1) $\text{Cos}^{-1}\left(\frac{5}{12}\right)$ (2) $\text{Cos}^{-1}\left(\frac{5}{13}\right)$

(3) $\text{Cos}^{-1}\left(\frac{12}{13}\right)$ (4) $\text{Cos}^{-1}\left(\frac{2}{13}\right)$

61. The sum of magnitudes of two forces acting at a point is 16N. If the resultant force is 8N and its direction is perpendicular to smaller force, then the forces are :

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

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

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

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

(3) $\cos^{-1}\left[\frac{-(x^2+y^2)}{x^2-y^2}\right]$ (4) $\cos^{-1}\left[\frac{(x^2-y^2)}{x^2+y^2}\right]$

63. Given that $P = Q = R$. If $\vec{P}+\vec{Q}=\vec{R}$ then the angle between $\vec{P}$ & $\vec{R}$ is θ_1. If $\vec{P}+\vec{Q}+\vec{R}=\vec{0}$ then the angle between $\vec{P}$ & $\vec{R}$ is θ_2. What is the relation between θ_1 and θ_2 :

(1) $\theta_1=\theta_2$ (2) $\theta_1=\frac{\theta_2}{2}$

(3) $\theta_1=2\theta_2$ (4) None of the above

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

(1) 30°, 60°, 90° (2) 45°, 45°, 90°

(3) 45°, 60°, 90° (4) 90°, 135°, 135°

65. 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 R is equal to :

(1) $\left(\frac{P^2-Q^2}{2PQ}\right)$ (2) Q

(3) $\frac{P}{Q}$ (4) $\frac{P+Q}{P-Q}$

66. A vector of length ℓ is turned through the angle θ about its tail. What is the change in the position vector of its head ?

(1) $\ell\cos(\theta/2)$ (2) $2\ell\sin(\theta/2)$

(3) $2\ell\cos(\theta/2)$ (4) $\ell\sin(\theta/2)$

Directions for Assertion & Reason questions

These questions consist of two statements each, printed as Assertion and Reason. While answering these Questions you are required to choose any one of the following four responses.

A.	If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
B.	If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
C.	If Assertion is True but the Reason is False.
D.	If both Assertion & Reason are false.

1. ***Assertion*** **:** If the initial and final positions coincide, the displacement is a null vector.

   Reason **:** A physical quantity can not be called a vector, if its magnitude is zero.

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

2. ***Assertion*** **:** A vector quantity is a quantity that has both magnitude and a direction and obeys the triangle law of addition or equivalently the parallelogram law of addition.

   Reason **:** The magnitude of the resultant vector of two given vectors can never be less than the magnitude of any of the given vector.

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

3. ***Assertion*** **:** The direction of a zero (null) vector is indeterminate.

   Reason **:** We can have $\vec{A} \times \vec{B} = \vec{A}.\vec{B}$ with $\vec{A} \neq \vec{0}$ and $\vec{B} \neq \vec{0}$.

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

4. ***Assertion*** **:** If the rectangular components of a force are 24N and 7N, then the magnitude of the force is 25N.

   Reason **:** If $|\vec{A}| = |\vec{B}| = 1$ then $|\vec{A} \times \vec{B}|^2 + |\vec{A}.\vec{B}|^2 = 1$

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

5. ***Assertion*** **:** If three vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ satisfy the relation $\vec{A}.\vec{B} = 0$ & $\vec{A}.\vec{C} = 0$ then the vector $\vec{A}$ may be parallel to $\vec{B} \times \vec{C}$.

   Reason **:** If $\vec{A} + \vec{B} = \vec{R}$ and A + B = R, then angle between $\vec{A}$ and $\vec{B}$ is zero.

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

6. ***Assertion*** **:** The angle between vectors $\vec{A} \times \vec{B}$ and $\vec{B} \times \vec{A}$ is π radian.

   Reason **:** $\vec{B} \times \vec{A} = -\vec{A} \times \vec{B}$

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

7. ***Assertion*** **:** The minimum number of vectors of unequal magnitude required to produce zero resultant is three.

   Reason **:** Three vectors of unequal magnitude which can be represented by the three sides of a triangle taken in order, produce zero resultant.

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

8. ***Assertion*** **:** A vector can have zero magnitude if one of its components is not zero.

   Reason **:** Scalar product of two vectors cannot be a negative quantity.

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

9. ***Assertion*** **:** The angle between the two vectors $(\hat{i} + \hat{j})$ and $(\hat{i} + \hat{k})$ is $\frac{\pi}{3}$ radian.

   Reason **:** Angle between two vectors $\vec{A}$ and $\vec{B}$ is given by $\theta = \cos^{-1}\left(\frac{\vec{A}.\vec{B}}{AB}\right)$.

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

10. ***Assertion*** **:** Distance is a scalar quantity.

    Reason **:** Distance is the length of path traversed.

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

11. ***Assertion*** : If position vector is given by $\vec{r} = \sin t\,\hat{i} + \cos t\,\hat{j} - 7t\,\hat{k}$, then magnitude of acceleration $|\vec{a}| = 1$.

Reason : The angles which the vector $\vec{A} = A_1\hat{i} + A_2\hat{j} + A_3\hat{k}$ makes with the co-ordinate axes are given by $\cos\alpha = \frac{A_1}{A}$, $\cos\beta = \frac{A_2}{A}$ & $\cos\gamma = \frac{A_3}{A}$.

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

12. ***Assertion*** : Adding a scalar to a vector of the same dimensions is a meaningful algebraic operation.

Reason : The displacement can be added with distance.

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

13. ***Assertion*** : The dot product of one vector with another vector may be a scalar or a vector.

Reason : If the product of two vectors is a vector quantity, then product is called a dot product.

[AIIMS 1998]

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

14. ***Assertion*** : A physical quantity can be regarded as a vector, if magnitude as well as direction is associated with it. **[AIIMS 2000]**

Reason : A physical quantity can be regarded as a scalar quantity, if it is associated with magnitude only.

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

15. ***Assertion*** : Vector $(\hat{i} + \hat{j} + \hat{k})$ is perpendicular to $(\hat{i} - 2\hat{j} + \hat{k})$ **[AIIMS 2009]**

Reason : Two non-zero vectors are perpendicular if their dot product is equal to zero.

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

ANSWER KEY — EXERCISE - I

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	1	1	2	3	4	4	1	2	3	4	4	3	3	1
Que.	16	17	18	19	20	21									
Ans.	4	2	2	1	1	4									

ANSWER KEY — EXERCISE - II

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	4	2	1	2	2	3	3	3	3	2	2	3	1	4
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	4	2	1	4	4	1	2	4	1	2	3	4	1	2	2
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	4	3	2	1	4	4	2	3	4	4	1	4	1	2	1
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	1	2	3	3	3	3	2	2	1	1	2	3	3	2	3
Que.	61	62	63	64	65	66									
Ans.	1	1	2	4	2	2									

ANSWER KEY — EXERCISE - III

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	3	3	2	2	1	2	4	1	1	2	4	4	2	1