VECTOR ALGEBRA

501. Let $\vec{\mathbf{u}}, \vec{\mathbf{v}}, \vec{\mathbf{w}}$ be such that $|\vec{\mathbf{u}}| = 1, |\vec{\mathbf{v}}| = 2, \vec{\mathbf{w}} = 3$. If the projection $\vec{\mathbf{v}}$ along $\vec{\mathbf{u}}$is equal to that of $\vec{\mathbf{w}}$ along $\vec{\mathbf{u}}$ and $\vec{\mathbf{v}}, \vec{\mathbf{w}}$ are perpendicular to each other, then $|\vec{\mathbf{u}} - \vec{\mathbf{v}} + \vec{\mathbf{w}}|$ are equals

a) 2 b) $\sqrt{7}$ c) $\sqrt{14}$ d) 14

502. Let $\vec{\mathbf{a}}, \vec{\mathbf{b}}, \vec{\mathbf{c}}$ be the position vectors of the vertices A, B, C respectively of $\Delta\, ABC$. The vector area of $\Delta\, ABC$ is

a) $\frac{1}{2}\{\vec{\mathbf{a}} \times (\vec{\mathbf{b}} \times \vec{\mathbf{c}}) + \vec{\mathbf{b}} \times (\vec{\mathbf{c}} \times \vec{\mathbf{a}}) + \vec{\mathbf{c}} \times (\vec{\mathbf{a}} \times \vec{\mathbf{b}})\}$ b) $\frac{1}{2}\{\vec{\mathbf{a}} \times \vec{\mathbf{b}} + \vec{\mathbf{b}} \times \vec{\mathbf{c}} + \vec{\mathbf{c}} \times \vec{\mathbf{a}}\}$

c) $\frac{1}{2}\{\vec{\mathbf{a}} + \vec{\mathbf{b}} + \vec{\mathbf{c}}\}$ d) $\frac{1}{2}(\vec{\mathbf{b}} \cdot \vec{\mathbf{c}})\vec{\mathbf{a}} + (\vec{\mathbf{c}} \cdot \vec{\mathbf{a}})\vec{\mathbf{b}} + (\vec{\mathbf{a}} \cdot \vec{\mathbf{b}})\vec{\mathbf{c}}$

503. IF $\vec{\mathbf{a}} \times (\vec{\mathbf{b}} \times \vec{\mathbf{c}}) = (\vec{\mathbf{a}} \times \vec{\mathbf{b}}) \times \vec{\mathbf{c}}$, where $\vec{\mathbf{a}}, \vec{\mathbf{b}}$ and $\vec{\mathbf{c}}$ are any three vectors such that $\vec{\mathbf{a}}.\vec{\mathbf{b}} \neq 0$, $\vec{\mathbf{b}} \cdot \vec{\mathbf{c}} \neq 0$, then $\vec{\mathbf{a}}$ and $\vec{\mathbf{c}}$ are

a) inclined at angle of $\frac{\pi}{6}$ between them b) Perpendicular

c) Parallel d) inclined at an angle of $\frac{\pi}{3}$ between them

504. A unit vector in the plane of $\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + \hat{\mathbf{k}}$ and $\hat{\mathbf{i}} + \hat{\mathbf{j}} + 2\hat{\mathbf{k}}$ and perpendicular to $2\hat{\mathbf{i}} + \hat{\mathbf{j}} + \hat{\mathbf{k}}$ is

a) $\hat{\mathbf{j}} - \hat{\mathbf{k}}$ b) $\frac{\hat{\mathbf{i}} + \hat{\mathbf{j}}}{\sqrt{2}}$ c) $\frac{\hat{\mathbf{j}} + \hat{\mathbf{k}}}{\sqrt{2}}$ d) $\frac{\hat{\mathbf{j}} - \hat{\mathbf{k}}}{\sqrt{2}}$

505. The unit vectors $\vec{a}$ and $\vec{b}$ are perpendicular, and the unit vector $\vec{c}$ is inclined at an angle θ to both $\vec{a}$ and $\vec{b}$. If $\vec{c} = \alpha\vec{a} + \beta\vec{b} + \gamma(\vec{a} \times \vec{b})$, then which one of the following is incorrect?

a) $\alpha \neq \beta$ b) $\gamma^2 = 1 - 2\,\alpha^2$ c) $\gamma^2 = -\cos 2\,\theta$ d) $\beta^2 = \frac{1 + \cos 2\,\theta}{2}$

506. A vector $\vec{c}$ of magnitude $5\sqrt{6}$ directed along the bisector of the angle between $\vec{a} = 7\hat{\imath} - 4\hat{\jmath} - 4\hat{k}$ and $\vec{b} = -2\hat{\imath} - \hat{\jmath} + 2\hat{k}$, is

a) $\pm\frac{5}{3}(2\hat{\imath} + 7\hat{\jmath} + \hat{k})$ b) $\pm\frac{3}{5}(\hat{\imath} + 7\hat{\jmath} + 2\hat{k})$ c) $\pm\frac{5}{3}(\hat{\imath} - 2\hat{\jmath} + 7\hat{k})$ d) $\pm\frac{5}{3}(\hat{\imath} - 7\hat{\jmath} + 2\hat{k})$

507. If the vectors $\vec{\mathbf{a}} = 2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + 6\hat{\mathbf{k}}$ and $\vec{\mathbf{b}}$ are collinear and $|\vec{\mathbf{b}}| = 21$, then $\vec{\mathbf{b}}$ is equal to

a) $\pm(2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + 6\hat{\mathbf{k}})$ b) $\pm3(2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + 6\hat{\mathbf{k}})$ c) $(\hat{\mathbf{i}} + \hat{\mathbf{j}} + \hat{\mathbf{k}})$ d) $\pm21(2\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + 6\hat{\mathbf{k}})$

508. A parallelogram is constructed on the vectors $\vec{a} = 3\vec{p} - \vec{q}, \vec{b} = \vec{p} + 3\vec{q}$ and also given that $|\vec{p}| = |\vec{q}| = 2$. If the vectors $\vec{p}$ and $\vec{q}$ are inclined at an angle $\pi/3$, then the ratio of the lengths of the diagonals of the parallelogram is

a) $\sqrt{6}:\sqrt{2}$ b) $\sqrt{3}:\sqrt{5}$ c) $\sqrt{7}:\sqrt{3}$ d) $\sqrt{6}:\sqrt{5}$

509. If $[2\vec{a} + 4\vec{b}\vec{c}\vec{d}] = \lambda[\vec{a}\vec{c}\vec{d}] + \mu[\vec{b}\vec{c}\vec{d}]$, then $\lambda + \mu =$

a) 6 b) -6 c) 10 d) 8

510. If A, B and C are the vertices of a triangle whose position vectors are $\vec{\mathbf{a}}, \vec{\mathbf{b}}$and $\vec{\mathbf{c}}$respectively G is the centroid of the ΔABC, then $\overrightarrow{\mathbf{GA}} + \overrightarrow{\mathbf{GB}} + \overrightarrow{\mathbf{GC}}$is

a) $\vec{\mathbf{0}}$ b) $\vec{\mathbf{a}} + \vec{\mathbf{b}} + \vec{\mathbf{c}}$ c) $\frac{\vec{\mathbf{a}} + \vec{\mathbf{b}} + \vec{\mathbf{c}}}{3}$ d) $\frac{\vec{\mathbf{a}} - \vec{\mathbf{b}} - \vec{\mathbf{c}}}{3}$

511. A, Bhave position vectors $\vec{a}, \vec{b}$ relative to the origin O and X, Y divide $\overrightarrow{AB}$ internally and externally respectively in the ratio 2 : 1. Then, $\overrightarrow{XY} =$

a) $\frac{3}{2}(\vec{b} - \vec{a})$ b) $\frac{4}{3}(\vec{a} - \vec{b})$ c) $\frac{5}{6}(\vec{b} - \vec{a})$ d) $\frac{4}{3}(\vec{b} - \vec{a})$

512. If $\vec{\mathbf{a}} = (2,1,-1), \vec{\mathbf{b}} = (1,-1,0), \vec{\mathbf{c}} = (5-1,1)$, then unit vector parallel to $\vec{\mathbf{a}} + \vec{\mathbf{b}} - \vec{\mathbf{c}}$ but in opposite direction is

a) $\frac{1}{3}(2\hat{\mathbf{i}} - \hat{\mathbf{j}} + 2\hat{\mathbf{k}})$ b) $\frac{1}{2}(2\hat{\mathbf{i}} - \hat{\mathbf{j}} + 2\hat{\mathbf{k}})$ c) $\frac{1}{3}(2\hat{\mathbf{i}} - \hat{\mathbf{j}} - 2\hat{\mathbf{k}})$ d) None of these

513. The number of vectors of unit length perpendicular to the two vectors $\vec{\mathbf{a}} = (1,1,0)$ and $\vec{\mathbf{b}} = (0,1,1)$ is

a) One b) Two c) Three d) Infinite

514. A vector which is a linear combination of the vectors $3\hat{\mathbf{i}} + 4\hat{\mathbf{j}} + 5\hat{\mathbf{k}}$ and $6\hat{\mathbf{i}} - 7\hat{\mathbf{j}} - 3\hat{\mathbf{k}}$ and is perpendicular to

the vector $\hat{\mathbf{i}}+\hat{\mathbf{j}}-\hat{\mathbf{k}}$ is

a) $3\hat{\mathbf{i}}-11\hat{\mathbf{j}}-8\hat{\mathbf{k}}$ b) $-3\hat{\mathbf{i}}+11\hat{\mathbf{j}}+87\hat{\mathbf{k}}$ c) $-9\hat{\mathbf{i}}+3\hat{\mathbf{j}}-2\hat{\mathbf{k}}$ d) $9\hat{\mathbf{i}}-3\hat{\mathbf{j}}+2\hat{\mathbf{k}}$

515. If $\vec{\mathbf{x}}$and $\vec{\mathbf{y}}$ are unit vectors and $\vec{\mathbf{x}}\cdot\vec{\mathbf{y}}=0$, then

a) $|\vec{\mathbf{x}}+\vec{\mathbf{y}}|=1$ b) $|\vec{\mathbf{x}}+\vec{\mathbf{y}}|=\sqrt{3}$ c) $|\vec{\mathbf{x}}+\vec{\mathbf{y}}|=2$ d) $|\vec{\mathbf{x}}+\vec{\mathbf{y}}|=\sqrt{2}$

516. If the volume of a parallelopiped with $\vec{\mathbf{a}}\times\vec{\mathbf{b}},\vec{\mathbf{b}}\times\vec{\mathbf{c}},\vec{\mathbf{c}}\times\vec{\mathbf{a}}$ as coterminous edges is 9 cu units, then the volume of the parallelopiped with

$(\vec{\mathbf{a}}\times\vec{\mathbf{b}})\times(\vec{\mathbf{b}}\times\vec{\mathbf{c}}),(\vec{\mathbf{b}}\times\vec{\mathbf{c}})\times(\vec{\mathbf{c}}\times\vec{\mathbf{a}}),(\vec{\mathbf{c}}\times\vec{\mathbf{a}})\times(\vec{\mathbf{a}}\times\vec{\mathbf{b}})$ as coterminous edges is

a) 9 cu units b) 729 cu units c) 81 cu units d) 27 cu units

517. The non-zero vectors $\vec{\mathbf{a}}$, $\vec{\mathbf{b}}$ and $\vec{\mathbf{c}}$ are related by $\vec{\mathbf{a}}=8\vec{\mathbf{b}}$and $\vec{\mathbf{c}}=-7\vec{\mathbf{b}}$.Then, the angle between $\vec{\mathbf{a}}$and $\vec{\mathbf{c}}$ is

a) π b) 0 c) $\frac{\pi}{4}$ d) $\frac{\pi}{2}$

518. For any three non-zero vectors$\vec{\mathbf{r}}_1\vec{\mathbf{r}}_2and\vec{\mathbf{r}}_3$, $\begin{vmatrix}\vec{\mathbf{r}}_1\cdot\vec{\mathbf{r}}_1 & \vec{\mathbf{r}}_1\cdot\vec{\mathbf{r}}_2 & \vec{\mathbf{r}}_1\cdot\vec{\mathbf{r}}_3\\ \vec{\mathbf{r}}_2\cdot\vec{\mathbf{r}}_1 & \vec{\mathbf{r}}_2\cdot\vec{\mathbf{r}}_2 & \vec{\mathbf{r}}_2\cdot\vec{\mathbf{r}}_3\\ \vec{\mathbf{r}}_3\cdot\vec{\mathbf{r}}_1 & \vec{\mathbf{r}}_3\cdot\vec{\mathbf{r}}_2 & \vec{\mathbf{r}}_3\cdot\vec{\mathbf{r}}_3\end{vmatrix}=0$, Then, which of the following is false?

a) All the three vectors are parallel to one and the same plane
b) All the three vectors are linearly dependent
c) This system of equation has a non-trivial solution
d) All the three vectors are perpendicular to each other

519. If $\vec{\mathbf{a}}=\hat{\mathbf{i}}+\hat{\mathbf{j}}+\hat{\mathbf{k}},\vec{\mathbf{b}}=\hat{\mathbf{i}}+\hat{\mathbf{j}},\vec{\mathbf{c}}=\hat{\mathbf{i}}$ and $(\vec{\mathbf{a}}\times\vec{\mathbf{b}})\times\vec{\mathbf{c}}=\lambda\vec{\mathbf{a}}+\mu\vec{\mathbf{b}}$, then $\lambda+\mu$ is equal to

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

520. Let $\vec{\mathbf{a}},\vec{\mathbf{b}},\vec{\mathbf{c}}$ be three vector such that $\vec{\mathbf{a}}\neq\vec{\mathbf{0}}$ and $\vec{\mathbf{a}}\times\vec{\mathbf{b}}=2\vec{\mathbf{a}}\times\vec{\mathbf{c}},|\vec{\mathbf{a}}|=|\vec{\mathbf{c}}|=1,|\vec{\mathbf{b}}|=4$ and $|\vec{\mathbf{b}}\times\vec{\mathbf{c}}|=\sqrt{15}$. If $\vec{\mathbf{b}}-2\vec{\mathbf{c}}=\lambda\vec{\mathbf{a}}$, then λ is equal to

a) 1 b) ±4 c) 3 d) -2

521. If $\vec{\mathbf{r}}\cdot\vec{\mathbf{a}}=0,\vec{\mathbf{r}}\cdot\vec{\mathbf{b}}=0$ and $\vec{\mathbf{r}}\cdot\vec{\mathbf{c}}=0$ for some non-zero vector $\vec{\mathbf{r}}$. Then, the value of $[\vec{\mathbf{a}}\vec{\mathbf{b}}\vec{\mathbf{c}}]$ is

a) 0 b) $\frac{1}{2}$ c) 1 d) 2

522. If $\vec{a},\vec{b},\vec{c}$ are any three mutually perpendicular vectors of equal magnitude a, then $|\vec{a}+\vec{b}+\vec{c}|$ is equal to

a) a b) $\sqrt{2}\,a$ c) $\sqrt{3}\,a$ d) $2a$

523. A unit vector perpendicular to both the vectors $\hat{\mathbf{i}}+\hat{\mathbf{j}}$ and $\hat{\mathbf{j}}+\hat{\mathbf{k}}$ is

a) $\frac{-\hat{\mathbf{i}}-\hat{\mathbf{j}}+\hat{\mathbf{k}}}{\sqrt{3}}$ b) $\frac{-\hat{\mathbf{i}}+\hat{\mathbf{j}}-\hat{\mathbf{k}}}{3}$ c) $\frac{\hat{\mathbf{i}}+\hat{\mathbf{j}}+\hat{\mathbf{k}}}{\sqrt{3}}$ d) $\frac{\hat{\mathbf{i}}-\hat{\mathbf{j}}+\hat{\mathbf{k}}}{\sqrt{3}}$

524. Let, $\vec{\mathbf{a}}=\hat{\mathbf{i}}+2\hat{\mathbf{j}}+\hat{\mathbf{k}}$, $\vec{\mathbf{b}}=\hat{\mathbf{i}}-\hat{\mathbf{j}}+\hat{\mathbf{k}},\vec{\mathbf{c}}=\hat{\mathbf{i}}+\hat{\mathbf{j}}-\hat{\mathbf{k}}$. A vector coplanar to $\vec{\mathbf{a}}$ and $\vec{\mathbf{b}}$has a projection along $\vec{\mathbf{c}}$ of magnitude $\frac{1}{\sqrt{3}}$, then the vector is

a) $4\hat{\mathbf{i}}-\hat{\mathbf{j}}+4\hat{\mathbf{k}}$ b) $4\hat{\mathbf{i}}+\hat{\mathbf{j}}-4\hat{\mathbf{k}}$ c) $2\hat{\mathbf{i}}+\hat{\mathbf{j}}+\hat{\mathbf{k}}$ d) None of these

525. Let $\vec{\mathbf{u}}$ and $\vec{\mathbf{v}}$ are unit vectors such that $\vec{\mathbf{u}}\times\vec{\mathbf{v}}+\vec{\mathbf{u}}=\vec{\mathbf{w}}$ and $\vec{\mathbf{w}}\times\vec{\mathbf{u}}=\vec{\mathbf{v}}$, then the value of $[\,\vec{\mathbf{u}}\vec{\mathbf{v}}\vec{\mathbf{w}}\,]$ is

a) 1 b) -1 c) 0 d) None of these

526. The position vectors of the points A,B,C are $2\hat{\imath}+\hat{\jmath}-\hat{k},3\hat{\imath}-2\hat{\jmath}+\hat{k}$ and $\hat{\imath}+4\hat{\jmath}-3\hat{k}$ respectively. These points

a) Form an isosceles triangle
b) Form a right triangle
c) Are collinear
d) Form a scalene triangle

527. If $\vec{\mathbf{a}}=\hat{\mathbf{i}}-\hat{\mathbf{j}}-\hat{\mathbf{k}}$ and $\vec{\mathbf{b}}=\lambda\hat{\mathbf{i}}-3\hat{\mathbf{j}}+\hat{\mathbf{k}}$ and the orthogonal projection of $\vec{\mathbf{b}}$ on $\vec{\mathbf{a}}$ is $\frac{4}{3}(\hat{\mathbf{i}}-\hat{\mathbf{j}}-\hat{\mathbf{k}})$then λ is equal to

a) 0 b) 2 c) 12 d) -1

528. If three points A,B and C have position vectors $(1,x,3),(3,4,7)$ and $(y,-2,-5)$ respectively and, if they are collinear, then (x,y) is equal to

a) $(2,-3)$ b) $(-2,3)$ c) $(2,3)$ d) $(-2,-3)$

529. $\overrightarrow{\mathbf{OA}}$ and $\overrightarrow{\mathbf{BO}}$ are two vectors of magnitude 5 and 6 respectively. If $\angle BOA = 60°$, then $\overrightarrow{\mathbf{OA}} \cdot \overrightarrow{\mathbf{OB}}$ is equal to

a) 0 b) 15 c) -15 d) $15\sqrt{3}$

530. If $\vec{a}$ and $\vec{b}$ are two unit vectors inclined at an angle θ such that $\vec{a}+\vec{b}$ is a unit vector, then θ is equal to

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

531. $\overrightarrow{\mathbf{AB}} \times \overrightarrow{\mathbf{AC}} = 2\hat{\mathbf{i}} - 4\hat{\mathbf{j}} + 4\hat{\mathbf{k}}$, then the area of $\Delta\, ABC$ is

a) 3 sq units b) 4 sq units c) 16 sq units d) 9 sq units

532. If the vectors $\vec{\mathbf{c}}, \vec{\mathbf{a}} = x\hat{\mathbf{i}} + y\hat{\mathbf{j}} + z\hat{\mathbf{k}}$ and $\vec{\mathbf{b}} = \hat{\mathbf{j}}$ are such that $\vec{\mathbf{a}}, \vec{\mathbf{c}}$ and $\vec{\mathbf{b}}$ from a right handed system, then $\vec{\mathbf{c}}$ is

a) $z\hat{\mathbf{i}} - x\hat{\mathbf{k}}$ b) $\vec{\mathbf{0}}$ c) $y\hat{\mathbf{j}}$ d) $-z\hat{\mathbf{i}} - x\hat{\mathbf{k}}$

533. Let $\vec{\mathbf{a}}, \vec{\mathbf{b}}, \vec{\mathbf{c}}$ be the vectors such that $\vec{\mathbf{a}} \neq 0$ and $\vec{\mathbf{a}} \times \vec{\mathbf{b}} = 2\vec{\mathbf{a}} \times \vec{\mathbf{c}}$, $|\vec{\mathbf{a}}| = |\vec{\mathbf{c}}| = 1$, $|\vec{\mathbf{b}}| = 4$ and $|\vec{\mathbf{b}} \times \vec{\mathbf{c}}| = \sqrt{15}$. If $\vec{\mathbf{b}} - 2\vec{\mathbf{c}} = \lambda\vec{\mathbf{a}}$, then λ is equal to

a) 1 b) -4 c) 3 d) -2

534. The position vectors of P and Q are respectively $\vec{a}$ and $\vec{b}$. If R is a point on $\vec{P}Q$ such that $\vec{P}R = 5\,\vec{P}Q$, then the position vector of R, is

a) $5\vec{b} - 4\vec{a}$ b) $5\vec{b} + 4\vec{a}$ c) $4\vec{a} - 5\vec{b}$ d) $4\vec{b} + 5\vec{a}$

535. The vector $\vec{c}$ is perpendicular to the vectors $\vec{a} = (2,-3,1)$, $\vec{b} = (1,-2,3)$ and satisfies the condition $\vec{c}.(\hat{\imath} + 2\hat{\jmath} - 7\hat{k})$. Then, $\vec{c} =$

a) $7\hat{\imath} + 5\hat{\jmath} + \hat{k}$ b) $-7\hat{\imath} - 5\hat{\jmath} - \hat{k}$ c) $\hat{\imath} + \hat{\jmath} - \hat{k}$ d) None of these

536. If $ABCD$ is a quadrilateral, then $\vec{B}A + \vec{B}C + \vec{C}D + \vec{D}A =$

a) $2\vec{B}A$ b) $2\vec{A}B$ c) $2\vec{A}C$ d) $2\vec{B}C$

537. The vector equation of the sphere whose centre is the point (1,0,1)and radius is 4, is

a) $|\vec{\mathbf{r}} - (\hat{\mathbf{i}} + \hat{\mathbf{k}})| = 4$ b) $|\vec{\mathbf{r}} + (\hat{\mathbf{i}} + \hat{\mathbf{k}})| = 4^2$ c) $|\vec{\mathbf{r}} \cdot (\hat{\mathbf{i}} + \hat{\mathbf{k}})| = 4$ d) $|\vec{\mathbf{r}} \cdot (\hat{\mathbf{i}} + \hat{\mathbf{k}})| = 4^2$

538. If three concurrent edges of a parallelopiped of volume V represent vectors $\vec{a}, \vec{b}, \vec{c}$ then the volume of the parallelopiped whose three concurrent edges are the three concurrent diagonals of the three faces of the given parallelopiped, is

a) V b) $2\,V$ c) $3\,V$ d) None of these

539. A unit vector in xy-plane makes an angle of 45° with the vector $\hat{\imath} + \hat{\jmath}$ and an angle of 60° with the vector $3\hat{\imath} - 4\hat{\jmath}$ is

a) $\hat{\imath}$ b) $\frac{\hat{\imath} + \hat{\jmath}}{\sqrt{2}}$ c) $\frac{\hat{\imath} - \hat{\jmath}}{\sqrt{2}}$ d) None of these

540. The equation $\mathbf{r}^{\vec{2}} - 2\,\vec{\mathbf{r}} \cdot \vec{\mathbf{c}} + h = 0, |\vec{\mathbf{c}}| > \sqrt{h}$, represent

a) Circle b) Ellipse c) Cone d) Sphere

541. The points with position vectors $10\hat{\imath} + 3\hat{\jmath}, 12\hat{\imath} - 5\hat{\jmath}$ and $a\hat{\imath} + 11\hat{\jmath}$ are collinear if the value of a is

a) -8 b) 4 c) 8 d) 12

542. 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 $[\vec{a}\vec{b}\vec{c}] =$

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

543. $[\vec{a}\vec{b}\vec{a} \times \vec{b}] + (\vec{a}.\vec{b})^2 =$

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

544. If $\vec{\mathbf{u}}, \vec{\mathbf{v}}, \vec{\mathbf{w}}$ are non-coplanar vectors and p, q are real numbers, then the equality $[3\vec{\mathbf{u}}\ p\ \vec{\mathbf{v}}\ p\ \vec{\mathbf{w}}] - [p\ \vec{\mathbf{v}}\vec{\mathbf{w}}\ q\ \vec{\mathbf{u}}] - [2\vec{\mathbf{w}}\ q\ \vec{\mathbf{v}}\ q\ \vec{\mathbf{u}}] = 0$ holds for

a) Exactly two value of (p, q) b) More than two but not all values of (p, q)

c) All values of $(p.q)$ d) Exactly one value of (p, q)

545. $\vec{\mathbf{a}} \cdot [(\vec{\mathbf{b}} + \vec{\mathbf{c}}) \times (\vec{\mathbf{a}} + \vec{\mathbf{b}} + \vec{\mathbf{c}})]$ equals

a) 0 b) $\vec{\mathbf{a}} + \vec{\mathbf{b}} + \vec{\mathbf{c}}$ c) $\vec{\mathbf{a}}$ d) $\vec{\mathbf{a}} \cdot (\vec{\mathbf{b}} + \vec{\mathbf{c}})$

546. If the vectors $\hat{\mathbf{i}} - 3\hat{\mathbf{j}} + 2\hat{\mathbf{k}}, -\hat{\mathbf{i}} + 2\hat{\mathbf{j}}$ represent the diagonals of a parallelogram, them its area will be

a) 21 b) $\frac{\sqrt{21}}{2}$ c) $2\sqrt{21}$ d) $\frac{\sqrt{21}}{4}$

547. Given $\vec{\mathbf{a}} \perp \vec{\mathbf{b}}$, $|\vec{\mathbf{a}}| = 1$ and if $(\vec{\mathbf{a}} + 3\vec{\mathbf{b}}) \cdot (2\vec{\mathbf{a}} - \vec{\mathbf{b}}) = -10$ then $|\vec{\mathbf{b}}|$ is equal to

a) 1 b) 3 c) 2 d) 4

548. If $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}, \vec{b} = \hat{\imath} + \hat{\jmath}, \vec{c} = \hat{\imath}$ and $(\vec{a} \times \vec{b}) \times \vec{c} = \lambda\vec{a} + \mu\vec{b}$, then $\lambda + \mu =$

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

549. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\vec{a} = \vec{b} + \vec{c}$ and the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{2}$, then

a) $a^2 = b^2 + c^2$ b) $b^2 = c^2 + a^2$ c) $c^2 = a^2 + b^2$ d) $2a^2 - b^2 = c^2$

550. If $\vec{\mathbf{a}}, \vec{\mathbf{b}}, \vec{\mathbf{c}}$ and $\vec{\mathbf{d}}$ are the unit vectors such that $(\vec{\mathbf{a}} \times \vec{\mathbf{b}}) \cdot (\vec{\mathbf{c}} \times \vec{\mathbf{d}}) = 1$ and $\vec{\mathbf{a}} \cdot \vec{\mathbf{c}} = \frac{1}{2}$, then

a) $\vec{\mathbf{a}}, \vec{\mathbf{b}}, \vec{\mathbf{c}}$ are non-coplanar b) $\vec{\mathbf{a}}, \vec{\mathbf{b}}, \vec{\mathbf{d}}$ are non-coplanar

c) $\vec{\mathbf{b}}, \vec{\mathbf{d}}$ are non-parallel d) $\vec{\mathbf{a}}, \vec{\mathbf{d}}$ are parallel and $\vec{\mathbf{b}}, \vec{\mathbf{c}}$ are parallel

551. The projection of the vector $2\hat{\imath} + 3\hat{\jmath} - 2\hat{k}$ on the vector $\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$, is

a) $\frac{2}{\sqrt{14}}$ b) $\frac{1}{\sqrt{14}}$ c) $\frac{3}{\sqrt{14}}$ d) None of these

552. If unit vector $\vec{\mathbf{c}}$ makes an angle $\frac{\pi}{3}$ with $\hat{\mathbf{i}} + \hat{\mathbf{j}}$, then minimum and maximum values of $(\hat{\mathbf{i}} \times \hat{\mathbf{j}}) \cdot \vec{\mathbf{c}}$ respectively are

a) $0, \frac{\sqrt{3}}{2}$ b) $-\frac{\sqrt{3}}{2}, \frac{\sqrt{3}}{2}$ c) $-1, \frac{\sqrt{3}}{2}$ d) None of these

553. $\hat{a}$ and $\hat{b}$ are two mutually perpendicular unit vectors. If the vectors $x\,\hat{a} + x\hat{b} + z(\hat{a} \times \hat{b}), \hat{a} + (\hat{a} \times \hat{b})$ and $z\hat{a} + z\hat{b} + y(\hat{a} \times \hat{b})$ lie in a plane, then z is

a) A.M. of x and y b) G.M. of x and y c) H.M. of x and y d) Equal to zero

554. If $\vec{\mathbf{a}} = (1, p, 1)$, $\vec{\mathbf{b}} = (q, 2, 2)$, $\vec{\mathbf{a}} \cdot \vec{\mathbf{b}} = r$ and $\vec{\mathbf{a}} \times \vec{\mathbf{b}} = (0, -3, 3)$, then p, q, r are in that order

a) 1,5,9 b) 9,5,1 c) 5,1,9 d) None of these

555. The vectors $3\hat{\imath} - 2\hat{\jmath} + \hat{k}, \hat{\imath} - 3\hat{\jmath} + 5\hat{k}$ and $2\hat{\imath} + \hat{\jmath} - 4\hat{k}$ form the sides of a triangle. This triangle is

a) An acute angled triangle

b) An obtuse angled triangle

c) A right angled triangle

d) An equilateral triangle

556. The vector $\hat{\mathbf{i}} + x\hat{\mathbf{j}} + 3\hat{\mathbf{k}}$ is rotated through an angle θ and doubled in magnitude, then it becomes $4\hat{\mathbf{i}} + (4x - 2)\hat{\mathbf{j}} + 2\hat{\mathbf{k}}$. The values of x is

a) $\left\{-\frac{2}{3}, 2\right\}$ b) $\left\{\frac{1}{3}, 2\right\}$ c) $\left\{\frac{2}{3}, 0\right\}$ d) $\{2,7\}$

557. If $\vec{a} = 2\hat{\imath} - 3\hat{\jmath} + 5\hat{k}, \vec{b} = 3\hat{\imath} - 4\hat{\jmath} + 5\hat{k}$ and $\vec{c} = 5\hat{\imath} - 3\hat{\jmath} - 2\hat{k}$, then the volume of the parallelopiped with coterminus edges $a + \vec{b}, \vec{b} + \vec{c}, \vec{c} + \vec{a}$ is

a) 2 b) 1 c) −1 d) 0

558. Image of the point P with position vector $7\hat{\mathbf{i}} - \hat{\mathbf{j}} + 2\hat{\mathbf{k}}$ in the line whose vector equation is $\vec{\mathbf{r}} = (9\hat{\mathbf{i}} + 5\hat{\mathbf{j}} + 5\hat{\mathbf{k}}) + \lambda(\hat{\mathbf{i}} + 3\hat{\mathbf{j}} + 5\hat{\mathbf{k}})$ has position vector

a) $-9\hat{\mathbf{i}} + 5\hat{\mathbf{j}} + 2\hat{\mathbf{k}}$ b) $9\hat{\mathbf{i}} + 5\hat{\mathbf{j}} + 2\hat{\mathbf{k}}$ c) $9\hat{\mathbf{i}} + 5\hat{\mathbf{j}} - 2\hat{\mathbf{k}}$ d) $9\hat{\mathbf{i}} - 5\hat{\mathbf{j}} - 2\hat{\mathbf{k}}$

559. If $\vec{\mathbf{a}}, \vec{\mathbf{b}}, \vec{\mathbf{c}}$ are the pth, qth, nth terms of an HP and $\vec{\mathrm{u}} = (q - r)\hat{\mathbf{i}} + (r - p)\hat{\mathbf{j}} + (p - q)\hat{\mathbf{k}}$ and $\vec{\mathrm{v}} = \frac{\hat{\mathbf{i}}}{a} + \frac{\hat{\mathbf{j}}}{b} + \frac{\hat{\mathbf{k}}}{c}$, then

a) $\vec{\mathbf{u}}, \vec{\mathbf{v}}$ are parallel vectors b) $\vec{\mathbf{u}}, \vec{\mathbf{v}}$ are orthogonal vectors

c) $\vec{\mathbf{u}} \cdot \vec{\mathbf{v}} = 1$ d) $\vec{\mathbf{u}} \times \vec{\mathbf{v}} = \hat{\mathbf{i}} + \hat{\mathbf{j}} + \hat{\mathbf{k}}$

560. If $\hat{\mathbf{i}} - \hat{\mathbf{k}}, \lambda\,\hat{\mathbf{i}} + \hat{\mathbf{j}} + (1 - \lambda)\hat{\mathbf{k}}$ and $\mu\hat{\mathbf{i}} + \lambda\,\hat{\mathbf{j}} + (1 + \lambda\,\hat{\mathbf{j}} - \mu)\hat{\mathbf{k}}$ are three coterminal edges of a parallelopiped, then its volume depends on

a) only λ b) Only μ c) Both λ and μ d) Neither λ nor μ

561. The vector $\vec{\mathbf{c}} \cdot (\vec{\mathbf{b}} + \vec{\mathbf{c}}) \times (\vec{\mathbf{a}} + \vec{\mathbf{b}} + \vec{\mathbf{c}})$ is equal to

a) $\vec{\mathbf{c}} \cdot \vec{\mathbf{b}} \times \vec{\mathbf{a}}$ b) $\vec{\mathbf{0}}$ c) $\vec{\mathbf{a}} \cdot \vec{\mathbf{a}} \times \vec{\mathbf{b}}$ d) $\vec{\mathbf{a}} \cdot \vec{\mathbf{c}} \times \vec{\mathbf{b}}$

562. If $ABCD$ is a parallelogram, then $\vec{AC} - \vec{BD} =$

a) $4\vec{AB}$ b) $3\vec{AB}$ c) $2\vec{AB}$ d) $\vec{AB}$

563. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a}+\vec{b}+\vec{c}=0$, then the value of $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$, is

a) 1 b) 3 c) $-3/2$ d) None of these

564. If $\vec{\mathbf{a}}, \vec{\mathbf{b}}, \vec{\mathbf{c}}$ are vectors such that $\vec{\mathbf{c}}=\vec{\mathbf{a}}+\vec{\mathbf{b}}$ and $\vec{\mathbf{a}} \cdot \vec{\mathbf{b}}=0$, then

a) $a^2+b^2+c^2=0$ b) $a^2-b^2=c^2$ c) $a^2+b^2=c^2$ d) $\vec{\mathbf{c}}=\vec{\mathbf{a}} \times \vec{\mathbf{b}}$

565. If $\vec{\mathbf{a}}=2\hat{\mathbf{i}}+\hat{\mathbf{j}}+2\hat{\mathbf{k}}$ and $\vec{\mathbf{b}}=5\hat{\mathbf{i}}-3\hat{\mathbf{j}}+\hat{\mathbf{k}}$, then the projection of $\vec{\mathbf{b}}$ on $\vec{\mathbf{a}}$ is

a) 3 b) 4 c) 5 d) 6

566. Forces of magnitudes 3 and 4 units acting along $6\hat{\mathbf{i}}+2\hat{\mathbf{j}}+3\hat{\mathbf{k}}$ and $3\hat{\mathbf{i}}-2\hat{\mathbf{j}}+6\hat{\mathbf{k}}$ respectively act on a particle and displace it from $(2,2-1)$to $(4,3,1)$. The work done is

a) 124/7 b) 120/7 c) 125/7 d) 121/7

567. The value of $[\vec{\mathbf{a}}\vec{\mathbf{b}}+\vec{\mathbf{c}}\vec{\mathbf{a}}+\vec{\mathbf{b}}+\ \vec{\mathbf{c}}]$ is

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