

UP Board Class 12 Mathematics 2026 (Set 324 DB) Question Paper



General Instructions

- (i) This question paper contains 34 questions. All questions are compulsory.
- (ii) It comprises 5 single-correct multiple-choice questions.
- (iii) Attempt every question; detailed solutions are provided in the companion solutions booklet.

1. If $A = \{1, 2, 3\}$, then the number of equivalence relations on A containing $(1, 2)$ is:

- (A) 1
- (B) 2
- (C) 3
- (D) 4

2. The function $f : \mathbb{Z} \rightarrow \mathbb{Z}$ defined by $f(x) = x^3 \forall x \in \mathbb{Z}$ is:

- (A) Onto
- (B) Neither one-one nor onto
- (C) One-one but not onto
- (D) Many-one

3. $\sin(\tan^{-1} x), |x| < 1$ is equal to:

- (A) $\frac{x}{\sqrt{1-x^2}}$
- (B) $\frac{1}{\sqrt{1-x^2}}$
- (C) $\frac{1}{\sqrt{1+x^2}}$
- (D) $\frac{x}{\sqrt{1+x^2}}$
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4. $A = [a_{ij}]_{m \times n}$ is a square matrix if:

- (A) $m < n$
- (B) $m > n$
- (C) $m = n$
- (D) None of these
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5. The value of $\int x \cos x \, dx$ is:

- (A) $\cos x + x \sin x + c$
- (B) $x \sin x + c$
- (C) $x \cos x + c$
- (D) $\sin x + x \cos x + c$
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6. Find the value of $\int_{-1}^{+1} (x+1) \, dx$.

7. Find the integrating factor of the differential equation $x \frac{dy}{dx} + 2y = x^2$ ($x \neq 0$).

8. Find the projection of vector $(\hat{i} - \hat{j})$ on vector $(\hat{i} + \hat{j})$.

9. If $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$ and A, B are independent events, find the value of $P(A/B)$.

10. If $X = \{1, 2, 3\}$ and $Y = \{a, b\}$, then find the number of functions from X to Y .

11. Write $\tan^{-1}\left(\frac{x}{\sqrt{a^2 - x^2}}\right)$, $|x| < a$ in simplest form.

12. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -1 & 3 \\ -1 & 0 & 2 \end{bmatrix}$, then find the value of $(2A - B)$.

13. Prove that $3 \cos^{-1} x = \cos^{-1}(4x^3 - 3x)$, $x \in \left[\frac{1}{2}, 1\right]$.

14. Differentiate the function $\sin^2 x$ with respect to the function $e^{\cos x}$.

15. Prove that the given function $f(x) = 3x + 17$ is increasing on $\mathbb{R}$.

16. If $f : \mathbb{R} \rightarrow \mathbb{R}$ and $g : \mathbb{R} \rightarrow \mathbb{R}$ be functions such that $f(x) = \cos x$ and $g(x) = 3x^3$, then find $f \circ g$.

17. Find the general solution of the differential equation $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$.

18. Find the magnitude of the vectors $\vec{a}$ and $\vec{b}$, if having equal magnitudes and angle 60° between them and their scalar product is $\frac{1}{2}$.

19. Find the shortest distance between the lines $\vec{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$ and $\vec{r} = 3\hat{i} + 3\hat{j} - 5\hat{k} + \mu(2\hat{i} + 3\hat{j} + 6\hat{k})$.

20. Find the general solution of the differential equation $\log\left(\frac{dy}{dx}\right) = 3x + 4y$.

21. Show that the line passing through the points $(1, -1, 2)$ and $(3, 4, -2)$ is perpendicular to the line passing through the points $(0, 3, 2)$ and $(3, 5, 6)$.

22. If $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and $A^2 = KA - 2I$, then find the value of K .

23. Prove that the function defined by $f(x) = \begin{cases} x^2 \sin \frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$ is continuous.

24. A circular disc having radius 3 cm is warmed and due to expansion its radius is increasing at the rate 0.05 cm/s. Find the increasing rate of its area when its radius is 3.2 cm.

25. Find the minimum value of the linear programming problem $Z = 200x + 500y$ under the following constraints: $x + 2y \geq 10$, $3x + 4y \leq 24$, $x \geq 0$, $y \geq 0$ by graphical method.

26. A die is thrown twice and found that the sum of the numbers is 6. Find the conditional probability of getting number 4 at least once.

27. If vectors $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular and having equal magnitude, then show that the vector $\vec{a} + \vec{b} + \vec{c}$ is equally inclined to the vectors $\vec{a}, \vec{b}, \vec{c}$.

28. Find the area of the circle $x^2 + y^2 = r^2$.

29. If $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$, then find A^{-1} .

30. Solve the system of linear equations by Matrix Method: $2x + 3y + 3z = 5$, $x - 2y + z = -4$, $3x - y - 2z = 3$.

31. Prove that the radius of the largest (maximum surface area) right circular cylinder that can be inscribed in a cone is half of the radius of the cone.

32. Evaluate: $\int_0^{\pi/2} \log \sin x \, dx$.

33. Find the value of $\int_0^{\pi} \frac{x \, dx}{a^2 \cos^2 x + b^2 \sin^2 x}$.

34. If $y = \sin^{-1} x$, then show that $(1 - x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} = 0$.