Bihar Board Class 12 Maths Elective Set D 2025 Question Paper with Solutions

Time Allowed :3 Hours 15 Minutes	Maximum Marks :70	Total Questions :96

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours 15 Minutes duration.
2. The question paper consists of 96 questions.
3. In Section - B, there are 20 short answer type questions, each carrying 2 marks, out of which any 10 questions are to be answered. Apart from these, there are 6 long answer type questions, each carrying 5 marks, out of which any 3 questions are to be answered.
4. Minimum 30% marks in each subject (30 out of 100 for theory, adjusted for practicals where applicable).
5. Use of any electronic appliances is strictly prohibited.

2. The slope of the tangent to the curve $y = 2x^P + 3\sin x$ at $x = 0$ is:
(A) 3
(B) -1
(C) 0
(D) -3

---

3. The rate of change of the area of a circle with respect to its radius r (in cm^2/cm) at $r = 6$ cm is:
(A) 10π
(B) 12π
(C) 8π
(D) 11π

---

4. If events A and B are independent, then:
(A) $P(A \cap B) = P(A)P(B)$
(B) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
(C) $P(A \cup B) = 0$
(D) $P(A \cap B) = P(A) + P(B)$

---

5. The probability of drawing a king from a pack of 52 cards is:

(A) $\frac{1}{13}$
(B) π
(C) e
(D) 1

---

7. If $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{4}$, and $P(A \cap B) = \frac{1}{5}$, then $P(B|A)$ is:
(A) $\frac{2}{5}$
(B) $\frac{3}{5}$
(C) $\frac{1}{5}$
(D) $\frac{4}{5}$

---

8. A coin is tossed 10 times. The probability of getting exactly six heads is:
(A) $\binom{10}{6}\left(\frac{1}{2}\right)^6\left(\frac{1}{2}\right)^4$
(B) $\binom{10}{6}\left(\frac{1}{2}\right)^7$
(C) $\binom{10}{6}\left(\frac{1}{2}\right)^8$
(D) $\binom{10}{6}\left(\frac{1}{2}\right)^{10}$

---

9. If $P(A) = \frac{6}{11}$, $P(B) = \frac{5}{11}$, and $P(A \cup B) = \frac{7}{11}$, then $P(A \cap B)$ is:
(A) $\frac{4}{11}$
(B) $\frac{5}{11}$
(C) $\frac{7}{11}$
(D) $\frac{9}{11}$

---

10. The equation of the xy-plane is:
(A) $x = 0$
(B) $y = 0$
(C) $z = 0$
(D) None of these

---

11. The direction cosines of the z-axis are:
(A) $(1, 0, 1)$
(B) $(0, 0, 1)$
(C) $(0, 1, 0)$
(D) $(0, 0, 0)$

---

12. The distance between the points $(4, 3, 7)$ and $(1, -1, -5)$ is:

(A) 13
(B) 15
(C) 12
(D) 5

---

13. Evaluate: $\int (x + \cos 2x)\, dx =$

(A) $\frac{x}{2} \sin 2x + \frac{1}{4} \cos 2x + c$
(B) $\frac{x}{2} \sin 2x - \frac{1}{4} \cos 2x + c$
(C) $2x \sin 2x + 4 \cos 2x + c$
(D) $2x^2 + 2 \sin 2x + c$

---

16. Evaluate: $\int \frac{dx}{x(x+2)} =$

(A) $\frac{1}{2} \log \left| \frac{x}{x+2} \right| + c$
(B) $\frac{1}{2} \log \left| \frac{x+2}{x} \right| + c$
(C) $\log |x| - \log |x+2| + c$
(D) $\log |x| + \log |x+2| + c$

---

17. Evaluate: $\int \sqrt{a^2 - x^2}\, dx =$

(A) $2x\sqrt{a^2 - x^2} + c$
(B) $\frac{x}{2}\sqrt{a^2 - x^2} + \frac{a^2}{2} \sin^{-1} \frac{x}{a} + c$
(C) $2x\sqrt{a^2 - x^2} + \frac{a^2}{2} \sin^{-1} \frac{x}{a} + c$
(D) $2x\sqrt{x^2 - a^2} - \frac{a^2}{2} \sin^{-1} \frac{x}{a} + c$

---

18. Evaluate: $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^7 x\, dx =$

(A) -1
(B) 0
(C) 1
(D) 2

---

19. Evaluate: $\int_0^a \left(\sqrt{x} + \sqrt{a - x}\right) \sqrt{x}\, dx =$

(A) a
(B) $2a$

(C) $\frac{a}{2}$
(D) $3a$

---

20. Evaluate: $\int_0^{\frac{\pi}{2}} \cos 2x \, dx =$

(A) 0
(B) 1
(C) -1
(D) 2

---

21. Evaluate: $\int_0^{\frac{\pi}{6}} \cos x \cdot \cos 2x \, dx =$

(A) $\frac{6}{5}$
(B) 1
(C) $\frac{12}{5}$
(D) $-\frac{12}{5}$

---

22. Evaluate: $\int_{-\pi}^{\pi} \tan x \, dx =$

(A) -1
(B) 0
(C) 2
(D) -2

---

23. Evaluate: $\int_0^4 \sqrt{x} \, dx =$

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

---

24. Evaluate: $\cos^{-1}\left(-\frac{1}{2}\right) =$

(A) $\frac{3\pi}{2}$
(B) $\frac{3\pi}{1}$
(C) $\frac{6\pi}{1}$
(D) $\frac{2\pi}{1}$

---

25. If $x \in [-1, 1]$, **then** $\cos^{-1} x =$
(A) $\frac{\pi}{2} - \cot^{-1} x$
(B) $\frac{\pi}{2} - \sin^{-1} x$
(C) $\frac{\pi}{2} - \tan^{-1} x$
(D) $\frac{\pi}{2} - \sec^{-1} x$

---

26. If $x \in [-1, 1]$, **then** $\sin^{-1}(-x) =$
(A) $-\sin^{-1} x$
(B) $\sin^{-1} x$
(C) $-\cos^{-1} x$
(D) $\cos^{-1} x$

---

28. Evaluate: $\tan\left(\tan^{-1}\frac{3}{1} + \tan^{-1}\frac{2}{1}\right)$
(A) 1
(B) 0
(C) 2
(D) 3

---

29. Evaluate: $\sin\left(\cot^{-1} x\right)$
(A) $\sqrt{1+x^2}$
(B) x
(C) $(1+x^2)^{-\frac{3}{2}}$
(D) $\frac{1}{\sqrt{1+x^2}}$

---

30. Evaluate: $\cos^{-1}\left(\cos\frac{6\pi}{7}\right)$
(A) $\frac{6\pi}{7}$
(B) $\frac{6\pi}{5}$
(C) $\frac{3\pi}{7}$
(D) $\frac{6\pi}{7}$

---

31. Evaluate: $\frac{3\pi}{2} - \sin^{-1}\left(-\frac{1}{2}\right)$
(A) 0
(B) $\frac{3\pi}{2}$
(C) 2π
(D) π

---

32. Evaluate: $\tan^{-1} 3 - \sec^{-1}(-2)$

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

---

1. Relations Let R be the relation in the set $\mathbb{N}$ given by:

$$R = \{(a, b) : a = b - 2, b > 6\}.$$

The correct answer in the following is:
(A) $(6, 8) \in R$
(B) $(2, 4) \in R$
(C) $(3, 8) \in R$
(D) $(8, 7) \in R$

---

2. Evaluate the integral:

$$\int \frac{dx}{a^2 + x^2}$$

The correct answer is:
(A) $\frac{1}{a} \tan^{-1}\left(\frac{x}{a}\right) + c$
(B) $\tan^{-1}\left(\frac{a}{x}\right) + c$
(C) $\frac{1}{a} \tan^{-1}\left(\frac{a}{x}\right) + c$
(D) $\frac{1}{a} \tan^{-1} x + c$

---

3. Evaluate the integral:

$$\int \sec x \, dx$$

The correct answer is:
(A) $\log|\sec x + \tan x| + c$
(B) $\log|\sec x - \tan x| + c$
(C) $\log|\sec x| + c$
(D) $\tan x + c$

---

4. Evaluate the integral:

$$\int \sec^5 x \tan x \, dx$$

The correct answer is:
(A) $5 \tan^5 x + c$
(B) $\frac{1}{5} \sec^5 x + c$

(C) $5 \log |\cos x| + c$
(D) $\tan^5 x + c$

---

5. Evaluate the integral:

$$\int \tan^2 x \, dx$$

The correct answer is:
(A) $\tan x + x + c$
(B) $\tan x - x + c$
(C) $\cot x + x + c$
(D) $\cot x - x + c$

---

6. Evaluate the integral:

$$\int \cos^2 x \cdot \sin^2 x \, dx$$

The correct answer is:
(A) $\cot x - \tan x + c$
(B) $\tan x - \cot x + c$
(C) $-\cot x - \tan x + c$
(D) $-\tan x + \cot x + c$

---

7. Evaluate the integral:

$$\int \frac{x^2 + 1}{x^4 + 1} \, dx$$

The correct answer is:
(A) $3x^3 + c$
(B) $3x^3 - x + 2\tan^{-1}(x) + c$
(C) $2\tan^{-1}(x) + c$
(D) $3x^3 + x + 2\tan^{-1}(x) + c$

---

8. Evaluate the integral:

$$\int \frac{1 + \cos(2x)}{1 - \cos(2x)} \, dx$$

The correct answer is:
(A) $\tan x + c$
(B) $\tan x + x + c$

(C) $\tan x - x + c$
(D) $-\tan x + x + c$

---

9. Evaluate the integral:

$$\int \frac{2}{2-3x}\,dx$$

The correct answer is:
(A) $-\log|2-3x| + c$
(B) $-\frac{3}{1}\log|2-3x| + c$
(C) $-\log|2-3x| + c$
(D) $2\tan^{-1}\left(\frac{x}{4}\right) + c$

---

10. Evaluate the integral:

$$\int \frac{1+x^8}{x^3}\,dx$$

The correct answer is:
(A) $\tan^{-1}\left(\frac{x}{4}\right) + c$
(B) $4\tan^{-1}\left(\frac{x}{4}\right) + c$
(C) $\frac{4}{1}\tan^{-1}\left(\frac{x}{4}\right) + c$
(D) $2\tan^{-1}\left(\frac{x}{4}\right) + c$

---

11. Evaluate the integral:

$$\int xe^x\,dx$$

The correct answer is:
(A) $e^x + c$
(B) $x - 1 + c$
(C) $e^x(x-1) + c$
(D) $e^x(x+1) + c$

---

12. If

$$A = \begin{bmatrix} 2 & -3 \\ 4 & 6 \end{bmatrix}$$

then

$$A^{-1} =$$

The correct answer is:

(A) $\begin{bmatrix} 4 & 6 \\ 8 & 12 \end{bmatrix}$

(B) $\begin{bmatrix} 4 & -6 \\ 8 & 12 \end{bmatrix}$

(C) $\begin{bmatrix} 4 & 6 \\ 8 & 12 \end{bmatrix}$

(D) $\begin{bmatrix} 4 & -6 \\ 8 & 12 \end{bmatrix}$

---

13. If

$$A = \begin{bmatrix} 3 & 6 \\ -5 & 4 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 7 & 8 \\ 5 & 6 \end{bmatrix},$$

then

$$6A - 5B =$$

The correct answer is:

(A) $\begin{bmatrix} 17 & 5 \\ 4 & 54 \end{bmatrix}$

(B) $\begin{bmatrix} 17 & 5 \\ -4 & 54 \end{bmatrix}$

(C) $\begin{bmatrix} -17 & -55 \\ -4 & -6 \end{bmatrix}$

(D) $\begin{bmatrix} 17 & -55 \\ -4 & -54 \end{bmatrix}$

---

14. If

$$A = \begin{bmatrix} 2 & \sqrt{2} & 0 \\ 3 & -2 & \frac{2}{5} \end{bmatrix}$$

then

$$A^t =$$

The correct answer is:

(A) $\begin{bmatrix} 2 & 0 \\ \sqrt{2} & 2 \\ 3 & \frac{2}{5} \end{bmatrix}$

(B) $\begin{bmatrix} 2 & 0 \\ \sqrt{2} & 2 \\ 3 & \frac{2}{5} \end{bmatrix}$

(C) $\begin{bmatrix} 2 & \sqrt{2} & 0 \\ 3 & -2 & \frac{2}{5} \end{bmatrix}$

(D) $\begin{bmatrix} 3 & 2 \\ -2 & \frac{2}{5} \\ 0 & 2 \end{bmatrix}$

---

15. If

$$2A + B + X = 0$$

where

$$A = \begin{bmatrix} -1 & 2 \\ 3 & 4 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 3 & 1 \\ 5 & -2 \end{bmatrix},$$

then

$$X =$$

(A) $\begin{bmatrix} 1 & -13 \\ -7 & 2 \end{bmatrix}$

(B) $\begin{bmatrix} 1 & 7 \\ 2 & 13 \end{bmatrix}$

(C) $\begin{bmatrix} -1 & -7 \\ -2 & -13 \end{bmatrix}$

(D) $\begin{bmatrix} 1 & 13 \\ -7 & -2 \end{bmatrix}$

---

1. Solve the system:

$$\begin{pmatrix} x \\ y \end{pmatrix} \quad \Rightarrow \quad \begin{pmatrix} 2x - 1 \\ 9 \end{pmatrix}$$

Find the values of x and y.

(A) $x = 3$, $y = 9$
(B) $x = 1$, $y = 9$
(C) $x = 0$, $y = 9$
(D) $x = 3$, $y = 4$

---

1. Find the derivative of $\sin^2 x$**:**

$$\frac{d}{dx}\left(\sin^2 x\right)$$

(A) $2 \sin x$
(B) $\sin 2x$

(C) $\cos 2x$
(D) $2\cos x$

---

1. Find the derivative of $x^5 + \cos 2x$:

$$\frac{d}{dx}\left(x^5 + \cos 2x\right)$$

(A) $5x^4 + \sin 2x$
(B) $5x^4 + \cos 2x$
(C) $5x^4 - 2\sin 2x$
(D) $x^5 + 2\sin 2x$

---

1. Find the derivative of $\sec^{-1}(x)$:

$$\frac{d}{dx}\left(\sec^{-1}(x)\right)$$

(A) $\frac{1}{\sqrt{1-x^2}}$
(B) $\frac{x}{\sqrt{x^2-1}}$
(C) $\frac{1}{\sqrt{1+x^2}}$
(D) $\frac{-x}{\sqrt{x^2-1}}$

---

1. Find the derivative of a^x:

$$\frac{d}{dx}\left(a^x\right)$$

(A) $a^x \log a$
(B) $a^x \log x$
(C) a^x
(D) $\log a$

---

1. Find the derivative of $\log(\cos x)$:

$$\frac{d}{dx}\left(\log(\cos x)\right)$$

(A) $\tan x$
(B) $-\tan x$

(C) $\cot x$
(D) $-\cot x$

---

1. Find the order and degree of the differential equation:

$$xy\left(\frac{d^2y}{dx^2}\right) + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$$

(A) Order = 2, Degree = 1
(B) Order = 2, Degree = 2
(C) Order = 1, Degree = 2
(D) Order = 1, Degree = 1

---

1. Solve the equation:

$$\frac{dx}{dy} + 2y = \sin x$$

(A) e^x
(B) e^{3x}
(C) e^{2x}
(D) e^{4x}

---

1. Solve the differential equation:

$$\frac{dx}{dy} = e^{x+y}$$

(A) $e^x + e^{-y} = c$
(B) $e^x + e^y = c$
(C) $e^{-x} + e^y = c$
(D) $e^{-x} + e^{-y} = c$

---

1. Solve the differential equation:

$$\frac{dx}{dy} = \frac{x}{y}$$

(A) $y = \log|x| + c$
(B) $y = cx$

(C) $y = x \log |x| + cx$
(D) $y = \log |x| + cx$

---

1. Solve the differential equation:

$$\frac{dx}{dy} + 2y = e^{3x}$$

(A) e^{3x}
(B) e^{2x}
(C) e^{x}
(D) e^{4x}

---

1. Find the dot product of the vectors:

$$(4\hat{i} + 3\hat{j} + 3\hat{k}) \cdot (6\hat{i} - 4\hat{j} + \hat{k})$$

(A) 22
(B) 15
(C) 21
(D) 18

---

1. Find the cross product of the vectors:

$$\left(\hat{i} + 3\hat{j} - 2\hat{k}\right) \times \left(-\hat{i} + 3\hat{k}\right)$$

(A) $9\hat{i} - \hat{j} + 3\hat{k}$
(B) $9\hat{i} + \hat{j} - 3\hat{k}$
(C) $\hat{i} - \hat{j} + 3\hat{k}$
(D) $\hat{i} + \hat{j} - 3\hat{k}$

---

1. Find the magnitude of the vector:

$$\left|\hat{i} - \hat{j} - \hat{k}\right|$$

(A) 3
(B) 3

(C) 2
(D) 2

---

1. Find the dot product of the unit vectors:

$$\hat{j} \cdot \hat{j}$$

(A) 0
(B) 1
(C) -1
(D) $\hat{k}$

---

1. Find the cross product of the unit vectors:

$$\hat{k} \times \hat{j}$$

(A) $-\hat{i}$
(B) $\hat{j}$
(C) 0
(D) $\hat{k}$

---

1. Find the value of:

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

(A) 1
(B) 0
(C) -1
(D) 3

---

1. Find the value of the scalar triple product:

$$\hat{i} \cdot (\hat{j} \times \hat{k})$$

(A) 1
(B) 0
(C) -1
(D) $\hat{i}$

---

1. If

$$\vec{a} = \hat{i} + \hat{j} + 2\hat{k},$$

then the corresponding unit vector $\hat{a}$ in the direction of $\vec{a}$ is:

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

---

1. If

$$\vec{a} = 3\hat{i} + \hat{j} - 2\hat{k} \quad \text{and} \quad \vec{b} = \hat{i} + \lambda\hat{j} - 3\hat{k}$$

are perpendicular to each other, then the value of λ is:

(A) -3
(B) -6
(C) -9
(D) -1

---

1. Evaluate the integral:

$$\int \cot^2(x)\, dx$$

(A) $\cot(x) + x + k$
(B) $-\cot(x) + x + k$
(C) $-\cot(x) - x + k$
(D) $\cot(x) - x + k$

---

1. The angle between the vectors

$$\vec{a} = 2\hat{i} - 3\hat{j} + 2\hat{k} \quad \text{and} \quad \vec{b} = \hat{i} + 4\hat{j} + 5\hat{k}$$

is:

(A) 30°
(B) 90°
(C) 45°
(D) 60°

---

1. Given that

$$|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$$

which of the following is true?

(A) $|\vec{a}| = |\vec{b}|$
(B) $\vec{a} = \vec{b}$
(C) $\vec{a} \perp \vec{b}$
(D) $|\vec{a}| = 0$

---

1. The projection of the vector

$$\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$$

on the vector

$$\vec{b} = 4\hat{i} - 4\hat{j} + 7\hat{k}$$

is:

(A) 9
(B) $\frac{19}{9}$
(C) $\frac{9}{19}$
(D) 19

---

1. The minimum value of $Z = 3x + 5y$ subject to the constraints:

$$x + y \leq 2, \quad x \geq 0, \quad y \geq 0$$

is:

(A) 16
(B) 15
(C) 0
(D) none of these

---

1. The maximum value of $Z = 3x + 2y$ subject to the constraints:

$$3x + y \leq 15, \quad x \geq 0, \quad y \geq 0$$

is:

(A) 30
(B) 15
(C) 10
(D) none of these

---

1. The direction ratios of two straight lines are l, m, n and l_1, m_1, n_1. The lines will be perpendicular to each other if:

(A) $\frac{l_1}{l} = \frac{m_1}{m} = \frac{n_1}{n}$
(B) $\frac{l_1}{l} + \frac{m_1}{m} + \frac{n_1}{n} = 0$
(C) $l^2 + m^2 + n^2 = l_1^2 + m_1^2 + n_1^2$
(D) $ll_1 + mm_1 + nn_1 = 0$

---

1. The direction ratios of a straight line are $1, 3, 5$. Then its direction cosines are:

(A) $\frac{1}{\sqrt{9}}, \frac{3}{\sqrt{9}}, \frac{5}{\sqrt{9}}$
(B) $\frac{3}{\sqrt{35}}, \frac{3}{\sqrt{35}}, \frac{5}{\sqrt{35}}$
(C) $\frac{5}{\sqrt{35}}, \frac{3}{\sqrt{35}}, \frac{1}{\sqrt{35}}$
(D) none of these

---

1. The equation of the plane parallel to the plane $3x - 5y + 4z = 11$ is:

(A) $3x - 5y + 4z = 21$
(B) $3x + 5y + 4z = 25$
(C) $3x + 5y + 4z = 35$
(D) none of these

---

1. The angle between two planes $2x + y - 2z = 5$ and $3x - 6y - 2z = 7$ is:

(A) $\frac{2}{\pi}$
(B) $\frac{4}{\pi}$
(C) $\cos^{-1}\left(\frac{4}{21}\right)$
(D) $\cos^{-1}\left(\frac{16}{61}\right)$

---

1. The distance of the plane $x - 2y + 4z = 9$ from the point $(2, 1, -1)$ is:

(A) $\frac{21}{13}$
(B) $\frac{21}{13}\,21$
(C) $\frac{13}{21}$
(D) none of these

---

1. If two planes $2x - 4y + 3z = 5$ and $x + 2y + \lambda z = 12$ are mutually perpendicular to each other, then $\lambda =$:

(A) -2
(B) 2
(C) 3
(D) none of these

---

1. If the line

$$\frac{x-3}{a} = \frac{y-4}{b} = \frac{z-5}{c}$$

is parallel to the line

$$\frac{x}{5} = \frac{y}{3} = \frac{z}{2}$$

then:

(A) $5a + 3b + 2c = 0$
(B) $\frac{5}{a} = \frac{3}{b} = \frac{2}{c}$
(C) $5a = 3b = 2c$
(D) none of these

---

1. If the line

$$\frac{x-x_1}{a_1} = \frac{y-y_1}{b_1} = \frac{z-z_1}{c_1}$$

is parallel to the plane

$$a_2x + b_2y + c_2z + d = 0$$

then:

(A) $\frac{a_2}{a_1} = \frac{b_2}{b_1} = \frac{c_2}{c_1}$
(B) $a_1x + b_1y + c_1z = 0$
(C) $a_1a_2 + b_1b_2 + c_1c_2 = 0$
(D) none of these

---

1. If

$$\frac{x}{18} = \frac{6}{18}$$

then x is equal to:

(A) 6
(B) ± 6
(C) -6
(D) 0

---

1. Evaluate the integral:

$$\int \frac{1 - \sin 2x}{dx}$$

(A) $\sin x + \cos x + c$
(B) $\sin x - \cos x + c$
(C) $\cos x - \sin x + c$
(D) $\tan x - \cot x + c$

---

1. Solve the following expression:

$$\frac{x}{x-1} \times \frac{x+1}{x}$$

(A) 2
(B) 0
(C) 1
(D) -1

---

1. Evaluate the determinant of the following matrix:

$$\begin{vmatrix} 1 & 2 & 5 \\ 1 & 1 & 4 \\ -2 & -3 & -9 \end{vmatrix}$$

(A) 2
(B) 1
(C) 0
(D) -1

---

1. Evaluate the determinant of the following matrix:

$$\begin{vmatrix} 3 & 1 & 2 \\ -4 & -2 & 3 \\ 5 & 1 & 1 \end{vmatrix}$$

(A) 0
(B) 46
(C) -46
(D) 1

---

1. Evaluate the following matrix multiplication:

$$5 \times \begin{pmatrix} 5 & 7 \\ 6 & 8 \end{pmatrix}$$

(A) $\begin{pmatrix} 25 & 35 \\ 30 & 8 \end{pmatrix}$
(B) $\begin{pmatrix} 25 & 35 \\ 30 & 40 \end{pmatrix}$
(C) $\begin{pmatrix} 5 & 35 \\ 6 & 40 \end{pmatrix}$
(D) $\begin{pmatrix} 25 & 25 \\ 30 & 40 \end{pmatrix}$

---

1. For a function $f : A \to B$, the function will be onto if:

(A) $f(A) \subset B$
(B) $f(A) = B$
(C) $f(A) \supset B$
(D) None of these

---

1. The matrix $A = [a_{ij}]$ of size $m \times n$ is a square matrix if:

(A) $m = n$
(B) $m < n$
(C) $m > n$
(D) None of these

---

1. Evaluate the following matrix multiplication:

$$\begin{pmatrix} -3 & 5 & 2 \end{pmatrix} \times \begin{pmatrix} 1 \\ 6 \\ -4 \end{pmatrix}$$

(A) $\begin{pmatrix} -18 & 30 & 12 \\ 12 & -20 & -8 \end{pmatrix}$
(B) $\begin{pmatrix} -18 & 5 & -20 \\ 12 & 30 & -8 \end{pmatrix}$

(C) $\begin{pmatrix} 30 & -18 & 12 \\ -20 & 12 & -8 \end{pmatrix}$

(D) $\begin{pmatrix} 18 & 30 & 12 \\ 12 & 20 & 8 \end{pmatrix}$

---

2. Let $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$**. Then,** $A^5 =$**:**

(A) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

(B) $\begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix}$

(C) $\begin{bmatrix} 0 & 5 \\ 5 & 0 \end{bmatrix}$

(D) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

---

3. If $A = \begin{bmatrix} 3 & -5 \\ -1 & 2 \end{bmatrix}$**, then adjoint** $A =$**:**

(A) $\begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$

(B) $\begin{bmatrix} 2 & 3 \\ 1 & 5 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 3 \\ 2 & 5 \end{bmatrix}$

(D) $\begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$

---

4. Find $\frac{d}{dx} \log(\sec x + \tan x)$**:**

(A) $\frac{1}{\sec x + \tan x}$

(B) $\sec x$

(C) $\tan x$

(D) $\sec x + \tan x$

---

5. Find $\frac{d}{dx}\left(\sec^{-1} x + \csc^{-1} x\right)$**:**

(A) 1

(B) 0

(C) 2

(D) -1

6. If $y = \tan^{-1}\left(\frac{1-\cos x}{\sin x}\right)$, then $\frac{dy}{dx} =$:
(A) 1
(B) -1
(C) $\frac{1}{2}$
(D) $-\frac{1}{2}$

---

7. If $x = a\sec\theta$, $y = b\tan\theta$, then $\frac{dy}{dx} =$:
(A) $\frac{b}{a}\sec\theta$
(B) $\frac{b}{a}\csc\theta$
(C) $\frac{b}{a}\cot\theta$
(D) $\frac{b}{a}$

---

8. If $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \ldots \text{ to } \infty}}}$, then $\frac{dy}{dx} =$:
(A) $\frac{\sin x}{2y-1}$
(B) $\frac{\cos x}{y-1}$
(C) $\frac{\cos x}{2y-1}$
(D) $\frac{1}{2y-1}$

---

9. If $y = x^{20}$, then $\frac{d^2y}{dx^2} =$:
(A) x^{18}
(B) $20x^{19}$
(C) $380x^{18}$
(D) x^{19}

---

10. Evaluate the integral:

$$\int \sqrt{1+\cos 2x}\, dx = ?$$

(A) $\sqrt{2}\cos x + c$
(B) $\sqrt{2}\sin x + c$
(C) $\frac{2}{x^2} + c$
(D) $\sqrt{2}\sin\frac{x}{2} + c$

---

11. Evaluate the integral:

$$\int \frac{\log x}{x}\, dx = ?$$

(A) $\frac{1}{2}(\log x)^2 + c$
(B) $-\frac{1}{2}(\log x)^2 + c$
(C) $\frac{2}{x^2} + c$
(D) $-\frac{2}{x^2} + c$

---

12. Evaluate the integral:

$$\int \frac{\cos\sqrt{x}}{\sqrt{x}}\,dx = ?$$

(A) $2\sin\sqrt{x} + c$
(B) $\sin\sqrt{x} + c$
(C) $\cos\sqrt{x} + c$
(D) $2\cos\sqrt{x} + c$

---

13. Evaluate the integral:

$$\int \sqrt{\cos x}\cdot\sin x\,dx = ?$$

(A) $\frac{2}{3}(\cos x)^{3/2} + c$
(B) $-\frac{2}{3}(\cos x)^{3/2} + c$
(C) $(\cos x)^{3/2} + c$
(D) $-(\cos x)^{3/2} + c$

---

14. If $y = \sin(xy)$, then find $\frac{dy}{dx}$:

---

15. Evaluate the integral:

$$\int (x+2)^2\,dx = ?$$

---

16. Evaluate $P(A \cup B)$ if $2P(A) = P(B) = \frac{5}{13}$ and $P(A|B) = \frac{2}{5}$:

---

17. Prove that

$$4\left(\cot^{-1}3 + \cot^{-1}2\right) = \pi.$$

---

18. Prove that

$$\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\frac{x+y}{1-xy}\right),$$

provided $xy < 1$.

---

19. Find $\frac{dy}{dx}$ if

$$y = \sqrt{\sin x^2}.$$

---

20. Find $f \circ g$ and $g \circ f$ if

$$f(x) = 8x^3 \quad \text{and} \quad g(x) = x^{1/3}.$$

---

21. Find the angle between the vectors

$$\mathbf{A} = 5\vec{i} + 3\vec{j} + 4\vec{k} \quad \text{and} \quad \mathbf{B} = 6\vec{i} - 8\vec{j} - \vec{k}.$$

---

22. Maximize

$$Z = 20x + 3y,$$

subject to the constraints:

$$3x + 2y \leq 10, \quad x \geq 0, \quad y \geq 0.$$

---

23. Solve the differential equation:

$$x^2 \frac{dy}{dx} = 2xy.$$

---

24. Evaluate the determinant:

$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix}.$$

---

25. If

$$A = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix},$$

show that $A^2 = A$.

26. If

$$x \cos y = \sin(x + y),$$

find $\frac{dy}{dx}$.

---

27. Differentiate

$$\tan^{-1}\left(\frac{2x}{1 - x^2}\right)$$

with respect to

$$\sin^{-1}\left(\frac{2x}{1 + x^2}\right).$$

---

28. If

$$x = \sqrt{1 + t^2}, \quad y = \sqrt{1 - t^2},$$

then find $\frac{dy}{dx}$.

---

29. If

$$y = x^{\sin x},$$

find $\frac{dy}{dx}$.

---

30. Find the value of

$$\int_0^{\pi/2} \frac{dx}{1 + \sqrt{\tan x}}.$$

---

31. Find the value of

$$\int_0^a \sqrt{a^2 - x^2}\, dx.$$

---

32. Find the distance between the planes

$$x - 2y + 2z = 6 \quad \text{and} \quad 3x - 6y + 6z = 2.$$

---

33. Find the equation of the plane whose intercepts on the axes x, y, z are respectively $2, 3$, and -4.

34. Find the value of p so that the lines

$$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z+17}{p} \quad \text{and} \quad \frac{x+4}{2} = \frac{y+9}{2} = \frac{z-1}{2}$$

are mutually perpendicular.

---

35. Evaluate the integral

$$\int \cos^3 x \cdot \sin x \, dx.$$

---

36. Evaluate the integral

$$\int \frac{x^2-1}{x^2+4} \, dx.$$

---

37. Solve the differential equation

$$\frac{dy}{dx} = e^{x+y}.$$

---

38. Find the mean for the following probability distribution:

x_i	0	1	2	3
p_i	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{8}$

---

39. If $\vec{a} = \vec{i} - \vec{j} + \vec{k}$ and $\vec{b} = 2\vec{i} + \vec{j} + 3\vec{k}$, then find the value of $|\vec{a} + \vec{b}|$.

---

40. Find the direction cosines of the vector $3\vec{i} - 4\vec{j} + 12\vec{k}$.

---

41. Find the value of

$$\int_0^{\pi/2} x \cos x \, dx.$$

---

42. Integrate

$$\int \sin^3 x \, dx.$$

---

43. Integrate

$$\int \frac{dx}{\sqrt{x+1}+\sqrt{x+2}}.$$

---

44. Prove that

$$\sin^{-1}\frac{4}{5}+\sin^{-1}\frac{5}{13}+\sin^{-1}\frac{16}{65}=\frac{\pi}{2}.$$

---

45. Evaluate:

$$\int_0^{\pi/2} \log(\cos x)\, dx.$$

---

46. Solve:

$$(1+x^2)\frac{dy}{dx}+y=\tan^{-1}x.$$

---

47. Find $\frac{dy}{dx}$ when

$$(\sin y)^x=(\cos x)^y.$$

---

48. Evaluate the determinant

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix}.$$

---

49. Evaluate:

$$(\vec{i}-3\vec{j}+4\vec{k})\cdot\left[(2\vec{i}-\vec{j})\times(\vec{j}+\vec{k})\right].$$

---

50. Minimize

$$Z=2x+y,$$

subject to

$$5x + 10y \leq 50, \quad x + y \geq 1, \quad y \leq 4, \quad x \geq 0, \quad y \geq 0.$$

---

51. In four throws, with a pair of dice, what is the probability of occurrence of doublets at least twice?
