EXERCISE LEVEL –I

EL– I

Q.1 If I, J, and k be unit vector in the X, Y, and Z direction respectively suppose that
$A = 3I - J + 2K$ Find the magnitude of the vector A.
(A) $\sqrt{8}$ (B) $\sqrt{12}$ (C) $\sqrt{14}$ (D) $\sqrt{4}$

Q.2 If A = 2I +J, B = I – 4J +K and C = J +K find the magnitude of the vector 2A – B +C and show that it is not a unit vector.
(A) $\sqrt{78}$ (B) $\sqrt{28}$ (C) $\sqrt{58}$ (D) $\sqrt{36}$

Q.3 two vector $a = xi + 14j$ and $b = 3i - 7yj$ are equal vector if:
(A) $x = 6, y = -1/2$ (B) $x = 3, y = 2$
(C) $x = 3, y = -1/2$ (D) $x = 3, y = -2$

Q.4 What is the sum of vector 3I + 3J – K and A zero vector?
(A) 3I + 3J – K (B) 0I + 0J – 0K
(C) –3I + 3J + K (D) 3I + 3J + K

Q.5 Two vectors are considered to be collinear vectors if their cross product is.
(A) Equal to zero vector (B) Not equal to zero vector
(C) Equal to unit vector (D) none of the above

Q.6 The vector that have the same initial point are called.
(A) Coplanar vector (B) Co-initial vector
(C) Coterminous vector (D) Collinear vector

Q.7 Two vector are equal if they have the same magnitude and the same direction.
(A) True (A) False

Q.8 A zero vector id a unique vector.
(A) True (B) False

Q.9 State true or false any two given vectors can be considered as collinear vectors if these vectors are parallel to the same given line.
(A) True (B) False

Q.10 Given two vector $\vec{P} = (2,5)$ and$\vec{Q} = (3,-2)$, determine the magnitude of the resultant vector $\vec{R}$ using their components.
(A) $\sqrt{8}$ (B) $\sqrt{34}$ (C) $\sqrt{16}$ (D) $\sqrt{53}$

Q.11 Given the two vector $\vec{A} = (5,10)$ and $\vec{B} = (4,-5)$ determine the angel of the resultant sum vector $\vec{C}$ using their components.
(A) 29.05° (B) 12.45° (C) 51.08° (D) 34.02°

Q.12 What is the formula for the magnitude of resultant vector of two vectors P and Q?

(A) $|R| = \sqrt{(P^2 + Q^2 - 2PQ\sin\theta)}$ (B) $|R| = \sqrt{(P^2 + Q^2 + 2PQ\sin\theta)}$

(C) $|R| = \sqrt{(P^2 - Q^2 + 2PQ\cos\theta)}$ (D) $|R| = \sqrt{(P^2 + Q^2 + 2PQ\cos\theta)}$

Q.13 The formula for the direction of the resultant vector of two vectors P and Q is

$\beta = \tan - 1\left[\frac{Q\sin\theta}{P + Q\cos\theta}\right]$

(A) True (B) False

Q.14 What is the scalar product of vectors a and b when the angle between them is 90°

(A) 1 (B) 0 (C) Not defined (D) –1

Q.15 Find the scalar product of vectors a = -i + j - k and b = -2i + 2j - 2k

(A) 1 (B) 0 (C) –6 (D) 6

Q.16 A unit vector along a bisector of the angle between the two vectors

(A) $\left(\frac{5\hat{i}+2\hat{j}+1\ \hat{k}}{\sqrt{390}}\right)$ (B) $\left(\frac{15\hat{i}-2\hat{j}-19\hat{k}}{15\sqrt{590}}\right)$

(C) $\left(\frac{5\hat{i}-22\hat{j}-9\hat{k}}{15\sqrt{590}}\right)$ (D) $\left(\frac{5\hat{i}-22\hat{j}+\hat{k}}{\sqrt{510}}\right)$

Q.17 If $\vec{a}$ and $\vec{b}$ are position vectors of A and B respectively, then the position vector of a point C in AB produced such that $\vec{AC} = 3\vec{AB}$ is

(A) $3\vec{a} - \vec{b}$ (B) $3\vec{b} - \vec{a}$

(C) $3\vec{a} - 2\vec{b}$ (D) $3\vec{b} - 2\vec{a}$

Q.18 Let ABCDEF be a regular hexagon. If $\vec{AD} = x\vec{BC}$ and $\vec{CF} = y\vec{AB}$, then xy =

(A) 4 (B) –4

(C) 2 (D) –2

Q.19 $\vec{AB} = 3\hat{i} + \hat{j} - \hat{k}$ and $\vec{AC} = \hat{i} - \hat{j} + 3\hat{k}$. If the point P on the line segment BC is equidistant from AB and AC, then $\vec{AP}$ is

(A) $2\hat{i} - \hat{k}$ (B) $\hat{i} - 2\hat{k}$

(C) $2\hat{i} + \hat{k}$ (D) $\hat{i} + 2\hat{k}$

Q.20 The vector $\vec{AB} = 3\hat{i} + 4\hat{k}$ and $\vec{AC} = 5\hat{i} - 2\hat{j} + 4\hat{k}$ are the sides of a triangle ABC. The length of median through A is

(A) $3\sqrt{2}$ (B) $\frac{6}{\sqrt{3}}$

(C) $\frac{33}{\sqrt{2}}$ (D) $\sqrt{33}$

Q.21 If A, B, C, D and E are five coplanar points, then the value of $\vec{DA} + \vec{DB} + \vec{DC} + \vec{AE} + \vec{BE} + \vec{CE}$ is equal to

(A) $\vec{DE}$ (B) $3(\vec{DE})$

(C) $2(\vec{DE})$ (D) $4(\vec{ED})$

Q.22 Let α, β, γ be distinct real numbers. The points with position vectors $\alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$, $\beta\hat{i} + \gamma\hat{j} + \alpha\hat{k}$, $\gamma\hat{i} + \alpha\hat{j} + \beta\hat{k}$

(A) Are collinear
(B) Form an equilateral triangle
(C) Form a scalene triangle
(D) Form a right angled triangle

Q.23 The vectors $\hat{i} + \hat{j}$, $\hat{j} + \hat{k}$ and $\hat{k} + \hat{i}$ are

(A) Linearly dependent
(B) Linearly independent
(C) Form a. scalene triangle
(D) Form a right angled triangle

Q.24 If G and G′ are the centroids of the triangle ABC and A′B′C′, then the value of $\overrightarrow{AA'} + \overrightarrow{BB'} + \overrightarrow{CC'}$ equals

(A) $\overrightarrow{GG'}$
(B) $2\overrightarrow{GG'}$
(C) $3\overrightarrow{GG'}$
(D) 0

Q.25 If M and N are the mid-points of the diagonals AC and BD respectively of a quadrilateral ABCD, then the value of $\overrightarrow{AB} + \overrightarrow{AD} + \overrightarrow{CB} + \overrightarrow{CD}$ equals

(A) $2\overrightarrow{MN}$
(B) $2\overrightarrow{NM}$
(C) $4\overrightarrow{NM}$
(D) $4\overrightarrow{MN}$

Q.26 If S is the circumcentre, O is the orthocentre of $\triangle ABC$, then $\overrightarrow{SA} + \overrightarrow{SB} + \overrightarrow{SC}$ equals

(A) $\overrightarrow{SO}$
(B) $2(\overrightarrow{SO})$
(C) $\overrightarrow{OS}$
(D) $2(\overrightarrow{OS})$

Q.27 If $|\vec{a}| = 1, |\vec{b}| = 2, |\vec{c}| = 3$ and $\vec{a} + \vec{b} + \vec{c} = 0$, then the value of $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$ equals

(A) 0
(B) –7
(C) –5
(D) $-\frac{14}{3}$

Q.28 If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 4\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{c} = \hat{i} + \alpha\hat{j} + \beta\hat{k}$ 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.29 Let $\vec{a}, \vec{b}, \vec{c}$ are three non-zero vectors such that any two of them are non-collinear. If $\vec{a} + \vec{b}$ is collinear with $\vec{c}$ and $\vec{b} + \vec{c}$ is collinear with $\vec{a}$, then the value of $\vec{a} + \vec{b} + \vec{c}$ equals

(A) $3\vec{a}$
(B) $3\vec{b}$
(C) $3\vec{c}$
(D) $\vec{0}$

Q.30 If $\vec{a}$ and $\vec{b}$ are non-collinear vectors, then the value of x for which vectors $\vec{\alpha} = (x-2)\vec{a} + \vec{b}$ and $\vec{\beta} = (3+2x)\vec{a} - 2\vec{b}$ are collinear, is given by

(A) $\frac{1}{2}$
(B) $\frac{1}{4}$
(C) 0
(D) -1

Q.31 If $\hat{x}, \hat{y}, \hat{z}$ are mutually perpendicular unit vectors and $a\hat{x} + a\hat{y} + c\hat{z}, \hat{x} + \hat{z}$ and $c\hat{x} + c\hat{y} + b\hat{z}$ are coplanar, then

(A) a. b. c are in A.P. (B) a, b, c are in G.P.
(C) a, b, c are in H.P. (D) a, c, b are in G.P.

Q.32 If θ is the angle between unit vectors $\vec{a}$ and $\vec{b}$, then $\sin\left(\frac{\theta}{2}\right)$ equals

(A) $\frac{1}{2}|\vec{a} + \vec{b}|$ (B) $\frac{1}{2}|\vec{a} \times \vec{b}|$
(C) $\frac{1}{2}\sqrt{1 - (\vec{a} \cdot \vec{b})}$ (D) $\frac{1}{2}|\vec{a} - \vec{b}|$

Q.33 The unit vector perpendicular to the plane of vectors $\hat{i} + \hat{j} + \hat{k}$ and $\hat{i} + \hat{j}$, is given by

(A) $\pm(\frac{\hat{i}+\hat{j}}{\sqrt{2}})$ (B) $\pm(\frac{-\hat{i}+\hat{j}}{\sqrt{2}})$
(C) $\pm(\frac{\hat{i}+2\hat{j}}{\sqrt{5}})$ (D) $\hat{i}$

Q.34 ABCD is a parallelogram with $\vec{AC} = \hat{i} - 2\hat{j} + \hat{k}$ and $\vec{BD} = -\hat{i} + 2\hat{j} - 5\hat{k}$. The

(A) $2\sqrt{5}$ (B) $\sqrt{5}$
(C) $\sqrt{3}$ (D) $2\sqrt{3}$

Q.35 The vectors $\vec{a} \times (\vec{b} \times \vec{c}), \vec{b} \times (\vec{c} \times \vec{a})$ and $\vec{c} \times (\vec{a} \times \vec{b})$ are

(A) Linearly dependent (B) Equal vectors
(C) Parallel vectors (D) Linearly independent

Q.36 The unit vector which is orthogonal to the vector $3\hat{i} + 2\hat{j} + 6\hat{k}$ and is coplanar with the vectors $2\hat{i} + \hat{j} + \hat{k}$ and $\hat{i} - \hat{j} + \hat{k}$ is

(A) $\frac{3\hat{j}-\hat{k}}{\sqrt{10}}$ (B) $\frac{2\hat{i}-3\hat{j}}{\sqrt{13}}$
(C) $\frac{2\hat{i}-6\hat{j}+\hat{k}}{\sqrt{41}}$ (D) $\frac{\hat{i}+3\hat{k}}{\sqrt{10}}$

Q.37 If $\vec{a}, \vec{b}, \vec{c}$ are three unit vectors such that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{1}{2}\left(\vec{b} + \vec{c}\right)$. If the vectors $\vec{b}$ and $\vec{c}$ are non-parallel, then

(A) $\frac{\pi}{3}$ (B) $\frac{2\pi}{3}$
(C) $\frac{5\pi}{6}$ (D) $\frac{\pi}{2}$

Q.38 If $\vec{a}$ and $\vec{b}$ are two unit vectors, then the vector $(\vec{a} + \vec{b}) \times (\vec{a} \times \vec{b})$ is parallel to the vector

(A) $\vec{a} - \vec{b}$ (B) $\vec{a} + \vec{b}$
(C) $2\vec{a} - \vec{b}$ (D) $2\vec{a} + \vec{b}$

Q.39 Given three unit vectors $\vec{a}, \vec{b}, \vec{c}$; no two of which are collinear satisfying $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{1}{2}\vec{b}$ The angle between $\vec{a}$ and $\vec{b}$ is

(A) $\frac{\pi}{3}$ (B) $\frac{\pi}{4}$
(C) $\frac{\pi}{2}$ (D) $\frac{\pi}{6}$

Q.40 If $\vec{a}, \vec{b}, \vec{c}$ are three non-coplanar, non-zero vectors, then the value of $(\vec{a} \cdot \vec{a})\vec{b} \times \vec{c} + (\vec{a} \cdot \vec{b})\vec{c} \times \vec{a} + (\vec{a} \cdot \vec{c})\vec{a} \times \vec{b}$ 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) $[\vec{a}\ \vec{c}\ \vec{b}]\vec{a}$

Q.41 If $\vec{a}, \vec{c}, \vec{d}$ are non-coplanar vectors, then $\vec{d} \cdot \{\vec{a} \times [\vec{b} \times (\vec{c} \times \vec{d})]\}$ is equal to

(A) $(\vec{b} \cdot \vec{d})[\vec{a}\,\vec{c}\,\vec{d}]$ (B) $(\vec{a} \cdot \vec{d})[\vec{a}\ \vec{c}\ \vec{d}]$

(C) $(\vec{c} \cdot \vec{d})[\vec{a}\,\vec{c}\,\vec{d}]$ (D) $(\vec{a} \cdot \vec{b})[\vec{a}\ \vec{c}\ \vec{d}]$

Q.42 If $\begin{vmatrix} a & a^2 & 1+a^3 \\ b & b^2 & 1+b^3 \\ c & c^2 & 1+c^3 \end{vmatrix} = 0$ and the vectors $A \equiv (1, a, a^2), B \equiv (1, b, b^2), C \equiv (1, c, c^2)$ are non-coplanar, then the value of abc equal to

(A) –1 (B) 1

(C) 0 (D) $a + b + c$

Q.43 If the vectors $\vec{a}, \vec{b}, \vec{c}$ are coplanar, then the value of $\begin{vmatrix} \vec{a} & \vec{b} & \vec{c} \\ \vec{a} \cdot \vec{a} & \vec{a} \cdot \vec{b} & \vec{a} \cdot \vec{c} \\ \vec{b} \cdot \vec{a} & \vec{b} \cdot \vec{b} & \vec{b} \cdot \vec{c} \end{vmatrix} =$

(A) $\vec{a}$ (B) $\vec{0}$

(C) $-\vec{a}$ (D) $\vec{a} + \vec{b} + \vec{c}$

Q.44 If $\vec{A} = 2\hat{i} + \hat{k}, \vec{B} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{C} = 4\hat{i} - 3\hat{j} + 7\hat{k}$, then a vector $\vec{r}$ which satisfies $\vec{r} \times \vec{B} = \vec{C} \times \vec{B}$

(A) $-\hat{i} - 8\hat{j} + 2\hat{k}$ (B) $\hat{i} - 8\hat{j} + 2\hat{k}$

(C) $\hat{i} + 8\hat{j} + 2\hat{k}$ (D) $-(\hat{i} + 8\hat{j} + 2\hat{k})$

Q.45 If $\vec{x} \times \vec{b} = \vec{c} \times \vec{b}$ and $\vec{x} \perp \vec{a}$, then $\vec{x}$ is equal to

(A) $\frac{\vec{b} \times (\vec{a} \times \vec{c})}{\vec{b} \cdot \vec{c}}$ (B) $\frac{(\vec{b} \times \vec{c}) \times \vec{a}}{\vec{b} \cdot \vec{a}}$

(C) $\frac{\vec{a} \times (\vec{c} \times \vec{a})}{\vec{a} \cdot \vec{b}}$ (D) $\frac{\vec{a} \times (\vec{b} \times \vec{c})}{\vec{a} \cdot \vec{c}}$

Q.46 If $\vec{a}$ is a unit vector, $\vec{a} \times \vec{r} = \vec{b}, \vec{a} \cdot \vec{r} = c, \vec{a} \cdot \vec{b} = 0$, then $\vec{r}$ is equal to

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

(C) $c\vec{b} - (\vec{a} \times \vec{b})$ (D) $c\vec{a} - (\vec{a} \times \vec{b})$

Q.47 If $\vec{x} + \vec{y} = \vec{a}, \vec{x} \times \vec{y} = \vec{b}$ and $\vec{x} \cdot \vec{a} = 1$, then

(A) $\vec{x} = \frac{\vec{a} + \vec{a} \times \vec{b}}{a^2}$ (B) $\vec{y} = \frac{(a^2+1)\vec{a} - \vec{a} \times \vec{b}}{a^2}$

(C) $\vec{x} = \frac{\vec{b} + \vec{a} \times \vec{b}}{a^2}$ (D) $\vec{y} = \frac{(b^2-1)\vec{b} - \vec{a} \times \vec{b}}{a^2}$

Q.48 A unit vector in XY plane that makes an angle of 45° with the vector $\hat{i}+\hat{j}$ and an angle of 60° with the vector $3\hat{i}-4\hat{j}$ is

(A) $\hat{i}$
(B) $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$
(C) $\frac{\hat{i}-\hat{j}}{\sqrt{2}}$
(D) No such vector exists

Q.49 If $\vec{a}\cdot\vec{b}=\beta$ and $\vec{a}\times\vec{b}=\vec{c}$, then $\vec{b}$ is equal to

(A) $\frac{(\beta\vec{a}-\vec{a}\times\vec{c})}{a^2}$
(B) $\frac{\beta\vec{a}+(\vec{a}\times\vec{c})}{a^2}$
(C) $\frac{(\beta\vec{c}-\vec{a}\times\vec{c})}{a^2}$
(D) $\frac{\beta\vec{c}+(\vec{a}\times\vec{c})}{a^2}$

Q.50 Let $\vec{a}=\hat{i}+\hat{j}$ and $\vec{b}=2\hat{i}-\hat{k}$, then point of intersection of the lines $\vec{r}\times\vec{a}=\vec{b}\times\vec{a}$ and $\vec{r}\times\vec{b}=\vec{a}\times\vec{b}$ is

(A) $-\hat{i}+\hat{j}+\hat{k}$
(B) $3\hat{i}-\hat{j}+\hat{k}$
(C) $3\hat{i}+\hat{j}-\hat{k}$
(D) $\hat{i}-\hat{j}-\hat{k}$

Q.51 Let the unit vectors $\vec{a}$ and $\vec{b}$ be perpendicular to each other and the unit vector $\hat{c}$ be inclined at an angle θ to both $\vec{a}$ and $\vec{b}$, if $\hat{c}=x\vec{a}+y\vec{b}+z(\vec{a}\times\vec{b})$, then

(A) $x=\cos\theta, y=\sin\theta, z=\cos 2\theta$
(B) $x=\sin\theta, y=\cos\theta, z=-\cos 2\theta$
(C) $x=y=\cos\theta, z^2=\cos 2\theta$
(D) $x=y=\cos\theta, z^2=-\cos 2\theta$

Q.52 If the non-zero vectors $\vec{a}$ and $\vec{b}$ are perpendicular to each other. then the solution of the equation $\vec{r}\times\vec{a}=\vec{b}$, is given by

(A) $\vec{r}=x\vec{a}+\frac{1}{\vec{a}\cdot\vec{a}}(\vec{a}\times\vec{b})$
(B) $\vec{r}=x\vec{b}-\frac{1}{\vec{b}\cdot\vec{b}}(\vec{a}\times\vec{b})$
(C) $\vec{r}=x(\vec{a}\times\vec{b})$
(D) $\vec{r}=x\vec{b}+\frac{1}{\vec{a}\cdot\vec{a}}(\vec{a}\cdot\vec{b})$

Q.53 If the sum of two unit vector is a unit vector, then the magnitude of their difference is

(A) 1
(B) $\sqrt{2}$
(C) $\sqrt{5}$
(D) $\sqrt{3}$

Q.54 The unit vector in the direction of the vector $\vec{a}=\hat{i}+2\hat{j}+3\hat{k}$, is

(A) $\frac{1}{\sqrt{14}}\hat{i}+\frac{2}{\sqrt{14}}\hat{j}+\frac{3}{\sqrt{14}}\hat{k}$
(B) $\frac{2}{\sqrt{14}}\hat{i}+\frac{1}{\sqrt{14}}\hat{j}+\frac{3}{\sqrt{14}}\hat{k}$
(C) $\frac{5}{\sqrt{14}}\hat{i}+\frac{1}{\sqrt{14}}\hat{j}+\frac{3}{\sqrt{14}}\hat{k}$
(D) $\frac{6}{\sqrt{14}}\hat{i}+\frac{3}{\sqrt{14}}\hat{j}+\frac{1}{\sqrt{14}}\hat{k}$

Q.55 What is the magnitude of the scalar product of the following vectors?
$\vec{a}=\hat{i}+\hat{j}; \vec{b}=\hat{i}+\hat{k}$

(A) 1
(B) 2
(C) $\sqrt{2}$
(D) 3

Q.56 If $\vec{a}=\hat{i}+\hat{j}, \vec{b}=\hat{j}+\hat{k}, \vec{c}=\hat{k}+\hat{i}$, a unit vector parallel to $\vec{a}+\vec{b}+\vec{c}$.

(A) $2\hat{i}+2\hat{j}+2\hat{k}$
(B) $\frac{\hat{i}+\hat{j}+\hat{k}}{\sqrt{3}}$
(C) $\frac{(\hat{i}+\hat{j}+\hat{k})}{2\sqrt{8}}$
(D) $\frac{\vec{a}+\vec{b}+\vec{c}}{\sqrt{3}}$

Q.57 $p_1\hat{i} + p_2\hat{j}$ is a unit vector perpendicular to $4\hat{i} - 3\hat{j}$ if
(A) $p_1 = 0.6, p_2 = 0.8$
(B) $p_1 = 3, p_2 = 4$
(C) $p_1 = 0.8, p_2 = 0.6$
(D) $p_1 = 4, p_2 = 3$

Q.58 The vector $\cos\alpha \cdot \cos\beta\hat{i} + \cos\alpha \cdot \sin\beta\hat{j} + \sin\alpha\hat{k}$ is a/an
(A) Null vector
(B) Unit vector
(C) Constant vector
(D) Vector of magnitude 3

Q.59 If OACB is a parallelogram with $\vec{OC} = \vec{a}$ and $\vec{AB} = \vec{b}$, then $\vec{OA}$ is equal to
(A) $\vec{a} + \vec{b}$
(B) $\vec{a} - \vec{b}$
(C) $\frac{1}{2}(\vec{b} - \vec{a})$
(D) $\frac{1}{2}(\vec{a} - \vec{b})$

Q.60 If the vectors $3\hat{i} + \lambda\hat{j} + \hat{k}$ and $2\hat{i} - \hat{j} + 8\hat{k}$ are perpendicular, then λ is equal to
(A) –14
(B) 7
(C) 14
(D) $\frac{1}{7}$

Q.61 A unit vector perpendicular to the plane passing through the points whose position vectors are $\hat{i} - \hat{j} + 2\hat{k}, 2\hat{i} - \hat{k}$ and $2\hat{i} + \hat{k}$ is
(A) $2\hat{i} + \hat{j} + \hat{k}$
(B) $\frac{1}{\sqrt{6}}(\hat{i} + 2\hat{j} + \hat{k})$
(C) $\pm(\frac{\hat{i}-\hat{j}}{\sqrt{2}})$
(D) $\frac{1}{\sqrt{6}}(3\hat{i} + 4\hat{j} - \hat{k})$

Q.62 If $\vec{a} \cdot \hat{i} = \vec{a} \cdot (\hat{i} + \hat{j}) = \vec{a} \cdot (\hat{i} + \hat{j} + \hat{k}) = 1$, then $\vec{a} =$
(A) Zero vector
(B) $\hat{i}$
(C) $\hat{j}$
(D) $\hat{i} + \hat{j} + \hat{k}$

Q.63 The vectors $2\hat{i} - \hat{j} + \hat{k}, \hat{i} - 3\hat{j} - 5\hat{k}$ and $3\hat{i} - 4\hat{j} - 4\hat{k}$ forms a/an
(A) Equilateral triangle
(B) Isosceles triangle
(C) Right triangle
(D) Right isosceles triangle

Q.64 The magnitude of the sum of two vectors is equal to the difference in their magnitudes. What is the angle between vectors?
(A) 0°
(B) 45°
(C) 90°
(D) 180°

Q.65 ABCDEF is a regular hexagon where centre O is the origin, if the position vector of A is $\hat{i} - \hat{j} + 2\hat{k}$, then $\vec{BC}$ is equal to
(A) $\hat{i} - \hat{j} + 2\hat{k}$
(B) $-\hat{i} + \hat{j} - 2\hat{k}$
(C) $3\hat{i} + 3\hat{j} - 4\hat{k}$
(D) Both (1) & (2)

Q.66 The area of parallelogram whose diagonals coincide with the following pair of vectors is $5\sqrt{3}$. The vectors are
(A) $3\hat{i} + 2\hat{j} - \hat{k}, 3\hat{i} - \hat{j} + 4\hat{k}$
(B) $\frac{3\hat{i}}{2} - \frac{\hat{j}}{2} - \hat{k}, 2\hat{i} - 6\hat{j} + 8\hat{k}$
(C) $3\hat{i} + \hat{j} - 2\hat{k}, \hat{i} + 3\hat{j} + 4\hat{k}$
(D) $-(3\hat{i} + \hat{j} - 2\hat{k}), \hat{i} - 3\hat{j} - 4\hat{k}$

Q.67 If $|\vec{a} \times \vec{b}| = 2, |\vec{a} \cdot \vec{b}| = 2$, then $|\vec{a}|^2|\vec{b}|^2$ is equal to

(A) 6 (B) 2

(C) 8 (D) 20

Q.68 The vectors $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = -2\hat{i} + 3\hat{j} - 4\hat{k}$ and $\vec{c} = \hat{i} - 3\hat{j} + \lambda\hat{k}$ are coplanar if the value of λ is

(A) 1 (B) 2

(C) 3 (D) 5

Q.69 If $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that $[\vec{a} \quad \vec{b} \quad \vec{c}] = 4$, then $[\vec{a} \times \vec{b} \quad \vec{b} \times \vec{c} \quad \vec{c} \times \vec{a}]$ is equal to

(A) 8 (B) 64

(C) 4 (D) 16

Q.70 STATEMENT-1: Let $\vec{a}, \vec{b}$ be two vectors such that $\vec{a} \cdot \vec{b} = 0$, then a and b are perpendicular. and

STATEMENT-2: Two non-zero vectors are perpendicular if and only if their dot product is zero.

(A) Statement-1 is True, Statement-2 is true; Statement-2 is a correct explanation for Statement-1

(B) Statement-1 is True, Statement-2 is true; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is true

Q.71 Let $\vec{u}$ and $\vec{v}$ be unit vectors inclined at an angle θ such that for some vector $\vec{w}, \vec{w} + \vec{w} \times \vec{u} = \vec{v}$.

STATEMENT-1 : $\vec{u} \cdot \vec{w} = \cos\theta$.

and

STATEMENT-2 : $|\vec{u} \times \vec{v}| = \sin\theta$.

(A) Statement-1 is True, Statement-2 is true; Statement-2 is a correct explanation for Statement-1

(B) Statement-1 is True, Statement-2 is true; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is true

Q.72 STATEMENT-1: If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$, then $\vec{a} - \vec{d}$ is perpendicular to $\vec{b} - \vec{c}$.

And

STATEMENT-2: If $\vec{P}$ and $\vec{Q}$ are perpendicular then $\vec{P} \cdot \vec{Q} = 0$.

(A) Statement-1 is True, Statement-2 is true; Statement-2 is a correct explanation for Statement-1

(B) Statement-1 is True, Statement-2 is true; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is true

Let $\vec{u}, \vec{v}, \vec{w}$ be three unit vectors such that $\vec{u} + \vec{v} + \vec{w} = \vec{a}, (\vec{u} \times \vec{v}) \times \vec{w} = \vec{b}, \vec{u} \times (\vec{v} \times \vec{w}) = \vec{c}$, $\vec{a} \cdot \vec{u} = \frac{3}{2}, \vec{a} \cdot \vec{v} = \frac{7}{4}, |\vec{a}| = 2$ then

Q.73 Vector $\vec{u}$ is given by

(A) $\vec{a} + \frac{8}{3}\vec{b} + \frac{4}{3}\vec{c}$ (B) $\vec{a} + \vec{b} + \vec{c}$

(C) $\frac{\vec{a}+\vec{b}+\vec{c}}{3}$ (D) $\vec{a} + \frac{\vec{b}}{3} + \frac{\vec{c}}{2}$

Q.74 Vector $\vec{v}$ is given by

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

(B) $\frac{\vec{a}+\vec{c}}{2}+\vec{b}$

(C) $-4\vec{b}$

(D) $\vec{a}+\frac{\vec{b}}{3}+\frac{\vec{c}}{2}$

Q.75 Vector $\vec{w}$ is given by

(A) $\frac{\vec{a}+\vec{b}}{3}$

(B) $\frac{\vec{b}-\vec{c}}{3}$

(C) $\frac{4}{3}(\vec{a}+\vec{b})$

(D) $\frac{4}{3}(\vec{b}-\vec{c})$

Q.76 Vector $\vec{u}+\vec{w}$ is

(A) $\vec{a}+3\vec{b}$

(B) $\vec{a}+4\vec{b}$

(C) $3\vec{a}+\vec{b}$

(D) $4\vec{a}+\vec{b}$

Q.77 Vector $\vec{u}+\vec{w}+\vec{v}$ is

(A) $\vec{a}+\vec{b}$

(B) $\vec{a}+2\vec{b}+3\vec{c}$

(C) $\vec{a}$

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

Q.78 Let O be the centre of a regular hexagon ABCDEF. Then the magnitude of sum of the vectors $\vec{OA}, \vec{OB}, \vec{OC}, \vec{OD}, \vec{OE}$ and $\vec{OF}$ is

(A) $\sqrt{3}$

(B) 0

(C) 2

(D) 1

Q.79 For any two vectors $\vec{a}$ and $\vec{b}$, which one of the following is not true?

(A) $|\vec{a}+\vec{b}| \le |\vec{a}|+|\vec{b}|$

(B) $|\vec{a}-\vec{b}| \le |\vec{a}|+|\vec{b}|$

(C) $|\vec{a}-\vec{b}| \le |\vec{a}|-|\vec{b}|$

(D) $|\vec{a}-\vec{b}| \ge |\vec{a}|-|\vec{b}|$

Q.80 What is the angle between $\vec{a}$ and the resultant of $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$?

(A) 0

(B) $\tan^{-1}\frac{a}{b}$

(C) $\tan^{-1}\frac{b}{a}$

(D) $\tan^{-1}\frac{(a-b)}{(a+b)}$

Q.81 L and M are the mid-points of the sides BC andCD a parallelogram ABCD. Then $\vec{AL}+\vec{AM}$ is equal to

(A) $\frac{1}{2}\vec{AC}$

(B) $\frac{2}{3}\vec{AC}$

(C) $\frac{3}{2}\vec{AC}$

(D) $\frac{3}{4}\vec{AC}$

Q.82 Let ABCD be a parallelogram whose diagonal intersect at P and let O be the origin.
Then $\vec{OA}+\vec{OB}+\vec{OC}+\vec{OD}$ equals

(A) $\vec{OP}$

(B) $2\vec{OP}$

(C) $3\vec{OP}$

(D) $4\vec{OP}$

Q.83 $\vec{a}$ and $\vec{b}$ are the position vectors of A, B respectively and C is a point on AB produced such that AC = 3AB. Then the position vector of C is

(A) $3\vec{b}-2\vec{a}$

(B) $2\vec{a}-3\vec{b}$

(C) $2\vec{a}+3\vec{b}$

(D) $3\vec{a}-2\vec{b}$

Q.84 The points with position vectors $60\hat{i} + 3\hat{j}, 40\hat{i} - 8\hat{j}, \lambda\hat{i} - 52\hat{j}$ are collinear, if λ is equal to
(A) –20 (B) 40
(C) –40 (D) 20

Q.85 Given two vectors $\vec{a} = 2\hat{i} - 3\hat{j} + 6\hat{k}, \vec{b} = -2\hat{i} + 2\hat{j} - \hat{k}$ and $\lambda = \frac{\text{the projection of } \vec{a} \text{ on } \vec{b}}{\text{the projection of } \vec{b} \text{ on } \vec{a}}$, then the value of λ is
(A) $\frac{3}{7}$ (B) 7
(C) 3 (D) $\frac{7}{3}$

Q.86 Let $\vec{a}, \vec{b}, \vec{c}$ be three nonzero vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ and $\lambda\vec{b} \times \vec{a} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} = \vec{0}$, then λ is
(A) 1 (B) 2
(C) –1 (D) –2

Q.87 If $\vec{a} \times \vec{b} = \vec{c}, \vec{b} \times \vec{c} = \vec{a}$, where $\vec{c} \neq 0$, then
(A) $|\vec{a}| = |\vec{c}|, |\vec{b}| = 1$ (B) $|\vec{a}| \neq |\vec{c}|, |\vec{b}| = 1$
(C) $|\vec{b}| \neq |\vec{c}|, |\vec{a}| = 1$ (D) $|\vec{a}| \neq |\vec{c}|$

Q.88 $\hat{i} \cdot (\hat{j} \times \hat{k}) + \hat{j} \cdot (\hat{i} \times \hat{k}) + \hat{k} \cdot (\hat{i} \times \hat{j})$ is equal to
(A) 3 (B) 0
(C)–3 (D) 1

Q.89 If $\vec{a}$ is any vector, then $(\vec{a} \times \hat{i})^2 + (\vec{a} \times \hat{j})^2 + (\vec{a} \times \hat{k})^2$ is equal to
(A) $|\vec{a}|^2$ (B) $2|\vec{a}|^2$
(C) $3|\vec{a}|^2$ (D) $4|\vec{a}|^2$

Q.90 The vectors $2\hat{i} + 3\hat{j} - 4\hat{k}$ and $a\hat{i} + b\hat{j} + c\hat{k}$ are perpendicular, if
(A) $a = 2, b = 3, c = -4$ (B) $a = 4, b = 4, c = 5$
(C) $a = 4, b = 4, c = -5$ (D) $a = -4, b = 4, c = -5$

Q.91 The projection of the vector $\hat{i} + \hat{j} + \hat{k}$ along the vector of $\hat{j}$ is
(A) 1 (B) 0
(C) 2 (D) –1

Q.92 If $\vec{a}$ and $\vec{b}$ are unit vectors inclined at an angle θ, then the value of $|\vec{a} - \vec{b}|$ is
(A) $2\sin\frac{\theta}{2}$ (B) $2\sin\theta$
(C) $2\cos\frac{\theta}{2}$ (D) $2\cos\theta$

Q.93 If $|\vec{a}| = |\vec{b}|$, then $(\vec{a} + \vec{b}) \cdot (\vec{a} - \vec{b})$ is equal to
(A) Positive (B) Negative
(C) Zero (D) None of these

Q.94 If $\vec{a}$ and $\vec{b}$ are unit vectors, then which of the following values of $\vec{a} \cdot \vec{b}$ is not possible?
(A) $\sqrt{3}$ (B) $\frac{\sqrt{3}}{2}$
(C) $\frac{1}{\sqrt{2}}$ (D) $\frac{-1}{2}$

Q.95 If $\vec{a}+\vec{b}+\vec{c}=\vec{0}, |\vec{a}|=3, |\vec{b}|=5, |\vec{c}|=7$, then angle between $\vec{a}$ and $\vec{b}$ is

(A) $\frac{\pi}{6}$
(B) $\frac{2\pi}{3}$
(C) $\frac{5\pi}{3}$
(D) $\frac{\pi}{3}$

Q.96 A unit vector in the xy-plane that makes an angle of $\frac{\pi}{4}$ with the vector $\hat{i}+\hat{j}$ and an angle of $\frac{\pi}{3}$ with the vector $3\hat{i}-4\hat{j}$ is

(A) $\hat{i}$
(B) $\frac{1}{\sqrt{2}}(\hat{i}+\hat{j})$
(C) $\frac{1}{\sqrt{3}}(\hat{i}+\hat{j}+\hat{k})$
(D) Not in existence

Q.97 The volume of the parallelepiped whose edges are $\vec{a}=2\hat{i}-3\hat{j}+4\hat{k}, \vec{b}=\hat{i}+2\hat{j}-\hat{k}$ and $\vec{c}=2\hat{i}-\hat{j}+2\hat{k}$ is

(A) -2 cubic unit
(B) 2 cubic unit
(C) 1 cubic unit
(D) 4 cubic unit

Q.98 If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a}$ is perpendicular to the plane $\vec{b}$ and $\vec{c}$ and angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{3}$, than value of $|\vec{a}+\vec{b}+\vec{c}|$ is

(A) 4
(B) 2
(C) 9
(D) 3

Q.99 Let $\vec{a}, \vec{b}, \vec{c}$ be the position vectors of three verticesA, B, C of a triangle respectively. Then the area of triangle is

(A) $\vec{a}\times\vec{b}+\vec{b}\times\vec{c}+\vec{c}\times\vec{a}$
(B) $\frac{1}{2}(\vec{a}\times\vec{b})\cdot\vec{c}$
(C) $\frac{1}{2}|\vec{a}\times\vec{b}|$
(D) $\frac{1}{2}|\vec{a}\times\vec{b}+\vec{b}\times\vec{c}+\vec{c}\times\vec{a}|$

Q.100 The vectors $2\hat{i}-m\hat{j}+3m\hat{k}$ and $(1+m)\hat{i}-2m\hat{j}+\hat{k}$ include an acute angle for

(A) All real m
(B) $m<-2$ or $m>-\frac{1}{2}$
(C) $m=-\frac{1}{2}$
(D) $m\in[-2,-\frac{1}{2}]$

EXERCISE LEVEL – II

EL– II

Q.1 Classify the following measures as scalars and vectors.

1) 10 kg 2) 2 meters north-west 3) 40°

4) 40 watt 5) 10^{-19} coulomb

Q.2 How to define a vector?

Q.3 What is the starting point of a vector?

Q.4 Is the position a vector?

Q.5 What is a negative vector?

Q.6 What are the Uses of Vector Algebra?

Q.7 What are the Properties of Vectors in Vector Algebra?

Q.8 What is the condition for two vectors to be perpendicular?

Q.9 Find the magnitude of the vector $\vec{a} = 5i - 3j + k$, using the formula from vector algebra.

Q.10 Let's say two vector are defined as $\vec{b} = \vec{e} - \vec{c} + 2\vec{d}$ and $\vec{a} = 3\vec{e} - \vec{d} + 2\vec{c}$. Find, $\vec{b} + \vec{a}$

Q.11 Find the projection of the vector $4\hat{i} + 2\hat{j} + \hat{k}$ on the vector $5\hat{i} - 3\hat{j} + 3\hat{k}$, using the projection vector formula.

Q.12 Find the projection of the vector $5\hat{i} + 4\hat{j} + \hat{k}$ in the direction of the vector $3\hat{i} + 5\hat{i} - 2\hat{k}$ by using the projection vector formula

Q.13 Find the projection of the vector $2\hat{i} - \hat{j} + 5\hat{k}$ and $4\hat{i} - \hat{j} + \hat{k}$.

Q.14 Find the projection of the vector $2\hat{i} - 6\hat{j} + \hat{k}$ and $8\hat{i} - 2\hat{j} + 4\hat{k}$

Q.15 Find the vector projection of vector $\vec{a} = (2,3,1)$ in the direction of vector $\vec{b} = (5, -2,2)$

Q.16 If $\vec{a} = (1, -2,2)$ and $\vec{b} = (5, -2,2)$ find:

(a) The scalar projection of $\vec{a}$ in the direction of $\vec{b}$.

(b) The vector projection of $\vec{a}$ in the direction of $\vec{b}$.

Q.17 Two vectors have their scalar magnitude as $|a = 2\sqrt{3}$ and $|b| = 4$, while the angle between the two vectors is 60°.

Calculate the cross product of two vectors.

Q.18 Find the cross product of two vectors $\vec{a} = (3,4,5)$ and $\vec{b} = (7,8,9)$

Q.19 If $\vec{a} = (2, -4,4)$ and $\vec{b} = (4,0,3)$, find the angle between them.

Q.20 Find $\vec{a} \times \vec{b}$ if $\vec{a} = 2\hat{i} + \hat{k}$ and $\vec{b} = \hat{i} + \hat{k} + \hat{k}$.

Q.21 Let $i + 3j + 5k$ and $5i + 6j - 6k$ be the two vectors.

Q.22 If two vector $a = xi + 2yj + 7zk$ and $b = 2i - j + 14k$ are equal vector then find the value of x, y, z..

Q.23 Check if the vector $x = 5i - 6j$ is equal to the vector $y = -5i + 6j$.

Q.24 Find the unit vector which is in the direction of $3i + 4j - 5k$.

Q.25 Find the vector of magnitude 8 unit and in the direction of the vector $\mathrm{I} - 7\mathrm{J} + 2\mathrm{K}$

Q.26 Find the unit vector parallel to the resultant of the vector.
$A = 2i - 3j + 4k$ And $B = -i + 5j - 2k$

Q.27 Two men apply equal force on a wooden box but in opposite direction. Will the box move in any direction?

Q.28 If $\vec{a} = (2, -1,3)$ then what is (A) $\vec{a} \times \vec{0}$ and (B) $\vec{a} \cdot \vec{0}$

Q.29 Which of the given vector $\vec{a} = \{2,3\}, \vec{b} = \{4,6\}, \vec{c} = \{6,12\}$ are collinear to one another.

Q.30 Show that the vector $\vec{a} = (3,5,7), \vec{b} = (6,10,14)$ are collinear vector.

Q.31 Find If the given vector $oa = 2i + j$ and $ob = 5i + j$ are coinitial vector.

ANSWER KEY – LEVEL – I

Q.	1	2	3	4	5	6	7	8	9	10
Ans.	C	C	D	A	A	B	A	A	A	B
Q.	11	12	13	14	15	16	17	18	19	20
Ans.	A	D	A	B	D	A	D	B	C	D
Q.	21	22	23	24	25	26	27	28	29	30
Ans.	B	B	B	C	D	A	B	D	D	B
Q.	31	32	33	34	35	36	37	38	39	40
Ans.	D	D	B	A	A	A	B	A	C	A
Q.	41	42	43	44	45	46	47	48	49	50
Ans.	A	A	B	A	B	D	A	D	A	C
Q.	51	52	53	54	55	56	57	58	59	60
Ans.	D	A	D	A	A	B	A	B	D	C
Q.	61	62	63	64	65	66	67	68	69	70
Ans.	C	B	C	C	B	D	C	D	D	A
Q.	71	72	73	74	75	76	77	78	79	80
Ans.	B	D	A	C	D	B	C	B	C	A
Q.	81	82	83	84	85	86	87	88	89	90
Ans.	C	D	A	C	D	B	A	D	B	B
Q.	91	92	93	94	95	96	97	98	99	100
Ans.	A	A	C	A	D	D	B	B	D	B