Multiple Choice Questions

[MHT-CET 2022] (online - shift)

1. A vector with magnitude of 3 units, which is perpendicular to each of the vectors $\bar{a} = 3i + j - 4k$ and $b = 6i + 5j - 2k$ is given by

   a) $\pm(2i - 2j - k)$ b) $\pm(2i - 2j + k)$ c) $\pm(2i + 2j + k)$ d) $\pm(2i + 2j - k)$

2. If $|\bar{a}| = 3$, $|\bar{b}| = 5$ and $|\bar{c}| = 7$ and $a + b + c = 0$ then the angle between $\bar{a}$ and $\bar{b}$ is

   a) $\pi/6$ b) $\pi/2$ c) $\pi/4$ d) $\pi/3$

3. If $\bar{a}, \bar{b}, \bar{c}$ are position vectors of points A, B, C respectively, with $2\bar{a} + 3\bar{b} - 5\bar{c} = \bar{0}$, then the ratio in which point C divides segment AB is

   a) 2 : 3 internally b) 3 : 2 internally c) 3 : 2 externally d) 2 : 3 externally

4. If $\overline{AB} = (2i + 3j - k)$ and A (1, 2, – 1) is the given point, then the co-ordinates of B are

   a) (3, 5, 2) b) (3, 5, – 2) c) (2, 4, 1) d) (2, 4, –1)

5. Let $\bar{a} = i - 2j + k$ and $b = i - j + k$ be two vectors. If $\bar{c}$ is a vector such that $b \times c = b \times a$ and $c.a = 0$ then $c \,.\, b$ is equal to

   a) $\frac{3}{2}$ b) $-\frac{3}{2}$ c) $\frac{1}{2}$ d) $-\frac{1}{2}$

6. For any two non-zero vectors a and b, $(ab + ba).(ab - ba)$ is

   a) $|a|^2 + |b|^2$ b) $2|a|^2$ c) $2|b|^2$ d) 0

7. If $|\bar{a}| = 5$, $|\bar{b}| = 3$, $|c| = 4$ and a is perpendicular to b and c such that angle between b and c is $\frac{5\pi}{6}$, then $[a\ b\ c] =$

   a) 25 b) 10 c) 30 d) 20

8. $|a| = \sqrt{3}$, $|b| = 5$, $b.c = 10$ and angle between b and c is $\pi/3$. If a is perpendicular to $b \times c$, then the value of $|a \times (b \times c)|$ is

   a) $10\sqrt{3}$ b) 15 c) 30 d) 10

9. If A = (5, 1, p), B = (1, q, p) and C = (1, –2, 3) are vertices of triangle and G = $\left(r, \frac{-4}{3}, \frac{1}{3}\right)$ is its centroid, then the values of p, q, r are respectively

   a) – 1, 3, 7/3 b) – 1, –3, 7/3 c) 1, – 3, 7/3 d) 1, 3, 7/3

10. The values of a, so that volume of parallelopiped formed by $i + aj + k$, $j + ak$ and $ai + k$ becomes minimum is

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

25. If the vectors $a = i - 2j + k$, $b = 2i - 5j + pk$ and $c = 5i - 9j + 4k$ are coplanar, then the value of p is

a) $-1/3$ b) 3 c) -3 d) $1/3$

26. If the vectors $(2i - qj + 3k)$ and $(4i - 5j + 6k)$ are collinear then the value of q is

a) $\frac{5}{2}$ b) $\frac{2}{3}$ c) $\frac{-5}{2}$ d) $\frac{-2}{5}$

27. If $a = i + 5k$, $b = 2i + 3k$, $c = 4i - j + 2k$ and $d = i - j$ then $(c - a)\ (b \times d) =$

a) 12 b) 30 c) 10 d) 20

28. The perimeter of the triangle whose vertices have the position vectors $i + j + k$, $5i + 3j - 3k$ and $2i + 5j + 9k$ is

a) $\left(\sqrt{15} - \sqrt{157}\right)$ units b) $\left(15 + \sqrt{157}\right)$ units

c) $\left(15 - \sqrt{157}\right)$ units d) $\left(\sqrt{15} + \sqrt{157}\right)$ units

29. For any non-zero vectors a and b $[b \ \ a \times b \ \ a] =$

a) $|a \times b|$ b) 0 c) $|a \times b|^2$ d) $a \times b$

30. If a, b, c are non – coplanar vectors and $(a + b + c)\ [(a \times b) + (b \times c) + (c \times a)] = K\ [a\ b\ c]$ then value of K is

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

[MHT-CET 2019]

31. If G $(3, -5, r)$ is centroid of triangle ABC where A $(7, -8, 1)$, B $(p, q, 5)$ and C $(q + 1, 5p, 0)$ are vertices of triangle then values of p, q, r are respectively.

a) $-4, 5, 4$ b) $6, 5, 4$ c) $-3, 4, 3$ d) $-2, 3, 2$

32. If $a + b$, $b + c$ and $c + a$ are coterminous edges of a parallelopiped then its volume is

a) $3\ [a\ c\ b]$ b) $2\ [a\ b\ c]$ c) $4\ [b\ a\ c]$ d) 0

33. If p, q and r are non – zero, non – coplanar vectors then $[p + q - r \quad p - q \quad q - r] =$

a) $[p\ q\ r]$ b) $3\ [p\ q\ r]$ c) 0 d) $2\ [p\ q\ r]$

34. Which of the following is not equal to W. (U × V) ?

a) U (V × W) b) V (U × W) c) V (W × U) d) (U × V) W

35. A, B, C and D are (3, 7, 4), (5, – 2, 3), (– 4, 5, 6) and (1, 2, 3) respectively. Then the volume of the parallelopiped with AB, AC and AD as the coterminus edges (in cubic units)

a) 92 b) 94 c) 91 d) 93

36. a and b are non-collinear vectors. If $c = (x - 2)\ a + b$ and $d = (2x + 1)\ a - b$ are collinear vectors, then the value of $x =$

a) 1/2 b) 1/3 c) 1/4 d) 1/5

37. For any non – zero vectors a, b, c the value of $a\ [(b + c) \times (a + b + c)]$

a) $[a\ b\ c]$ b) $[a\ c\ b]$ c) $2\ [a\ b\ c]$ d) 0

38. If the scalar triple product of the vectors $-3i + 7j - 3k$, $3i - 7j + \lambda k$ and $7i - 5j - 3k$ is 272 then $\lambda =$

a) 10 b) 11 c) 8 d) 9

39. If P (1, 2, 3), R (4, 5, –1) are the vertices and G (2, 3, –1) is the centroid of ΔPQR, then co-ordinates of midpoint of PQ are

a) (1, 2, 1) b) (1, 2, 2) c) (1, –2, –1) d) (1, 2, –1)

[MHT-CET 2021] (online)

11. If the volume of a tetrahedron whose conterminous edges are $\bar{a}+\bar{b}$, $b+c$, $c+a$ is 24 cubic units then the volume of parallelopiped whose conterminous edges are a, b, c is
a) 48 cubic units b) 144 cubic units c) 72 cubic units d) 10 cubic units

12. If $(2i + 6i + 27k) \times (i + \lambda j + \mu k) = 0$ then λ and μ are respectively.
a) $\frac{17}{2}, 3$ b) $3, \frac{17}{2}$ c) $3, \frac{27}{2}$ d) $\frac{27}{2}, 3$

13. In a quadrilateral PQRS, M and N are midpoints of the sides PQ and RS resepectively. If PS + QR = tMN then t =
a) 1/2 b) 4 c) 3/2 d) 2

14. The co-ordinates of the point P = (1, 2, 3) and O = (0, 0, 0) then the direction cosines of OP are
a) $\frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{3}{\sqrt{14}}$ b) $\frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}, \frac{1}{\sqrt{6}}$ c) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$ d) $\frac{2}{\sqrt{29}}, \frac{3}{\sqrt{29}}, \frac{4}{\sqrt{29}}$

15. If $a + b + c = 0$ with $|a| = 3$, $|b| = 5$ and $|c| = 7$ then the angle between $\bar{a}$ and $\bar{b}$ is
a) $(\pi/3)^c$ b) $(4\pi/3)^c$ c) $(2\pi/3)^c$ d) π^c

16. The area of triangle with vertices (1, 2, 0), (1, 0, a) and (0, 3, 1) is $\sqrt{6}$ sq. units, then the values of a are
a) $-8, 1$ b) $2, -4$ c) $-2, 4$ d) $8, -1$

17. If $\bar{a} = i + 2j + 3k$, $b = -1 + 2j + k$, $c = 3i + j$ and $a + \lambda b$ is perpendicular to c, then λ = ...
a) 5 b) 2 c) 3 d) 4

18. If $a = i + j + k$, $\bar{c} = j - k$, $a \times b = c$ and $a.b = 1$ then b =
a) i b) $-i$ c) j d) k

19. If the vectors $a = 2i + pj + 4k$ and $b = 6i - 9j + qk$ are collinear then p and q are
a) $p = 3, q = -12$ b) $p = 3, q = 21$ c) $p = -3, q = 12$ d) $p = -3, q = -12$

20. If $a + b$, $b + c$, $c + a$ are coterminus edges of parallelopiped, then its volume is
a) 0 b) 4 [b a c] c) 3 [a c b] d) 2 [a b c]

[MHT-CET 2020]

21. If $\bar{a} = \frac{1}{\sqrt{10}}(3i + k)$, $b = \frac{1}{7}(2i + 3j - 6k)$, then the value of $(2a - b)\,[(a \times b) \times (a + 2b)]$ is
a) 7 b) -5 c) 5 d) -7

22. If [a b c] = 4 then volume of parallelopiped with coterminous edges $a + 2b$, $b + 2c$, $c + 2a$ is
a) 40 units b) 36 units c) 32 units d) 20 units

23. If the points A (2, 1, -1), B (0, -1, 0), C (4, 0, 4) and D (2, 0, x) are coplanar then x =
a) 4 b) 1 c) 2 d) 3

24. If $\bar{a} = 3i + j - k$, $\bar{b} = 2i - j + 7k$ and $c = 7i - j + 23k$ are three vectors, then which of the following statements is true ?
a) a, b, c are mutually perpendicular b) a, b and c are coplanar
c) a, b and c are non-coplanar d) a and b are collinear

40. The ratio in which the xz plane cuts the line segment joining the points $(-2, -4, 7)$ and $(3, -5, 8)$ is
a) 3 : 2 b) 5 : 4 c) 4 : 5 d) 2 : 3
[MHT-CET 2018]

41. If a, b, c are mutually perpendicular vectors having magnituides 1, 2, 3 respectively, then $[a+b+c,\ b-a,\ c] = ?$
a) 0 b) 6 c) 12 d) 18

42. L and M are two points with position vectors $2a-b$ and $a+2b$ resp. The position vector of the point N which divides the line segment LM in the ratio 2 : 1 externally is
a) $3b$ b) $4b$ c) $5b$ d) $3a+4b$
[MHT-CET 2017]

43. Let PQRS be a quadrilateral. If M and N are midpoints of the sides PQ and RS respectively then PS + QR =
a) 3 MN b) 4 MN c) 2 MN d) 2 NM
[MHT-CET 2016]

44. If $a = i+j-2k$, $b = 2i-j+k$ and $c = 3i-k$ and $c = ma + nb$ then m + n =
a) 0 b) 1 c) 2 d) – 1

45. M and N are the midpoints of the diagonals AC and BD respectively of quadrilateral ABCD, then AB + AD + CB + CD =
a) 2 MN b) 2 NM c) 4 MN d) 4 NM

46. If G (g), H (h) and C (c) are centroid, orthocentre, and circumcenter of a triangle and $xc + yh + zg = 0$ then (x, y, z) =
a) 1, 1, – 2 b) 2, 1, – 3 c) 1, 3, – 4 d) 2, 3, – 5

47. If $a = i+j+k$, $b = 2i+\lambda j+k$ and $c = i-j+4k$ and $a\,(b \times c) = 10$ then λ is equal to
a) 6 b) 7 c) 9 d) 10
[MHT-CET 2015] (JEE – 2015)

48. In parallelogram ABCD, $|AB| = a$, $|AD| = b$, $|AC| = c$ then DA. AB has the value
a) $\frac{1}{2}(a^2+b^2+c^2)$ b) $\frac{1}{2}(a^2-b^2+c^2)$ c) $\frac{1}{2}(a^2+b^2-c^2)$ d) $\frac{1}{3}(b^2+c^2-a^2)$

49. Let a, b and c be three non-zero vectors such that no two of them are collinear and $(a \times b) \times c = \frac{1}{3}|b||c|a$. If θ is the angle between vectors b and c, then the value of $\sin\theta$ is
a) $\frac{2}{3}$ b) $\frac{-2\sqrt{3}}{3}$ c) $\frac{2\sqrt{2}}{3}$ d) $\frac{-\sqrt{2}}{3}$

50. Let a and b be two unit vectors such that $|a+b| = \sqrt{3}$. If $c = a + 2b + 3(a \times b)$ then $2|c|$ is equal to
a) $\sqrt{55}$ b) $\sqrt{37}$ c) $\sqrt{51}$ d) $\sqrt{43}$
[MHT-CET 2014] (JEE – 2014)

51. If x, y and z are three unit vectors in three dimensional space, then the minimum value of $|x+y|^2 + |y+z|^2 + |z+x|^2$
a) $\frac{3}{2}$ b) 3 c) $3\sqrt{3}$

52. If $|a| = 2$, $|b| = 3$ and $|2a - b| = 5$, then $|2a + b|$ equals
a) 17 b) 7 c) 5 d) 1

53. If $[a \times b \quad b \times c \quad c \times a] = \lambda [a \ b \ c]^2$ then λ is equal to
a) 0 b) 1 c) 2 d) 3

[MHT-CET 2013]

54. The volume of parallelopiped with coterminous edges $3i - j + 4k$, $6i + 2j - 5k$ and $2i + j + \lambda k$ is one and half times that of parallelopiped having coterminous edges $j + k$, $i + k$ and $i + j$. Then λ =
a) 3 b) $\frac{-5}{2}$ c) 2 d) -2

55. If $c = 3a - 2b$ then the value of $a \cdot (b \times c)$ =
a) 1 b) 0 c) -1 d) 2

56. Three distinct points A, B and C with P.V.s. a, b and c respectively are collinear if there exist non – zero scalars x, y, z such that
a) $xa + yb + zc = 0$ and $x + y + z = 0$ b) $xa + yb + zc \neq 0$ and $x + y + z \neq 0$
c) $xa + yb + zc \neq 0$ and $x + y + z = 0$ d) $xa + yb + zc = 3$ and $x + y + z \neq 0$

[MHT-CET 2012]

57. If the position vectors of the vertices A, B and C are $6i$, $6j$ and k respectively with respect to origin O, the volume of tetrahedron OABC is
a) 6 b) 3 c) 1/6 d) 1/3

58. If three vectors $2i - j - k$, $i + 2j - 3k$ and $3i + \lambda j + 5k$ are coplanar then the value of λ is
a) -4 b) -2 c) -1 d) -8

59. The vector perpendicular to the vectors $4i - j + 3k$ and $-2i + j - 2k$ whose magnitude is 9.
a) $3i + 6j - 6k$ b) $3i - 6j + 6k$ c) $-3i + 6j + 6k$ d) None of these

60. If P is orthocentre, Q is circumcentre, and G is centroid of ΔABC, then $\overline{QP}$ =
a) 3 QG b) 2 QG c) QG d) 4 QG

61. If $a + b + c = 0$ and $|a| = 5$, $|b| = 3$ and $|c| = 7$ then angle between a and b is
a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{6}$

[MHT-CET 2011]

62. If $U = a - b$ and $V = a + b$ and $|a| = |b| = 2$ then $|U \times V|$ is equal to
a) $2\sqrt{16 - (ab)^2}$ b) $\sqrt{16 - (ab)^2}$ c) $2\sqrt{4 - (ab)^2}$ d) $2\sqrt{4 + (a.b)^2}$

63. If the vectors a, b and c are coplanar then

$$\begin{vmatrix} a & b & c \\ aa & ab & ac \\ ba & bb & bc \end{vmatrix}$$ is equal to

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

135. The centroid of tetrahedron with vertices at P (5, – 7, 0), Q (*a*, 5, 3), R (4, – 6, *b*), S (6, *c*, 2) is (4, – 3, 2), then $2a + 3b + c =$

a) – 7 b) – 5 c) 7 d) 15

136. The incentre of triangle ABC whose vertices are A (0, 2, 1), B (– 2, 0, 0), C (– 2, 0, 2) is

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

137. The vector $\bar{a} = x\hat{i} + 2\hat{j} + y\hat{k}$ lies in the plane of the vectors $\bar{b} = \hat{i} + \hat{j}$ and $\bar{c} = \hat{j} + \hat{k}$ and bisects the angle between $\bar{b}$ and $\bar{c}$. Then

a) $x = 1, y = 1$ b) $x = 1, y = 2$ c) $x = 2, y = 1$ d) $x = 2, y = 2$

138. Suppose that $\bar{a}, \bar{b}, \bar{c}$ are three non-coplanar vectors in R^3. Let the components of a vector $\bar{d}$ along $\bar{a}, \bar{b}, \bar{c}$ be 4, 3, 5 respectively. If the components of this vector $\bar{d}$ along $-\bar{a} + \bar{b} + \bar{c}$, $\bar{a} - \bar{b} + \bar{c}$ and $-\bar{a} - \bar{b} + \bar{c}$ are x, y and z respectively, then $2x + y + z =$

a) 6 b) 8 c) 9 d) 10

139. If the points P, Q and R are with position vectors $\hat{i} - 2\hat{j} + 3\hat{k}$, $-2\hat{i} + 3\hat{j} + 2\hat{k}$ and $-8\hat{i} + 13\hat{j}$ respectively, then these points are

a) non-collinear
b) collinear and P lies between Q and R
c) collinear and Q lies between P and R
d) collinear and R lies between P and Q

140. Let $\bar{a}, \bar{b}, \bar{c}$ be three non-zero vectors such that $\bar{b}$ and $\bar{c}$ are non-collinear. If $\bar{a} + 5\bar{b}$ is collinear with $\bar{c}$, $\bar{b} + 6\bar{c}$ is collinear with $\bar{a}$ and $\bar{a} + \alpha\bar{b} + \beta\bar{c} = 0$, then $\alpha + \beta =$

a) – 30 b) – 25 c) 30 d) 35

141. If $\bar{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}$, $\bar{b} = -\hat{i} + 2\hat{j} + \hat{k}$, $\bar{c} = 3\hat{i} + \hat{j}$ are such that $\bar{b} + \lambda\bar{a}$ is perpendicular to $\bar{c}$, then $\lambda =$

a) $\frac{1}{2}$ b) $\frac{1}{4}$ c) $\frac{1}{6}$ d) $\frac{1}{8}$

142. If the vectors $\bar{a} = \hat{i} - \hat{j} + 2\hat{k}$, $\bar{b} = 2\hat{i} + 4\hat{j} + \hat{k}$, $\bar{c} = m\hat{i} + \hat{j} + n\hat{k}$ are mutually perpendicular, then $(m, n) =$

a) (– 2, 3) b) (2, – 3) c) (– 3, 2) d) (3, – 2)

143. For all real x, the vectors $mx\hat{i} - 6\hat{j} - 3\hat{k}$ and $x\hat{i} + 2\hat{j} + 2mx\hat{k}$ makes an obtuse angle with each other, then the value of m lies in

a) (0, 1) b) $\left(0, \frac{4}{3}\right)$ c) $\left(-2, -\frac{4}{3}\right)$ d) $\left(-\frac{4}{3}, 0\right)$

144. If $\bar{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\bar{b} = 2\hat{i} + 3\hat{j} - \hat{k}$, then the angle between the vectors $2\bar{a} + \bar{b}$ and $\bar{a} + 2\bar{b}$ is

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