1. The are (is square units) of the parallelogram whose diagonals are $\vec{a} = \vec{i} + \vec{j} - 2\vec{k}$ and $\vec{b} = \vec{i} - 3\vec{j} + 4\vec{k}$
(a) $\sqrt{14}$ (b) $2\sqrt{14}$ (c) $2\sqrt{6}$ (d) $\sqrt{38}$

2. A constant force $\vec{F} = 2\vec{i} - 3\vec{j} + 2\vec{k}$ is acting on a particle such that the particle is displaced from the point A (1, 2, 3) to the point B(3, 4, 5). The work done by the force is
(a) 2 (b) 3 (c) $\sqrt{17}$ (d) $2\sqrt{51}$

3. A particle acted upon by forces $3\vec{i} + 2\vec{j} + 5\vec{k}$ and $2\vec{i} + \vec{j} - 3\vec{k}$ is displaced from a point P to a point Q whose respective position vector are $2\vec{i} - \vec{j} - 3\vec{k}$ and $4\vec{i} - 3\vec{j} + 7\vec{k}$ The work done by the force is
(a) 17 units (b) 24 units (c) 33 units (d) 42 units

4. 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) $2\vec{a} + \vec{b}$

5. A constant force $\vec{F} = 3\vec{i} + 2\vec{j} - 4\vec{k}$ is applied at the point (1, –1, 2). Then the vector moment of $\vec{F}$ about the point (2, –1, 3) is
(a) $-2\vec{i} + 7\vec{j} + 2\vec{k}$ (b) $-2\vec{i} - \vec{j} + 2\vec{k}$ (c) $2\vec{i} + 7\vec{j} - 2\vec{k}$ (d) $2\vec{i} - 7\vec{j} - 2\vec{k}$

6. The value of $(\vec{a} - \vec{b}).[(\vec{b} - \vec{c}) \times (\vec{c} - \vec{a})]$ is:
(a) 0 (b) $2[\vec{a}\vec{b}\vec{c}]$ (c) $3[\vec{a}\vec{b}\vec{c}]$ (d) none of these

7. If the vectors $2\vec{i} - \vec{j} + \lambda\vec{k}$, $\vec{i} - \vec{j} + 2\vec{k}$ and $3\vec{i} - 2\vec{j} + \vec{k}$ are coplanar, then the value of λ is
(a) – 1 (b) – 2 (c) – 3 (d) – 4

8. The vectors $\vec{a} = \vec{i} + \vec{j} + (m+1)\vec{k}, \vec{b} = \vec{i} + \vec{j} + m\vec{k}, \vec{c} = \vec{i} - \vec{j} + m\vec{k}$ are coplanar for
(a) m = 1/2 (b) m = – 1/2 (c) m = 2 (d) no value of m

9. If $\vec{a}', \vec{b}'$ and $\vec{c}'$ are vectors reciprocal to non-coplanar vectors $\vec{a}, \vec{b}$ and $\vec{c}$, then the value of $[\vec{a}'\vec{b}'\vec{c}']$ is
(a) – 1/2 (b) 0 (c) 1 (d) 4

10. Let $\vec{a}, \vec{b}$ and $\vec{b}$ three non-coplanar vectors and $\vec{p}, \vec{q}, \vec{r}$ be the corresponding reciprocal system of vectors, then the value of the expression $(\vec{a} + \vec{b} + \vec{c}).(\vec{p} + \vec{q} + \vec{r})$ is
(a) 0 (b) 1 (c) 2 (d) 3

11. The vector $\vec{b} = 3\vec{j} + 4\vec{k}$ is to be written as the sum of a vector $\vec{b}_1$, parallel to $\vec{a} = \vec{i} + \vec{j}$ and a vector $\vec{b}_2$ perpendicular to $\vec{a}$, then $\vec{b}_1$ equals
(a) $\frac{3}{2}(\vec{i} + \vec{j})$ (b) $\frac{2}{3}(\vec{i} + \vec{j})$ (c) $\frac{1}{2}(\vec{i} + \vec{j})$ (d) $\frac{1}{3}(\vec{i} + \vec{j})$

12. Let $\vec{a} = 2\vec{i} - \vec{j} + \vec{k}, \vec{b} = \vec{i} + 2\vec{j} - \vec{k}$ and $\vec{c} = \vec{i} + \vec{j} - 2\vec{k}$ be three vectors. A vector in the plane of $\vec{b}$ and $\vec{c}$ whose projection on $\vec{a}$ is of magnitude $\sqrt{\frac{2}{3}}$ 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) $2\vec{i} + \vec{j} + 5\vec{k}$

13. Let $\vec{a}, \vec{b}, \vec{c}$ be distinct non-negative numbers. If the vectors $a\vec{i} + a\vec{j} + c\vec{k}$, $\vec{i} + \vec{k}$, $c\vec{i} + c\vec{j} + b\vec{k}$ lie in a plane, then c is
(a) the A.M. of a and b (b) the G.M. of a and b
(c) the H.M. of a and b (d) equal to zero

14. Which of the following is a true statement :
(a) $(\vec{a} \times \vec{b}) \times \vec{c}$ is coplanar with $\vec{c}$ (b) $(\vec{a} \times \vec{b}) \times \vec{c}$ is perpendicular to $\vec{a}$
(c) $(\vec{a} \times \vec{b}) \times \vec{c}$ is perpendicular to $\vec{b}$ (d) $(\vec{a} \times \vec{b}) \times \vec{c}$ is perpendicular to $\vec{c}$

15. The vectors $\vec{i} + 2\vec{j} + 3\vec{k}, \lambda\vec{i} + 4\vec{j} + 7\vec{k}, -3\vec{i} - 2\vec{j} - 5\vec{k}$ are collinear if λ equals
(a) 3 (b) 4 (c) 5 (d) 6

16. $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ implies that
(a) $\vec{b} = \vec{c}$ (b) $\vec{a}$ and $\vec{b}$ are parallel
(c) $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular (d) $\vec{a}, \vec{b}, \vec{c}$ are coplanar

17. If $\vec{a} = 2\vec{i} + \vec{j} - 8\vec{k}$ and $\vec{b} = \vec{i} + 3\vec{j} - 4\vec{k}$, then the magnitude of $\vec{a} + \vec{b}$ =
(a) 13 (b) 13/3 (c) 3/13 (d) 4/13

18. The angle between the vectors $2\vec{i} + 6\vec{j} + 3\vec{k}$ and $12\vec{i} - 4\vec{j} + 3\vec{k}$ is
(a) $\cos^{-1}\left(\frac{1}{10}\right)$ (b) $\cos^{-1}\left(\frac{9}{11}\right)$ (c) $\cos^{-1}\left(\frac{9}{91}\right)$ (d) $\cos^{-1}\left(\frac{1}{9}\right)$

19. If the vectors $a\vec{i} + 2\vec{j} + 3\vec{k}$ and $-\vec{i} + 5\vec{j} + a\vec{k}$ are perpendicular to the each other, then a =
(a) 6 (b) – 6 (c) 5 (d) – 5

20. The area of a parallelogram whose adjacent sides are $\vec{i} - 2\vec{j} + 3\vec{k}$ and $2\vec{i} + \vec{j} - 4\vec{k}$ is
(a) $5\sqrt{3}$ (b) $10\sqrt{3}$ (c) $5\sqrt{6}$ (d) $10\sqrt{6}$

21. The number of vector of unit length perpendicular to the vectors $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = \hat{j} + \hat{k}$, is
(a) 1 (b) 2 (c) 4 (d) Infinite

22. The values of x for which the angle between the vectors $\vec{a} = x\hat{i} - 3\hat{j} - \hat{k}$ and $\vec{b} = 2x\hat{i} + x\hat{j} - \hat{k}$ is acute, and the angle between the vector $\vec{b}$ and the axis of ordinates is obtuse, rae
(a) 1, 2 (b) – 2, – 3 (c) all x < 0 (d) all x > 0

23. The value of $\vec{a}.(\vec{b} + \vec{c}) \times (\vec{a} + \vec{b} + \vec{c})$ is
(a) $2[\vec{a}\vec{b}\vec{c}]$ (b) $[\vec{a}\vec{b}\vec{c}]$ (c) 0 (d) none of these

24. Let $\vec{a}, \vec{b}, \vec{c}$ represent respectively BC, CA and AB where ABC is a triangle. Then,
(a) $\vec{a} + \vec{b} = \vec{c}$ (b) $\vec{b} + \vec{c} = \vec{a}$
(c) $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$ (d) $[\vec{a}\vec{b}\vec{c}] = [\vec{b}\vec{c}\vec{a}] = [\vec{c}\vec{a}\vec{b}]$

25. Given two vector $\hat{i}-\hat{j}$ and $\hat{i}+2\hat{j}$, the unit vector coplanar, with the two vectors and perpendicular to first is

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

26. For any vector $\vec{a}, |\vec{a}\times\hat{i}|^2+|\vec{a}\times\hat{j}|^2+|\vec{a}\times\hat{k}|^2 =$

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

27. The volume of the tetrahedron whose vertices are the points with position vectors $\hat{i}-\hat{j}+10\hat{k}$, $-\hat{i}-3\hat{j}+7\hat{k}, 5\hat{i}-\hat{j}+\lambda\hat{k}$ and $7\hat{i}-4\hat{j}+7\hat{k}$ is 11 cubic units if the value of λ is

(a) -1 (b) 1 (c) -7 (d) 7

28. The vectors $\vec{a}=x\hat{i}+(x+1)\hat{j}+(x+2)\hat{k}, \vec{b}=(x+3)\hat{i}$ + $(x+4)\hat{j}+(x+5)\hat{k}$ and $c=(x+6)\hat{i}+(x+7)\hat{j}$ + $(x+8)\hat{k}$ are coplanar for

(a) all values of x (b) $x < 0$

(c) $x > 0$ (d) none of these

29. If $\vec{e}_1=(1,1,1)$ and $\vec{e}_2=(1,1,-1)$ and $\vec{a}$ and $\vec{b}$ two vectors such that $\vec{e}_1+2\vec{a}+\vec{b}$ and $\vec{e}_2=\vec{a}+2\vec{b}$ then angle between $\vec{a}$ and $\vec{b}$ is

(a) $\cos^{-1}\left(\frac{7}{9}\right)$ (b) $\cos^{-1}\left(\frac{7}{11}\right)$ (c) $\cos^{-1}\left(-\frac{7}{11}\right)$ (d) $\cos^{-1}\left(\frac{6\sqrt{2}}{11}\right)$

30. The vectors $\vec{a}=3\hat{i}-2\hat{j}+2\hat{k}$ and $\vec{b}=-\hat{i}-2\hat{k}$ are the adjacent sides of a parallelogram. Then angle between its diagonals is

(a) $\pi/4$ (b) $\pi/3$ (c) $3\pi/4$ (d) $2\pi/3$

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