# Engineering Daily 12 [Set 04] EV

Binomial Expansion + Vector

**Total Marks:** 50 **Negative Marks:** 0.25 **Time:** 1 Hour

## MCQ 50 marks

1. If vectors $\vec{P} = 2\hat{i} + m\hat{j} - 3\hat{k}$ and $\vec{Q} = m\hat{i} - 4\hat{j} + 2\hat{k}$ are perpendicular to each other, what is the value of $m$?

Ⓐ 3 Ⓑ $-3$ Ⓒ 2 Ⓓ $-2$

2. What is the perpendicular distance from the point $(2, 1, -1)$ to the plane $x - 2y + 2z + 5 = 0$?

Ⓐ 2 Ⓑ 3 Ⓒ 1 Ⓓ 0

3. What is the perpendicular projection of the vector $\vec{A} = 3\hat{i} + 4\hat{j} - 5\hat{k}$ on the vector $\vec{B} = 2\hat{i} + 2\hat{j} + \hat{k}$?

Ⓐ 1 Ⓑ 3 Ⓒ 9 Ⓓ $\frac{1}{3}$

4. The vertices of a triangle are $(1, 0, 0)$, $(0, 2, 0)$ and $(0, 0, 3)$. What is its area?

Ⓐ 7 Ⓑ $\frac{7}{2}$ Ⓒ 14 Ⓓ $\frac{\sqrt{14}}{2}$

5. What is the angle between the line $\frac{x-1}{2} = \frac{y-2}{-1} = \frac{z+3}{2}$ and the plane $3x + 4y - 5z = 7$?

Ⓐ $\sin^{-1}\left(\frac{4}{15\sqrt{2}}\right)$ Ⓑ $\cos^{-1}\left(\frac{8}{15\sqrt{2}}\right)$

Ⓒ $\sin^{-1}\left(\frac{4}{15}\right)$ Ⓓ $\sin^{-1}\left(\frac{4\sqrt{2}}{15}\right)$

6. If $\vec{a} = x\hat{i} - 2\hat{j} + \hat{k}$, $\vec{b} = 3\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{c} = \hat{i} - 3\hat{j} + 3\hat{k}$ are coplanar, what is the value of $x$?

Ⓐ 2 Ⓑ 4 Ⓒ $-2$ Ⓓ $-4$

7. A plane passes through the point $(1, -2, 4)$ and is parallel to the plane $2x - y + 3z = 5$. What is the equation of the plane?

Ⓐ $2x - y + 3z = 16$ Ⓑ $2x - y + 3z = 5$

Ⓒ $2x + y + 3z = 16$ Ⓓ $x - 2y + 4z = 16$

8. Three vectors $\vec{a}, \vec{b}, \vec{c}$ have magnitudes 5, 12, 13 respectively and $\vec{a} + \vec{b} + \vec{c} = \vec{0}$. What is the angle between $\vec{a}$ and $\vec{b}$?

Ⓐ $0°$ Ⓑ $45°$ Ⓒ $90°$ Ⓓ $180°$

9. What is the equation of the plane passing through the points $(0, 1, 1)$, $(1, 0, 1)$ and $(1, 1, 0)$?

Ⓐ $x - y + z = 2$ Ⓑ $x + y - z = 2$

Ⓒ $x + y + z = 1$ Ⓓ $x + y + z = 2$

10. The position vectors of two moving particles are $\vec{r}_A = t\hat{i} + 2\hat{j}$ and $\vec{r}_B = 3\hat{i} + 2t\hat{j}$. What is the minimum distance between the particles?

Ⓐ 3.2 Ⓑ $\frac{4}{\sqrt{5}}$ Ⓒ $\frac{16}{5}$ Ⓓ $\frac{2}{\sqrt{5}}$

11. If $|\vec{A} \times \vec{B}| = 8$ and the angle between $\vec{A}$ and $\vec{B}$ is $30°$, what is the value of $\vec{A} \cdot \vec{B}$?

Ⓐ 8 Ⓑ $8\sqrt{3}$ Ⓒ 16 Ⓓ $16\sqrt{3}$

12. A plane passes through the point $(1, 1, 1)$ and is parallel to the vectors $\hat{i} - \hat{j}$ and $\hat{j} + \hat{k}$. What is the equation of the plane?

Ⓐ $x + y + z = 3$ Ⓑ $x - y + z = 1$

Ⓒ $x + y - z = 1$ Ⓓ $x - y - z = -1$

13. What is the angle between a body diagonal and a face diagonal of a cube?

Ⓐ $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ Ⓑ $\cos^{-1}\left(\sqrt{\frac{2}{3}}\right)$

Ⓒ $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$ Ⓓ $\cos^{-1}\left(\frac{2}{3}\right)$

14. If the planes $px + 2y - z = 5$ and $3x - py + 2z = 8$ are perpendicular to each other, what is the value of $p$?

Ⓐ 1 Ⓑ $-1$ Ⓒ 2 Ⓓ $-2$

15. $\vec{A} = 2\hat{i} - \hat{j}$ and $\vec{B}$ is an unknown vector such that $\vec{A} \cdot \vec{B} = 4$ and $\vec{A} \times \vec{B} = -3\hat{k}$. What is the vector $\vec{B}$?

Ⓐ $\hat{i} + 2\hat{j}$ Ⓑ $\hat{i} - 2\hat{j}$ Ⓒ $2\hat{i} + \hat{j}$ Ⓓ $-\hat{i} + 2\hat{j}$

16. Which unit vector lies in the $yz$-plane and is perpendicular to $2\hat{i} - 3\hat{j} + 4\hat{k}$?

Ⓐ $\pm\frac{3\hat{j}+4\hat{k}}{5}$ Ⓑ $\pm\frac{4\hat{j}+3\hat{k}}{5}$ Ⓒ $\pm\frac{4\hat{j}-3\hat{k}}{5}$ Ⓓ $\pm\frac{3\hat{j}-4\hat{k}}{5}$

17. What is the distance between the parallel planes $x - 2y + 2z = 4$ and $2x - 4y + 4z = 15$?

Ⓐ $\frac{7}{6}$ Ⓑ $\frac{11}{3}$ Ⓒ $\frac{11}{6}$ Ⓓ $\frac{7}{3}$

18. The speed of a river current is $6\ \text{kmh}^{-1}$ and the speed of a boat is $10\ \text{kmh}^{-1}$. At what angle to the current must the boat travel to reach the exact opposite point?

Ⓐ $\cos^{-1}(-\frac{3}{5})$ Ⓑ $\cos^{-1}(\frac{3}{5})$ Ⓒ $\sin^{-1}(\frac{3}{5})$ Ⓓ $120°$

19. $\vec{u}$ and $\vec{v}$ are two unit vectors and $|\vec{u} + \vec{v}| = \sqrt{3}$. What is the value of $|\vec{u} - \vec{v}|$?

Ⓐ $\sqrt{2}$ Ⓑ 2 Ⓒ 1 Ⓓ 0

20. What is the value of $\vec{A} \times (\vec{B} \times \vec{C}) + \vec{B} \times (\vec{C} \times \vec{A}) + \vec{C} \times (\vec{A} \times \vec{B})$?

Ⓐ $3[\vec{A}\ \vec{B}\ \vec{C}]$ Ⓑ $\vec{A} + \vec{B} + \vec{C}$

Ⓒ $\vec{0}$ Ⓓ $2(\vec{A} \times \vec{B})$

21. What is the value of $(\vec{a} - \vec{b}) \cdot \{(\vec{b} - \vec{c}) \times (\vec{c} - \vec{a})\}$?

Ⓐ $\vec{a} \cdot (\vec{b} \times \vec{c})$ Ⓑ $2\{\vec{a} \cdot (\vec{b} \times \vec{c})\}$

Ⓒ 0 Ⓓ $-1$

22. If $\binom{2n}{3} = 20\binom{n}{2}$, what is the value of $n$?

Ⓐ 4 Ⓑ 6 Ⓒ 8 Ⓓ 10

23. Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitude and $|\vec{A}+\vec{B}| = 2|\vec{A}-\vec{B}|$. What is the angle between them?

Ⓐ $\cos^{-1}\left(\frac{3}{5}\right)$ Ⓑ $\cos^{-1}\left(\frac{4}{5}\right)$ Ⓒ $\sin^{-1}\left(\frac{3}{5}\right)$ Ⓓ $60°$

24. $\vec{a}$ and $\vec{b}$ are unit vectors and $|\vec{a}\times\vec{b}| = \vec{a}\cdot\vec{b}$. What is the value of $|\vec{a}+\vec{b}|$?

Ⓐ $\sqrt{2}$ Ⓑ $2$ Ⓒ $\sqrt{2+\sqrt{2}}$ Ⓓ $\sqrt{2-\sqrt{2}}$

25. The position vector of a point is $\vec{r} = 3\cos(2t)\hat{i} + 3\sin(2t)\hat{j}$. What is the angle between the position vector $\vec{r}$ and the acceleration vector $\vec{a}$?

Ⓐ $0°$ Ⓑ $90°$ Ⓒ $180°$ Ⓓ $45°$

26. Two adjacent sides of a parallelogram are $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} - 2\hat{j} + \hat{k}$. What is its area?

Ⓐ $4\sqrt{3}$ Ⓑ $8\sqrt{3}$ Ⓒ $16\sqrt{3}$ Ⓓ $8\sqrt{2}$

27. $\vec{a}, \vec{b}, \vec{c}$ are three unit vectors and $\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a} = -\frac{3}{2}$. What is the value of $|\vec{a}+\vec{b}+\vec{c}|$?

Ⓐ $1$ Ⓑ $\frac{3}{2}$ Ⓒ $\sqrt{3}$ Ⓓ $0$

28. In the expansion of $\left(3x^3 - \frac{1}{x^2}\right)^{10}$, what is the value of the term independent of $x$?

Ⓐ $17010$ Ⓑ $-17010$ Ⓒ $210$ Ⓓ $810$

29. In the expansion of $\left(x - \frac{1}{x}\right)^{12}$, what is the value of the middle term?

Ⓐ $924$ Ⓑ $-924$ Ⓒ $792$ Ⓓ $-792$

30. In the expansion of $(2-x)^9$, what is the coefficient of $x^6$?

Ⓐ $672$ Ⓑ $-672$ Ⓒ $5376$ Ⓓ $-5376$

31. In the expansion of $(2x-3y+z)^8$, what is the sum of the coefficients of all terms?

Ⓐ $1$ Ⓑ $-1$ Ⓒ $0$ Ⓓ $8$

32. In the expansion of $(x+y+z+w)^5$, what is the total number of terms?

Ⓐ $20$ Ⓑ $35$ Ⓒ $56$ Ⓓ $70$

33. In the expansion of $(1+2x)^{-3}$, what is the coefficient of $x^4$? (where $|x| < \frac{1}{2}$)

Ⓐ $240$ Ⓑ $-240$ Ⓒ $120$ Ⓓ $-120$

34. In the expansion of $(1+x)^{19}$, which is the largest coefficient?

Ⓐ $\binom{19}{8}$ Ⓑ $\binom{19}{9}$ Ⓒ $\binom{19}{10}$ Ⓓ Both B and C

35. In the expansion of $(x+y)^8$, the 3rd and 4th terms are equal. What is the value of $\frac{x}{y}$?

Ⓐ $1$ Ⓑ $2$ Ⓒ $3$ Ⓓ $4$

36. What is the value of $\sum_{r=1}^{n} r\,3^r\binom{n}{r}$?

Ⓐ $n\,4^{n-1}$ Ⓑ $3n\,4^{n-1}$ Ⓒ $n\,3^{n-1}$ Ⓓ $3n\,4^n$

37. In the expansion of $\left(2x - \frac{3}{y}\right)^7$, what is the 3rd term from the end?

Ⓐ $-20412\,\frac{x^2}{y^5}$ Ⓑ $20412\,\frac{x^2}{y^5}$

Ⓒ $-22680\,\frac{x^3}{y^4}$ Ⓓ $22680\,\frac{x^3}{y^4}$

38. In the expansion of $(1+x)^n$, the 4th term is $20x^3$. What is the value of $n$?

Ⓐ $5$ Ⓑ $6$ Ⓒ $7$ Ⓓ $8$

39. In the expansion of $(3+kx)^7$, the coefficients of $x^3$ and $x^4$ are equal. What is the value of $k$?

Ⓐ $1$ Ⓑ $2$ Ⓒ $3$ Ⓓ $4$

40. In the expansion of $(1-x)^{-2}$, what is the coefficient of $x^n$? (where $|x| < 1$)

Ⓐ $n$ Ⓑ $n+1$ Ⓒ $n-1$ Ⓓ $n^2$

41. For which condition on $x$ does the expansion of $(4-5x)^{-\frac{1}{2}}$ converge?

Ⓐ $|x| < \frac{4}{5}$ Ⓑ $|x| < \frac{5}{4}$ Ⓒ $|x| > \frac{4}{5}$ Ⓓ $|x| < 4$

42. In the expansion of $\left(x^{\frac{1}{3}} + x^{-\frac{1}{2}}\right)^{10}$, which is the term independent of $x$?

Ⓐ $152$ Ⓑ $210$ Ⓒ $120$ Ⓓ $252$

43. In the expansion of $(1-x^2)^4(1-x)$, what is the coefficient of $x^3$?

Ⓐ $0$ Ⓑ $4$ Ⓒ $-4$ Ⓓ $-1$

44. In the expansion of $(1+x)^{12}$, what is the sum of the coefficients of the odd-power terms?

Ⓐ $4096$ Ⓑ $2048$ Ⓒ $1024$ Ⓓ $0$

45. In the expansion of $(1+ax)^n$, the first three terms are $1, -12x, 60x^2$ respectively.What is the value of $n$?

Ⓐ $4$ Ⓑ $5$ Ⓒ $6$ Ⓓ $8$

46. In the expansion of $\left(\sqrt{3} + \sqrt[4]{5}\right)^{20}$, how many rational terms are there?

Ⓐ $4$ Ⓑ $5$ Ⓒ $6$ Ⓓ $7$

47. What is the value of $C_0^2 + C_1^2 + C_2^2 + \cdots + C_n^2$, where $C_r = \binom{n}{r}$?

Ⓐ $\binom{2n}{n}$ Ⓑ $2^{2n}$ Ⓒ $\binom{2n}{n-1}$ Ⓓ $0$

48. In the expansion of $\frac{1+x}{(1-x)^3}$, what is the coefficient of $x^3$? (where $|x| < 1$)

Ⓐ $10$ Ⓑ $6$ Ⓒ $16$ Ⓓ $12$

49. In the expansion of $(1+4x)^{\frac{1}{2}}$, what is the coefficient of $x^2$?

Ⓐ $2$ Ⓑ $-2$ Ⓒ $4$ Ⓓ $-4$

50. In the expansion of $(1+x)^n$, the coefficients of the 5 th, 6th and 7th terms are in arithmetic progression. What can be the value of $n$?

Ⓐ $7, 14$ Ⓑ $8, 12$ Ⓒ $10, 11$ Ⓓ $9, 13$