Vectors and their Applications

Type – 1

Choose the most appropriate option (a, b, c or d).

Q 1. ABCDEF is a regular hexagon where centre O is the origin. If the position vectors of A and B are $\vec{i}-\vec{j}+2\vec{k}$ and $2\vec{i}+\vec{j}+\vec{k}$ respectively then $\vec{BC}$ is equal to

(a) $\vec{i}-\vec{j}+2\vec{k}$ (b) $-\vec{i}+\vec{j}-2\vec{k}$ (c) $3\vec{i}+3\vec{j}-4\vec{k}$ (d) none of these

Q 2. The position vectors of two vertices and the centroid of a triangle are $\vec{i}+\vec{j}, 2\vec{i}-\vec{j}+4\vec{k}$ and $\vec{k}$ respectively. The position vector of the third vertex of the triangle is

(a) $-3\vec{i}+2\vec{k}$ (b) $3\vec{i}-2\vec{k}$ (c) $\vec{i}+\frac{2}{3}\vec{k}$ (d) none of these

Q 3. Let the position vectors of the points A, B, C be $\vec{i}+2\vec{j},+3\vec{k},-\vec{i}-\vec{j}+8\vec{k}$ and $-4\vec{i}+4\vec{j},6\vec{k}$ respectively. Then the ABC is

(a) right angled (b) equilateral (c) isosceles (d) none of these

Q 4. $\vec{a},\vec{b},\vec{c}$ are three vectors of which every pair is noncollinear. If the vector $\vec{a}+\vec{b}$ and are collinear with $\vec{c}$ and $\vec{a}$ respectively then $\vec{a}+\vec{b}+\vec{c}$ is

(a) a unit vector (b) the null vector (c) equally inclined to $\vec{a},\vec{b},\vec{c}$ (d) none of these

Q 5. If $\vec{r}=3\vec{i}+2\vec{j}-5\vec{k}, \vec{a}=2\vec{i}-\vec{j}+\vec{k}, \vec{b}=\vec{i}+3\vec{j}-2\vec{k}$ and s $\vec{c}=2\vec{i}+\vec{j}-3\vec{k}$ such that $\vec{r}=\lambda\vec{a}+\mu\vec{b}+v\vec{c}$ then

(a) $\mu, \frac{\lambda}{2}, v$ are in AP (b) λ, μ, v are in AP (c) λ, μ, v are in HP (d) μ, λ, v are in GP

Q 6. The position vectors of three points are $2\vec{a}-\vec{b}+3\vec{c}, \vec{a}-2\vec{b}+\lambda\vec{c}$ and $\mu\vec{a}-5\vec{b}$ where $\vec{a},\vec{b},\vec{c}$ are noncoplanar vectors. The are collinear when

(a) $\lambda=-2\mu=\frac{9}{4}$ (b) $\lambda=-\frac{9}{4}, \mu=2$ (c) $\lambda=\frac{9}{4}, \mu=-2$ (d) none of these

Q 7. If $\vec{a}=\vec{i}+\vec{j}+\vec{k}, \vec{b}=4\vec{i}+3\vec{j}+4\vec{k}$ and $\vec{c}=\vec{i}+\alpha\vec{j}+\beta\vec{k}$ are linearly dependent vectors and $|\vec{c}|=\sqrt{3}$ then

(a) $\alpha = 1, \beta = -1$ (b) $\alpha = 1, \beta = \pm 1$ (c) $\alpha = -1, \beta = \pm 1$ (d) $\alpha = \pm 1, \beta = 1$

Q 8. Let $\vec{OA}=\vec{a}$ and $\vec{OB}=\vec{b}$. A vector along one of the bisectors of the angle $\angle AOB$ is

(a) $\vec{a}+\vec{b}$ (b) $\vec{a}-\vec{b}$ (c) $\frac{\vec{a}}{|\vec{a}|}+\frac{\vec{b}}{|\vec{b}|}$ (d) none of these

Q 9. A vector has components 2p and 1 with respect to a rectangular Cartesian system. The axes are rotated through an angle α about the origin in the anticlockwise sense. If the vector has components p + 1 and 1 with respect to the new system then

(a) $p = 1, -\frac{1}{3}$ (b) $p = 0$ (c) $p = -1, \frac{1}{3}$ (d) $p = 1, -1$

Q 10. If $\vec{a}$ and $\vec{b}$ are two vectors of magnitude inclined at an angle 60° then the angle between $\vec{a}$ and $\vec{a}+\vec{b}$ is

(a) 30° (b) 60° (c) 45° (d) none of these

Q 11. Let $|\vec{a}|=|\vec{b}|=|\vec{a}-\vec{b}|=1$ Then the angle between $\vec{a}$ and $\vec{b}$ is

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$

Q 12. A vector of magnitude 4 which is equally inclined to the vectors $\vec{i}+j, \vec{j}+\vec{k}\ \vec{k}+\vec{i}$ is

(a) $\frac{4}{\sqrt{3}}(\vec{i}-\vec{j}-\vec{k})$ (b) $\frac{4}{\sqrt{3}}(\vec{i}+\vec{j}-\vec{k})$ (c) $\frac{4}{\sqrt{3}}(\vec{i}+\vec{j}+\vec{k})$ (d) none of these

Q 13. If $\vec{a}+\vec{b}=2\vec{i}$ and $2\vec{a}-\vec{b}=\vec{i}-\vec{j}$ then cosine of the angle between $\vec{a}$ and $\vec{b}$ is

(a) $\sin^{-1}\frac{4}{5}$ (b) $\cos^{-1}\frac{4}{5}$ (c) $\cos^{-1}\frac{3}{5}$ (d) none of these

Q 14. Let $|\vec{a}|=1, |\vec{b}|=\sqrt{2}, |\vec{c}|=\sqrt{3}$, and $\vec{a}\perp(\vec{b}+\vec{c}), \vec{b}\perp(\vec{c}+\vec{a})$ and $\vec{c}\perp(\vec{a}+\vec{b})$. Then $|\vec{a}+\vec{b}+\vec{c}|$ is

(a) $\sqrt{6}$ (b) 6 (c) $\sqrt{14}$ (d) none of these

Q 15. $(\vec{a}.\vec{i})\vec{i}+(\vec{a}.\vec{j})\vec{j}+(\vec{a}.\vec{k})$ is equal to

(a) $\vec{i}+\vec{j}+\vec{k}$ (b) $\vec{a}$ (c) $3\vec{a}$ (d) none of these

Q 16. If a, b, are unit vectors such that a + b is also a unit vector then the angle between the vectors a and b is

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) $\frac{2\pi}{3}$

Q 17. If $\vec{a}.\vec{i} = \vec{a}.(\vec{i}+\vec{j}) = \vec{a}.(\vec{i}+\vec{j}+\vec{k}) = 1$ then $\vec{a}$ is

(a) $\vec{i}-\vec{j}$ (b) $\vec{i}$ (c) $\vec{j}$ (d) $\vec{k}$

Q 18. $(\vec{a}.\vec{i})^2+(\vec{a}.\vec{j})^2+(\vec{a}+\vec{k})^2$ is equal to

(a) $\vec{a}$ (b) 3 (c) $|\vec{a}.(\vec{i}+\vec{j}+\vec{k})|^2$ (d) $\vec{k}$

Q 19. $|\vec{a}+\vec{b}|^2-|\vec{a}-\vec{b}|^2$ is equal to

(a) $4\vec{a}.\vec{b}$ (b) 0 (c) $4|\vec{a}.\vec{b}|$ (d) none of these

Q 20. If a,b,c are the pth, qth, rth terms of an HP and

then $\vec{\mu}=(q-r)\vec{i}+(r-p)\vec{j}+(p-q)\vec{k}, \vec{v}\frac{\vec{i}}{a}+\frac{\vec{j}}{b}+\frac{\vec{k}}{c}$

(a) $\vec{\mu}.\vec{v}$ are parallel vectors (b) $\vec{\mu}.\vec{v}$ are orthogonal vectors

(c) $\vec{\mu}.\vec{v}=1$ (d) $\vec{\mu}\times\vec{v}=\vec{i}+\vec{j}+\vec{k}$

Q 21. If $\vec{a}+\vec{b}\perp\vec{a}$ and $|\vec{b}|=\sqrt{2}|\vec{a}|$ then

(a) $(2\vec{a}+\vec{b})\,||\,\vec{b}$ (b) $(2\vec{a}+\vec{b})\perp\vec{b}$ (c) $(2\vec{a}-\vec{b})\perp\vec{b}$ (d) $(2\vec{a}+\vec{b})\perp\vec{a}$

Q 22. Let $\vec{a}=2\vec{i}+\vec{j}+\vec{k}, \vec{b}=\vec{i}+2\vec{j}-\vec{k}$ and a unit vector $\vec{c}$ be coplanar. If $\vec{c}$ is perpendicular to $\vec{a}$ then $\vec{c}$ =

(a) $\frac{1}{\sqrt{2}}(-\vec{j}+\vec{k})$ (b) $\frac{1}{\sqrt{3}}(-\vec{i}-\vec{j}+\vec{k})$ (c) $\frac{1}{\sqrt{5}}(\vec{i}-2\vec{j})$ (d) $\frac{1}{\sqrt{3}}(\vec{i}-\vec{j}-\vec{k})$

Q 23. Let $\vec{\lambda}=\vec{a}\times(\vec{b}+\vec{c}), \vec{\mu}=\vec{b}\times(\vec{c}+\vec{a})$ and $\vec{v}=\vec{c}\times(\vec{a}+\vec{b})$. Then

(a) $\vec{\lambda}+\vec{\mu}=\vec{v}$ (b) $\vec{\lambda},\vec{\mu},\vec{v}$ are coplanar (c) $\vec{\lambda}+\vec{v}=2\vec{\mu}$ (d) none of these

Q 24. Let $\vec{a},\vec{b},\vec{c}$ be three unit vectors such that $|\vec{a}+\vec{b}+\vec{c}|=1$ $\vec{a}\perp\vec{b}$. If $\vec{c}$ makes angles α, β with $\vec{a},\vec{b}$ respectively then cos α + cos β is equal to

(a) $\frac{3}{2}$ (b) 1 (c) – 1 (d) none of these

Q 25. If $\vec{a},\vec{b}\vec{c}$ are three vectors of equal magnitude and the angle between each pair of vectors is $\frac{\pi}{3}$ such that $|\vec{a}+\vec{b}+\vec{c}|=\sqrt{6}$ then $|\vec{a}|$ is equal to

(a) 2 (b) – 1 (c) 1 (d) $\frac{1}{3}\sqrt{6}$

Q 26. If $|\vec{a}|=5, |\vec{a}-b|=8$ and $|\vec{a}+b|$ = 10 then $|\vec{b}|$ is

(a) 1 (b) $\sqrt{57}$ (c) 3 (d) none of these

Q 27. If $\vec{a}$ and $\vec{b}$ are unit vectors and α is the angle between them then cos $\frac{\alpha}{2}$ is

(a) $\frac{1}{2}|\vec{a}+\vec{b}|$ (b) $\frac{1}{2}|\vec{a}-\vec{b}|$ (c) $|\vec{a}+\vec{b}|$ (d) none of these

Q 28. If $|\vec{a}+\vec{b}|=|\vec{a}-\vec{b}|$ then

(a) $\vec{a}\,||\,\vec{b}$ (b) $\vec{a}\perp\vec{b}$ (c) $|\vec{a}|=|\vec{b}|$ (d) none of these

Q 29. Two vectors $\vec{a}=\vec{i}+\frac{\vec{i}}{\sqrt{3}}$ and $\vec{b}=\frac{\vec{i}}{\sqrt{3}}+\vec{j}$ are

(a) perpendicular to each other (b) parallel to each other

(c) inclined to each other at an angle $\frac{\pi}{3}$ (d) inclined to each other at an angle $\frac{\pi}{6}$

Q 30. Let $\vec{a}=2\vec{i}-\vec{j}+\vec{k}, \vec{b}=\vec{i}+3\vec{j}-\vec{k}$ and $\vec{c}=\vec{i}+\vec{j}-2\vec{k}$. Avector in the plane if $\vec{b}$ and $\vec{c}$ whose projection on $\vec{a}$ has the magnitude $\vec{a}$ is

(a) $2\vec{i}+3\vec{j}-3\vec{k}$ (b) $2\vec{i}+3\vec{j}+3\vec{k}$ (c) $-2\vec{i}-\vec{j}+5\vec{k}$ (d) $2\vec{i}+\vec{j}+5\vec{k}$

Q 31. ABC is an equilateral triangle of side a. The value of $\vec{AB}.\vec{BC}+\vec{BC}.\vec{CA}+\vec{CA}.\vec{AB}$ is equal to

(a) $\frac{3a^2}{2}$ (b) $3a^2$ (c) $-\frac{3a^2}{2}$ (d) none of these

Q 32. If $\vec{a}=\vec{i}+\vec{j}, \vec{b}=2\vec{j}-\vec{k}$ and $\vec{r}\times\vec{a}=\vec{b}\times\vec{a}, \vec{r}\times\vec{b}=\vec{a}\times\vec{b}$ then $\frac{\vec{r}}{|\vec{r}|}$ is equal to

(a) $\frac{1}{\sqrt{11}}(\vec{i}+3\vec{j}-\vec{k})$ (b) $\frac{1}{\sqrt{11}}(\vec{i}-3\vec{j}+\vec{k})$ (c) $\frac{1}{\sqrt{11}}(\vec{i}-\vec{j}+\vec{k})$ (d) none of these

Q 33. $(\vec{a}\times\vec{b})^2+(\vec{a}.\vec{b})^2$ is equal to

(a) 0 (b) $|\vec{a}|^2|\vec{b}|^2$ (c) $(|\vec{a}|+|\vec{b}|)^2$ (d) 1

Q 34. If $\vec{p},\vec{q}$ are two noncollinear and nonzero vector such that

$$(b-c)\vec{p}\times\vec{q}+(c-a)\vec{p}+(a-b)\vec{q}=0,$$

where a,b,c are the lengths of the sides of a triangle, then the triangle is

(a) right angled (b) obtuse angled (c) equilateral (d) isosceles

Q 35. If $\vec{a},\vec{b},\vec{c}$ are any three vectors such that $(\vec{a}+\vec{b}).\vec{c}=(\vec{a}-\vec{b}).\vec{c}=0$ then $(\vec{a}\times\vec{b})\times\vec{c}$ is

(a) $\vec{0}$ (b) $\vec{a}$ (c) $\vec{b}$ (d) none of these

Q 36. Then nit vector perpendicular to both the vectors $\vec{a}=\vec{i}+\vec{j}+\vec{k}$ and $\vec{b}=2\vec{i}-\vec{j}+3\vec{k}$ and making an acute angle with the vector $\vec{k}$ is

(a) $-\frac{1}{\sqrt{26}}(4\vec{i}-\vec{j}-3\vec{k})$ (b) $\frac{1}{\sqrt{26}}(4\vec{i}-\vec{j}-3\vec{k})$ (c) $\frac{1}{\sqrt{26}}(4\vec{i}-\vec{j}+3\vec{k})$ (d) none of these

Q 37. Let $\vec{a}=\vec{i}-2\vec{j}+3\vec{k},\vec{b}=2\vec{i}+3\vec{j}-\vec{k}$ and $\vec{c}=\lambda\vec{i}+\vec{j}(2\lambda-1)\vec{k}$. If $\vec{c}$ is parallel to the plane of the vectors $\vec{a}$ and $\vec{b}$ then λ is

(a) 1 (b) 0 (c) – 1 (d) 2

Q 38. Let $\vec{a}$ be a unit vector perpendicular to unit vectors $\vec{b}$ and $\vec{c}$ and if the angle between $\vec{b}$ and be α then $\vec{b}\times\vec{c}$ is

(a) $\cos\alpha\vec{a}$ (b) $\text{cosec}\,\alpha\vec{a}$ (c) $\sin\alpha\vec{a}$ (d) none of these

Q 39. If $\vec{a}.\vec{b}=0$ and $\vec{a}\times\vec{b}=\vec{0}$ then

(a) $\vec{a}\,||\,\vec{b}$ (b) $\vec{a}\perp\vec{b}$ (c) $\vec{a}=\vec{b}$ or $=\vec{b}=\vec{0}$ (d) none of these

Q 40. The area of the parallelogram whose diagonals represent the vectors $3\vec{i}+\vec{j}-2\vec{k}$ and $\vec{i}-3\vec{j}+4\vec{k}$ is

(a) $10\sqrt{3}$ (b) $5\sqrt{3}$ (c) 8 (d) 4

Q 41. $(\vec{r}.\vec{i})(\vec{r}\times\vec{i})+(\vec{r}.\vec{j})(\vec{r}\times\vec{j})+(\vec{r}.\vec{k})(\vec{r}\times\vec{k})$ is equal to

(a) $3\vec{r}$ (b) $\vec{r}$ (c) 8 (d) none of these

Q 42. Let $\vec{a}=\vec{i}+\vec{j}+\vec{k},\vec{c}=\vec{j}-\vec{k}$. If $\vec{b}$ is a vector satisfying $\vec{a}\times\vec{b}=\vec{c}$ and $\vec{a}.\vec{b}=3$ then $\vec{b}$ is

(a) $\frac{1}{3}(5\vec{i}+2\vec{j}+2\vec{k})$ (b) $\frac{1}{3}(5\vec{i}-2\vec{j}-2\vec{k})$ (c) $3\vec{i}-\vec{j}-\vec{k}$ (d) none of these

Q 43. A unit vector perpendicular to the plane passing through the points whose position vector are $\vec{i}-\vec{j}+2\vec{k}-2\vec{i}-\vec{k}$ and $2\vec{i}+\vec{k}$ is

(a) $2\vec{i}+\vec{j}+\vec{k}$ (b) $\frac{1}{\sqrt{6}}(2\vec{i}+\vec{j}+\vec{k})$ (c) $\frac{1}{\sqrt{6}}(\vec{i}+2\vec{j}+\vec{k})$ (d) none of these

Q 44. Let $\vec{r}\times\vec{a}=\vec{b}\times\vec{a}$ and v, where $\vec{a}.\vec{b}\neq 0$. Then $\vec{r}$ is equal to

(a) $\vec{b}+t\vec{a}$ where t is a scalar

(b) $\vec{b}-\frac{\vec{b}.\vec{c}}{\vec{a}.\vec{c}}\vec{a}$

(c) $\vec{a}-\vec{c}$

(d) none of these

Q 45. For the vectors $\vec{u},\vec{v},\vec{w}$ which of the following expressions is not equal to any one of the remaining three option?

(a) $\vec{u}.(\vec{v}\times\vec{w})$ (b) $(\vec{v}\times\vec{w}).\vec{u}$ (c) $\vec{v}.(\vec{u}\times\vec{w})$ (d) $(\vec{u}\times\vec{v}).\vec{w}$

Q 46. For three noncoplanar vectors $\vec{a},\vec{b},\vec{c}$ the relation hold

$$|\vec{a}\times\vec{b}.\vec{c}|=|\vec{a}||\vec{b}||\vec{c}|$$

holds if and only if

(a) $\vec{b}.\vec{c}=\vec{c}.\vec{a}=0$ (b) $\vec{a}.\vec{b}=\vec{b}.\vec{c}=0$ (c) $\vec{a}.\vec{b}=\vec{b}.\vec{c}=\vec{c}.\vec{a}=0$ (d) $\vec{c}.\vec{a}=\vec{a}.\vec{b}=0$

Q 47. $[\vec{a}+\vec{b}\ \ \vec{b}+\vec{c}\ \ \vec{c}+\vec{a}]$ is equal to

(a) $2[\vec{a}\ \vec{b}\ \vec{c}]$ (b) $3[\vec{a}\ \vec{b}\ \vec{c}]$ (c) $[\vec{a}\ \vec{b}\ \vec{c}]$ (d) 0

Q 48. $\vec{a}-\vec{b}\ \ \vec{b}-\vec{c}\ \ \vec{c}-\vec{a}$ is equal to

(a) $2[\vec{a}\ \vec{b}\ \vec{c}]$ (b) $[\vec{a}\ \vec{b}\ \vec{c}]$ (c) 0 (d) none of these

Q 49. Let $\vec{a},\vec{b},\vec{c}$ be three unit vectors and $\vec{a}.\vec{b}=\vec{a}.\vec{c}=0$. If the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{3}$ then

$|[\vec{a}\vec{b}\vec{c}]|$ is equal to

(a) $\frac{\sqrt{3}}{2}$ (b) $\frac{1}{2}$ (c) 1 (d) none of these

Q 50. Let a,b,c, be three distinct positive real numbers. If $\vec{p},\vec{q},\vec{r}$ lie in a plane, where

$\vec{p}=a\vec{i}-a\vec{j}+b\vec{k},\vec{q}=\vec{i}+\vec{k}$ and $\vec{r}=c\vec{i}+c\vec{j}+b\vec{k}$, then b us

(a) then AM of a,c (b) then GM if a,c (c) sthem HM of a,c (d) equal to 0

Q 51. Which of the following is not equal to s $[\vec{a}\ \ \vec{b}\ \ \vec{c}]$?

(a) $\vec{a}.\vec{b}\times\vec{c}$ (b) $\vec{c}\times\vec{a}.\vec{b}$ (c) $\vec{b}.\vec{a}\times\vec{c}$ (d) $\vec{c}.\vec{a}\times\vec{b}$

Q 52. If $[\vec{a}\ \ \vec{b}\ \ \vec{c}]$ = 1 then $\frac{\vec{a}.\vec{b}\times\vec{c}}{\vec{c}\times\vec{a}.\vec{b}}+\frac{\vec{b}.\vec{c}\times\vec{a}}{\vec{a}\times\vec{b}.\vec{c}}+\frac{\vec{c}.\vec{a}\times\vec{b}}{\vec{b}\times\vec{c}.\vec{a}}$ is equal to

(a) 3 (b) 1 (c) 0 (d) none of these

Q 53. $\vec{a},\vec{b},\vec{c}$ are noncoplanar vectors and $\vec{p},\vec{q},\vec{r}$ are defined as

$$\vec{p}=\frac{\vec{b}\times\vec{c}}{[\vec{b}\vec{c}\vec{a}]},\vec{q}=\frac{\vec{c}\times\vec{a}}{[\vec{c}\vec{a}\vec{b}]},\vec{r}=\frac{\vec{a}\times\vec{b}}{[\vec{a}\vec{b}\vec{c}]}$$

$(\vec{a}+\vec{b}).\vec{p}+(\vec{b}+\vec{c}).\vec{q}+(\vec{c}+\vec{a}).\vec{r}$ is equal to

(a) 0 (b) 1 (c) 2 (d) 3

Q 54. If $\vec{a},\vec{b},\vec{c}$ are three noncoplanar vectors represented by concurrent edges of a parallelepiped of volume 4 then

$$(\vec{a}+\vec{b}).(\vec{b}\times\vec{c})+(\vec{b}\times c).(\vec{c}\times\vec{a})+(\vec{c}+\vec{a}).(\vec{a}\times\vec{b})$$

is equal to

(a) 12 (b) 4 (c) $\pm$ 12 (d) 0

Q 55. If $\vec{a},\vec{b},\vec{c}$ are three noncoplanar nonzero vectors then

$$(\vec{a}.\vec{a})\vec{b}\times\vec{c}+(\vec{a}.\vec{b})\vec{c}\times\vec{a}+(\vec{a}.\vec{c})\vec{a}\times\vec{b}$$

Is equal to

(a) $[\vec{b}\ \vec{c}\ \vec{a}]\vec{a}$ (b) $[\vec{c}\ \vec{a}\ \vec{b}]\vec{b}$ (c) $[\vec{a}\ \vec{b}\ \vec{c}]\vec{c}$ (d) none of these

Q 56. Let $\vec{r}$ be a vector perpendicular to $\vec{a}+\vec{b}+\vec{c}$, where $[\vec{a}\ \vec{b}\ \vec{c}]=2$. If $\vec{r}=l(\vec{b}\times\vec{c})+m(\vec{c}\times\vec{a})+n(\vec{a}\times\vec{b})$ then l + m + n is

(a) 2 (b) 1 (c) 0 (d) none of these

Q 57. If $\vec{a},\vec{b},\vec{c}$ are any three vectors in space then $(\vec{c}+\vec{b})\times(\vec{c}+\vec{a}).(\vec{c}+\vec{b}+\vec{a})$ is equal to

(a) $3[\vec{a}\ \vec{b}\ \vec{c}]$ (b) 0 (c) $[\vec{a}\ \vec{b}\ \vec{c}]$ (d) none of these

Q 58. If $\vec{a},\vec{b},\vec{c}$ are three noncoplanar vectors then $[\vec{a}+\vec{b}+\vec{c}\ \ \vec{a}-\vec{c}\ \ \vec{a}-\vec{b}]$ is equal to

(a) 0 (b) $[\vec{a}\ \vec{b}\ \vec{c}]$ (c) $-3[\vec{a}\ \vec{b}\ \vec{c}]$ (d) $2[\vec{a}\ \vec{b}\ \vec{c}]$

Q 59. $[\vec{a}\ \ \vec{b}+\vec{c}\ \ \vec{a}+\vec{b}+\vec{c}]$ is equal to

(a) 0 (b) $2[\vec{a}\ \vec{b}\ \vec{c}]$ (c) $[\vec{a}\ \vec{b}\ \vec{c}]$ (d) none of these

Q 60. If $\vec{a},\vec{b}$ are nonezero and noncolinear vectors then $[\vec{a},\vec{b}\ \ \vec{i}]\,\vec{i}+[\vec{a}\ \vec{b}\ \ \vec{j}]\,\vec{j}+[\vec{a}\ \vec{b}\ \vec{k}]\vec{k}$ is equal to

(a) $\vec{a}+\vec{b}$ (b) $\vec{a}\times\vec{b}$ (c) $\vec{a}-\vec{b}$ (d) $\vec{b}\times\vec{a}$

Q 61. The three concurrent edges of a parallelpiped respesent the vectors $\vec{a},\vec{b},\vec{c}$ such that $[\vec{a}\ \vec{b}\ \vec{c}]=\lambda$. Then the volume of the parallelpiped whose three concurrent edges are the three concurrent diagonals of three faces of the given parallelpiped is

(a) 2λ (b) 3λ (c) λ (d) none of these

Q 62. $\vec{i}\times(\vec{a}\times\vec{i})+\vec{j}\times(\vec{a}\times\vec{j})+\vec{k}\times(\vec{a}\times\vec{k})$ is equal to

(a) $2\vec{a}$ (b) $3\vec{a}$ (c) $\vec{0}$ (d) none of these

Q 63. Let $\vec{a},\vec{b}$ and $\vec{c}$ be three vectors having magnitudes 1,1 and 2 respectively. If $\vec{a}\times(\vec{a}\times\vec{c})+\vec{b}=\vec{0}$, the acute angle between $\vec{a}$ and $\vec{c}$ is

(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{6}$ (d) none of these

Q 64. If $\vec{b}$ is a unit vector then $(\vec{a}.\vec{b})\vec{b}+\vec{b}\times(\vec{a}\times\vec{b})$ is equal to

(a) $\vec{a}^{2}\vec{b}$ (b) $(\vec{a}.\vec{b})\vec{a}$ (c) $\vec{a}$ (d) none of these

Q 65. Let $\vec{a},\vec{b},\vec{c}$ be three unit vectors such that $\vec{a}\times(\vec{b}\times\vec{c})=\frac{\vec{b}+\vec{c}}{\sqrt{2}}$ and the angles between $\vec{a},\vec{c}$ and $\vec{a},\vec{b}$ be α and β respectively then

(a) $\alpha=\frac{3\pi}{4},\beta=\frac{\pi}{4}$ (b) $\alpha=\frac{\pi}{4},\beta=\frac{7\pi}{4}$ (c) $\alpha=\frac{\pi}{4},\beta=\frac{3\pi}{4}$ (d) none of these

Q 66. Let $\vec{p},\vec{q},\vec{r}$ be three mutually perpendicular vectors of the same magnitude. If a vector $\vec{x}$ satisfies the equation

$$\vec{p}\times\{(\vec{x}-\vec{q})\times\vec{p}\}+\vec{q}\times\{(\vec{x}-\vec{r})\times\vec{q}\}+\vec{r}\{(\vec{x}-\vec{p})\times\vec{r}\}=\vec{0}$$

this x is given by

(a) $\frac{1}{2}(\vec{p}+\vec{q}-2\vec{r})$ (b) $\frac{1}{2}(\vec{p}+\vec{q}+\vec{r})$ (c) $\frac{1}{3}(\vec{p}+\vec{q}+\vec{r})$ (d) $\frac{1}{3}(2\vec{p}+\vec{q}+\vec{r})$

Q 67. If . and x represent dot product and cross product respectively then which of the following is meaningless?

(a) $(\vec{a}\times\vec{b}).(\vec{c}\times\vec{d})$ (b) $(\vec{a}\times\vec{b})\times(\vec{c}\times\vec{d})$ (c) $(\vec{a}.\vec{b})(\vec{c}\times\vec{d})$ (d) $(\vec{a}.\vec{b})\times(\vec{c}\times\vec{d})$

Q 68. $(\vec{a}\times\vec{i})^2+(\vec{a}\times\vec{j})^2+(\vec{a}\times\vec{k})^2$ is equal to

(a) $\vec{a}^2$ (b) $3\vec{a}^2$ (c) $2\vec{a}^2$ (d) none of these

Q 69. If $\|\vec{a}\vec{b}\times\vec{c}$ then $(\vec{a}\times\vec{b}).(\vec{a}\times\vec{c})$ is equal to

(a) $\vec{a}^2(\vec{b}.\vec{c})$ (b) $\vec{b}^2(\vec{a}.\vec{c})$ (c) $\vec{c}^2(\vec{a}.\vec{b})$ (d) none of these

Q 70. If $\vec{a},\vec{b},\vec{c}$ are noncoplanar nonzero vectors then

$$(\vec{a}\times\vec{b})\times(\vec{a}\times\vec{c})+(\vec{b}\times\vec{c})\times(\vec{b}\times\vec{a})+(\vec{c}\times\vec{a})\times(\vec{c}\times\vec{b})$$

is equal to

(a) $[\vec{a}\ \vec{b}\ \vec{c}]^2(\vec{a}+\vec{b}+\vec{c})$ (b) $[\vec{a}\ \vec{b}\ \vec{c}](\vec{a}+\vec{b}+\vec{c})$ (c) $\vec{0}$ (d) none of these

Q 71. If $\vec{a},\vec{b},\vec{c}$ are three noncoplanar nonzero vectors and $\vec{r}$ is any vector in space then

$(\vec{a}\times\vec{b})\times(\vec{r}\times\vec{c})+(\vec{b}\times\vec{c})\times(\vec{r}\times\vec{a})+(\vec{c}\times\vec{a})\times(\vec{r}\times\vec{b})$ is equal to

(a) $2[\vec{a}\ \vec{b}\ \vec{c}]\vec{r}$ (b) $3[\vec{a}\ \vec{b}\ \vec{c}]\vec{r}$ (c) $[\vec{a}\ \vec{b}\ \vec{c}]\vec{r}$ (d) none of these

Q 72. Let $\vec{a},\vec{b},\vec{c}$ be three unit vectors of which $\vec{b}$ and $\vec{c}$ are nonparallel. Let the angle between $\vec{a}$ and $\vec{b}$ be α and that between $\vec{a}$ and $\vec{b}$ be α and that between $\vec{a}$ and $\vec{c}$ be β. If $\vec{a}\times(\vec{b}\times\vec{c})=\frac{1}{2}\vec{b}$ then

(a) $\alpha=\frac{\pi}{3},\beta\frac{\pi}{2}$ (b) $\alpha=\frac{\pi}{2},\beta\frac{\pi}{3}$ (c) $\alpha=\frac{\pi}{6},\beta=\frac{\pi}{3}$ (d) none of these

Q 73. Let $\vec{a}=2\vec{i}+\vec{j}-2\vec{k}$ and $\vec{b}=\vec{i}+\vec{j}$. If $\vec{c}$ is a vector such that $\vec{a}.\vec{c}=|\vec{c}|,|\vec{c}-\vec{a}|=2\sqrt{2}$ and the angle between $\vec{a}\times\vec{b}$ and $\vec{c}$ is 30° then $|(\vec{a}\times\vec{b})\times\vec{c}|$ is equal to

(a) $\frac{2}{3}$ (b) $\frac{3}{2}$ (c) 2 (d) 3

Q 74. Let $\vec{a}$, and $\vec{b}$ be two noncollinear unit vectors. If $\vec{u}=\vec{a}-(\vec{a}.\vec{b})\vec{b}$ and $\vec{v}=\vec{a}\times\vec{b}$ then $|\vec{v}|$ is

(a) $|\vec{u}|$ (b) $|\vec{u}|+|\vec{u}.\vec{a}|$ (c) $|\vec{u}|+|\vec{u}.\vec{b}|$ (d) $|\vec{u}|+\vec{u}.(\vec{a}+\vec{b})$

Q 75. If $\vec{a},\vec{b},\vec{c}$ be three vectors such that $[\vec{a}\ \vec{b}\ \vec{c}] = 4$ then $[\vec{a}\times\vec{b}\ \ \vec{b}\times\vec{c}\ \ \vec{c}\times\vec{a}]$ is equal to

(a) 8 (b) 16 (c) 64 (d) none of these

Q 76. If $\vec{d}$ is a unit vector such that $\vec{d}=\lambda\vec{b}\times\vec{c}+\mu\vec{c}\times\vec{a}+v\vec{a}\times\vec{b}$ then

$$|(\vec{d}.\vec{a})(\vec{b}\times\vec{c})+(\vec{d}.\vec{b})(\vec{c}\times\vec{a})+(\vec{d}.\vec{c})(\vec{a}\times\vec{b})$$

is equal to

(a) $|[\vec{a}\ \vec{b}\ \vec{c}]|$ (b) 1 (c) $3|[\vec{a}\ \vec{b}\ \vec{c}]|$ (d) none of these

Q 77. $\vec{a}\times(\vec{b}\times\vec{c}),\vec{b}\times(\vec{c}\times\vec{a})$ and $\vec{c}\times(\vec{a}\times\vec{b})$ are

(a) linearly (b) dependent (c) equal vectors (d) none of these

Q 78. $[\vec{b}\ \vec{c}\ \vec{b}\times\vec{c}]+(\vec{b}.\vec{c})^2$ is equal to

(a) $|\vec{b}|^2|\vec{c}|^2$ (b) $(\vec{b}+\vec{c})^2$ (c) $|\vec{b}|^2+|\vec{c}|^2$ (d) none of these

Q 79. If the vector $\vec{a},\vec{b},\vec{c}$ and $\vec{d}$ are coplanar then $(\vec{a}\times\vec{b})\times(\vec{c}\times\vec{d})$ is equal to

(a) $\vec{a}+\vec{b}+\vec{c}+\vec{d}$ (b) $\vec{0}$ (c) $\vec{a}+\vec{b}=\vec{c}+\vec{d}$ (d) none of these

Q 80. If $\vec{a}\times(\vec{a}\times\vec{b})=\vec{b}\times(\vec{b}\times\vec{c})$ and $\vec{a}.\vec{b}\neq 0$ then $[\vec{a}\ \vec{b}\ \vec{c}]$ is equal to

(a) 0 (b) 1 (c) 2 (d) none of these

Q 81. Let $\vec{OA}=\vec{a},\vec{OB}=10\vec{a}+2\vec{b}$ and $\vec{OC}=\vec{b}$, where O, A and C noncollinear points. Let p denote the area of the quadrilateral OAB, and q denote the area of the parallelogram with OA and OC as adjacent sides. Then p/q is equal to

(a) 4 (b) 6 (c) $\frac{1}{2}\frac{|\vec{a}-\vec{b}|}{|\vec{a}|}$ (d) none of these

Q 82. The position vectors of the vertices A, B, C of a triangle are $\vec{i}-\vec{j}-3\vec{k},2\vec{i}+\vec{j}-2\vec{k}$ and $-5\vec{i}+2\vec{j}-6\vec{k}$ respectively. The length of the bisector AD of the angle BAC where D is on the line segment BC, is

(a) $\frac{15}{2}$ (b) $\frac{1}{4}$ (c) $\frac{11}{2}$ (d) none of these

Q 83. P is a point on the line through the point A whose position vector is $\vec{a}$ and the line is parallel to the vector $\vec{b}$. If PA = 6, the position vector of P is

(a) $\vec{a}+6\vec{b}$ (b) $\vec{a}+\frac{6}{|\vec{b}|}\vec{b}$ (c) $\vec{a}-6\vec{b}$ (d) $\vec{b}+\frac{6}{|\vec{a}|}\vec{a}$

Q 84. The coplanar points A,B,C,D are (2 – x, 2, 2), (2, 2 – y, 2), (2, 2, 2, 2 – z) and (1, 1, 1) respectively. Then

(a) $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=1$ (b) x + y + z = 1 (c) $\frac{1}{1-x}+\frac{1}{1-y}+\frac{1}{1-z}$ (d) none of these

Q 85. Let $\vec{AB}=3\vec{i}+\vec{j}-\vec{k}$ and $\vec{AC}=\vec{i}-\vec{j}+3\vec{k}$. If the point P on the line segment BC is equidistant from AB and AC then $\vec{AP}$ is

(a) $2\vec{i}-\vec{k}$ (b) $\vec{i}-2\vec{k}$ (c) $2\vec{i}+\vec{k}$ (d) none of these

Q 86. The cosine of the angle between two diagonals of a cube is

(a) $\frac{1}{3}$ (b) $\frac{2\sqrt{2}}{3}$ (c) $\frac{1}{2}$ (d) none of these

Q 87. If $\vec{AB}=\vec{b}$ and $\vec{AC}=\vec{c}$ then the length of the perpendicular from A to the line BC is

(a) $\frac{|\vec{b}\times\vec{c}|}{|\vec{b}+\vec{c}|}$ (b) $\frac{|\vec{b}\times\vec{c}|}{|\vec{b}-\vec{c}|}$ (c) $\frac{1}{2}\frac{|\vec{b}\times\vec{c}|}{|\vec{b}-\vec{c}|}$ (d) none of these

Q 88. The distance of the point (1, 1, 1) from the plane passing through the points (2, 1, 1), (1, 2, 1) and (1, 1, 2) is

(a) $\frac{1}{\sqrt{3}}$ (b) 1 (c) $\sqrt{3}$ (d) none of these

Q 89. The projection of the vector $\vec{i}+\vec{j}+\vec{k}$ one the line whose vector equation is

$\vec{r}=(3+t)\vec{i}+(2t-1)\vec{j}+3t\vec{k}$, t being the scalar parameter, is

(a) $\frac{1}{\sqrt{14}}$ (b) 6 (c) $\frac{6}{\sqrt{14}}$ (d) none of these

Q 90. If the vertices of a tetrahedron have the position vectors $\vec{0}, \vec{i}+\vec{j}, 2\vec{j}-\vec{k}$ and $\vec{i}+\vec{k}$ then the volume of the volume if of the tetrahedron is

(a) $\frac{1}{6}$ (b) 1 (c) 2 (d) none of these

Type 2

Choose the correct options. One or more option may be correct.

Q 91. A line passes through the point whose position vectors are $\vec{i}+\vec{j}-2\vec{k}$ and $\vec{i}-3\vec{j}+\vec{k}$. The position vector of a point on it at a unit distance from the first point is

(a) $\frac{1}{5}(6\vec{i}+\vec{j}-7\vec{k})$ (b) $\frac{1}{5}(4\vec{i}+9\vec{j}-13\vec{k})$ (c) $\vec{i}-4\vec{j}+3\vec{k})$ (d) none of these

Q 92. A vector of magnitude 2 along bisector of the angle between the two vectors $2\vec{i}-2\vec{j}+\vec{k}$ and $\vec{i}+2\vec{j}-2\vec{k}$ is

(a) $\frac{2}{\sqrt{10}}(\vec{i}-\vec{k})$ (b) $\frac{1}{\sqrt{26}}(\vec{i}-4\vec{j}+3\vec{k})$ (c) $\frac{2}{\sqrt{26}}(\vec{i}-4\vec{j}+3\vec{k})$ (d) none of these

Q 93. A unit vector coplanar with $\vec{i}+\vec{j}+2\vec{k}$ and $\vec{i}+2\vec{j}+\vec{k}$, and perpendicular to $\vec{i}+\vec{j}+\vec{k}$, is

(a) $\frac{1}{\sqrt{2}}(-\vec{j}+\vec{k})$ (b) $\frac{1}{\sqrt{2}}(\vec{k}-\vec{i})$ (c) $\frac{1}{\sqrt{2}}(\vec{i}-\vec{k})$ (d) $\frac{1}{\sqrt{2}}(\vec{j}-\vec{k})$

Q 94. A unit vector which is equally inclined to the vectors $\vec{i}, \frac{-2\vec{i}+\vec{j}+2\vec{k}}{3}-\vec{k})$ and $\frac{-4\vec{j}-3\vec{k}}{5}$ is

(a) $\frac{1}{\sqrt{51}}(-\vec{i}+5\vec{j}-5\vec{k})$ (b) $\frac{1}{\sqrt{51}}(\vec{i}+5\vec{j}-5\vec{k})$ (c) $\frac{1}{\sqrt{51}}(\vec{i}+5\vec{j}+5\vec{k})$ (d) $\frac{1}{\sqrt{51}}(\vec{i}-5\vec{j}+5\vec{k})$

Q 95. If $|\vec{a}| = 4, |\vec{b}| = 2$ and the angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{6}$ then $(\vec{a} \times \vec{b})^2$ equal to

(a) 48 (b) 16 (c) $\vec{a}^2$ (d) none of these

Q 96. Three points whose position vectors are $\vec{a}, \vec{b}, \vec{c}$ will be collinear if

(a) $\lambda \vec{a} + \mu \vec{b} = (\lambda + \mu)\vec{c}$ (b) $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} = \vec{0}$ (c) $[\vec{a}\ \vec{b}\ \vec{c}]$ (d) none of these

Q 97. Let $\vec{b} = 4\vec{i} + 3\vec{j}$. Let $\vec{c}$ be a vector perpendicular to $\vec{b}$ and it lies in the x–y plane. A vector in the x–y plane having projections 1 and 2 along $\vec{b}$ and $\vec{c}$ is

(a) $2\vec{i} - \vec{j}$ (b) $\vec{i} - 2\vec{j}$ (c) $\frac{1}{5}(-\vec{i} + 11\vec{j})$ (d) none of these

Q 98. If $\vec{a}, \vec{b}, \vec{c}$ are noncoplanar nonzero vectors and $\vec{r}$ is any vector in space then $[\vec{b}\ \vec{c}\ \vec{r}]\vec{a} + [\vec{c}\ \vec{a}\ \vec{r}]\vec{b} + [\vec{a}\ \vec{b}\ \vec{r}]\vec{c}$ is equal to

(a) $3[\vec{a}\ \vec{b}\ \vec{c}]\vec{r}$ (b) $[\vec{a}\ \vec{b}\ \vec{c}]\vec{r}$ (c) $[\vec{b}\ \vec{c}\ \vec{a}]\vec{r}$ (d) none of these

Q 99. If $\vec{a}, \vec{b}, \vec{c}$ are nonecoplanar vectors such that $\vec{b} \times \vec{c} = \vec{a}, \vec{a} \times \vec{b} = \vec{c}$ and $\vec{c} \times \vec{a} = \vec{b}$ then

(a) $|\vec{a}| = 1$ (b) $|\vec{b}| = 1$ (c) $|\vec{a}| + |\vec{b}| + |\vec{c}| = 3$ (d) none of these

Q 100. Let $\vec{a}, \vec{b}, \vec{c}$ be noncoplanar vectors and $\vec{p} = \frac{\vec{b} \times \vec{c}}{[\vec{a}\vec{b}\vec{c}]}, \vec{q} = \frac{\vec{c} \times \vec{a}}{[\vec{b}\vec{c}\vec{a}]}, \vec{r}\ \frac{\vec{a} \times \vec{b}}{[\vec{c}\vec{a}\vec{b}]}$ then

(a) $\vec{p}.\vec{a} = 1$ (b) $\vec{p}.\vec{a} + \vec{q}.\vec{b} + \vec{r}.\vec{c} = 3$ (c) $\vec{p}.\vec{a} + \vec{q}.\vec{b} + \vec{r}.\vec{c} = 0$ (d) none of these

Q 101. If $\vec{a}, \vec{b}, \vec{c}$ are any three vectors then $(\vec{a} \times \vec{b}) \times \vec{c}$ is a vector

(a) perpendicular to $\vec{a} \times \vec{b}$ (b) coplanar with $\vec{a}$ and $\vec{b}$

(c) parallel to $\vec{c}$ (D) parallel to either $\vec{a}$ or $\vec{b}$

Q 102. If $\vec{c} = \vec{a} \times \vec{b}$ and $\vec{b} = \vec{c} \times \vec{a}$ then

(a) $\vec{a}.\vec{b} = \vec{c}^2$ (b) $\vec{c}.\vec{a} = \vec{b}^2$ (c) $\vec{a} \perp \vec{b}$ (d) $\vec{a} || \vec{b} \times \vec{c}$

Q 103. If $\vec{x} \times \vec{b} = \vec{c} \times \vec{b}$ and $\vec{x} \perp \vec{a}$ then $\vec{x}$ is equal to

(a) $\frac{\vec{b} \times (\vec{a} \times \vec{c})}{\vec{b}.\vec{c}}$ (b) $\frac{(\vec{b} \times \vec{c}) \times \vec{a}}{\vec{b}.\vec{a}}$ (C) $\frac{(\vec{a} \times (\vec{c} \times \vec{b})}{\vec{a}.\vec{b}}$ (d) none of these

Q 104. The resolved part of the vector $\vec{a}$ along the vector $\vec{b}$ is $\vec{\lambda}$ and that perpendicular to $\vec{b}$ is $\vec{\mu}$. Then

(a) $\vec{\lambda} = \frac{(\vec{a}.\vec{b})\vec{a}}{\vec{a}^2}$ (b) $\vec{\lambda} = \frac{(\vec{a}.\vec{b})\vec{b}}{\vec{b}^2}$ (c) $\vec{\mu} = \frac{(\vec{b}.\vec{b})\vec{a} - (\vec{a}.\vec{b})\vec{b}}{\vec{b}^2}$ (d) $\vec{\mu} = \frac{\vec{b} \times (\vec{a} \times \vec{b})}{\vec{b}^2}$

Q 105. $(\vec{a} \times \vec{b}.(\vec{c} \times \vec{d})$ is equal to

(a) $\vec{a}.\{\vec{b} \times (\vec{c} \times \vec{d})\}$ (b) $(\vec{a}.\vec{c})(\vec{b}.\vec{d}) - (\vec{a}.\vec{d})(\vec{b}.\vec{c})$ (c) $\{(\vec{a} \times \vec{b}) \times \vec{c}\}.\vec{d}$ (d) $(\vec{d} \times \vec{c}).(\vec{b} \times \vec{a})$

Q 106. If $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ are any four then $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d})$ is a vactor

(a) perpendicular to $\vec{a}, \vec{b}, \vec{c}, \vec{d}$

(b) along the line of intersection of two planes, one containing $\vec{a}, \vec{b}$ and the other containing $\vec{c}, \vec{d}$

(c) equally inclined to both $\vec{a} \times \vec{b}$ and $\vec{c} \times \vec{d}$

(d) none of these

Answers

1b	2a	3b	4b	5a	6c	7d	8c	9a	10a
11b	12c	13b	14a	15b	16d	17b	18a	19a	20b
21b	22a	23b	24c	25c	26b	27a	28b	29d	30c
31c	32a	33b	34c	35a	36a	37b	38c	39c	40b
41c	42a	43b	44b	45c	46c	47a	48c	49a	50c
51c	52a	53d	54c	55a	56c	57c	58c	59a	60b
61a	62a	63c	64c	65c	66b	67d	68c	69a	70b
71a	72b	73b	74a	75b	76a	77a	78a	79b	80a
81b	82a	83b	74a	85c	86a	87b	88a	89c	90a
91a,b	92a,c	93a,d	94a,d	95b,c	96a,b	97a,c	98b,c	99a,b,c	100a,b
101a,b	102c,d	103b,c	104b,c,d	105a,b,c,d	106b,c				