

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



General Instructions

- (i) This question paper contains 35 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 $f : R \rightarrow R$ is given by $f(x) = (5 - x^5)^{1/5}$, then $f \circ f(x)$ is equal to:

- (A) $x^{1/5}$
- (B) x
- (C) x^5
- (D) $5 - x^5$

2. The value of $\int_2^{2\sqrt{3}} \frac{dx}{4 + x^2}$ is:

- (A) $\frac{\pi}{12}$
- (B) $\frac{\pi}{18}$
- (C) $\frac{\pi}{24}$
- (D) $\frac{\pi}{6}$

3. A relation R is defined in the set N as $R = \{(x, y) : y = x + 5, y > 5\}$. Then which of the following is correct?

- (A) $(6, 10) \in R$
(B) $(3, 6) \in R$
(C) $(4, 9) \in R$
(D) $(2, 6) \in R$
-

4. The value of $\int_0^{\pi/4} \sin^3 2x \cos 2x \, dx$ is:

- (A) $\frac{1}{2}$
(B) $\frac{1}{4}$
(C) $\frac{1}{8}$
(D) $\frac{1}{16}$
-

5. The probability of impossible events is:

- (A) 0
(B) $\frac{1}{2}$
(C) $\frac{1}{3}$
(D) $\frac{1}{4}$
-

6. Find the value of $\cos^{-1}\left(\frac{1}{2}\right) + 2 \sin^{-1}\left(\frac{1}{2}\right)$.

7. Write $\cot^{-1}\left(\frac{1}{\sqrt{x^2 - 1}}\right)$, $x > 1$ in the simplest form.

8. If the direction ratios of a line are $3, -2, -6$, then find its direction cosines.

9. Find the angle between the vectors $\vec{a} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$.

10. Show that the function $f(x) = x^3 - 6x^2 + 12x$, $x \in R$, is an increasing function on R .

11. If two vectors $\vec{a} = 5\hat{i} - \hat{j} - 3\hat{k}$ and $\vec{b} = \hat{i} + 3\hat{j} - 5\hat{k}$, then show that $(\vec{a} + \vec{b})$ and $(\vec{a} - \vec{b})$ are perpendicular.

12. If A and B are independent events and $P(A) = 0.3$, $P(B) = 0.4$, then find (i) $P(A \cap B)$, (ii) $P(A \cup B)$.

13. Prove that the relation given by $R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 3)\}$ in the set $\{1, 2, 3\}$ is reflexive but neither symmetric nor transitive.

14. If $\sin^{-1}(1 - x) - 2 \sin^{-1} x = \frac{\pi}{2}$, then find the value of x .

15. If $(\vec{a} + \vec{b}) \cdot (\vec{a} - \vec{b}) = 8$ and $|\vec{a}| = 8|\vec{b}|$, then find $|\vec{a}|$ and $|\vec{b}|$.

16. Simplify: $\cos \theta \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix} + \sin \theta \begin{bmatrix} \sin \theta & -\cos \theta \\ \cos \theta & \sin \theta \end{bmatrix}$.

17. Simplify: $\tan^{-1}\left(\frac{3a^2x - x^3}{a^3 - 3ax^2}\right)$.

18. Show that the points $A(2, 3, -4)$, $B(1, -2, 3)$ and $C(3, 8, -11)$ are collinear.

19. Find the minimum value of the objective function $Z = 3x + 5y$ under the following constraints by the graphical method: $x + 3y \geq 3$, $x + y \geq 2$, $x \geq 0$, $y \geq 0$.

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

21. If $y = Ae^{mx} + Be^{nx}$, then show that $\frac{d^2y}{dx^2} - (m + n)\frac{dy}{dx} + mny = 0$.

22. Find the values of a and b for which the function defined by $f(x) = \begin{cases} ax + 1, & x \leq 3 \\ bx + 3, & x > 3 \end{cases}$ is continuous at $x = 3$.

23. Find the value of the determinant $\begin{vmatrix} 18 & 22 & -13 \\ 7 & -9 & 11 \\ -11 & 7 & 17 \end{vmatrix}$.

24. Three vectors $\vec{a}, \vec{b}, \vec{c}$ satisfy the condition $\vec{a} + \vec{b} + \vec{c} = 0$. If $|\vec{a}| = 3, |\vec{b}| = 4$ and $|\vec{c}| = 2$, then find the value of $\mu = \vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$.

25. Prove that the height of a cylinder of maximum volume, inscribed in a sphere of radius R , is $\frac{2R}{\sqrt{3}}$.

26. Differentiate: $y = x^{\sin x} + (\cos x)^{\tan x}$.

27. Prove that if E and F are two independent events, then E and F' will also be independent.

28. Find the area surrounded by the line $y = 3x + 2$, the x -axis, and the ordinates $x = -1$ and $x = 1$.

29. Solve the following system of equations by matrix method: $3x - 2y + 3z = 8, 2x + y - z = 1, 4x - 3y + 2z = 4$.

30. Express the matrix $B = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$ in the form of the sum of a symmetric matrix and a skew-symmetric matrix.

31. Solve the differential equation $(x dy - y dx) y \sin\left(\frac{y}{x}\right) = (y dx + x dy) x \cos\left(\frac{y}{x}\right)$.

32. Find the value of $\int_{-1}^2 |x^3 - x| dx$.

33. Find the value of $\int_1^4 (|x - 1| + |x - 2| + |x - 3|) dx$.

34. Find the value of the integral $\int \frac{x^4}{(x - 1)(x^2 + 1)} dx$.

35. Show that the general solution of the differential equation $\frac{dy}{dx} + \frac{y^2 + y + 1}{x^2 + x + 1} = 0$ is $x + y + 1 = A(1 - x - y - 2xy)$, in which A is a parameter.