

UP Board Class 12 Mathematics 2026 (Set 324 DD) 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 the function $f : N \rightarrow N$ is defined as $f(x) = x^2$, then f is:

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

2. The relation $R = \{(a, b) : a \leq b^2\}$ is defined in the set of real numbers. Then R is:

- (A) Reflexive and symmetric but not transitive
- (B) Reflexive and transitive but not symmetric
- (C) Symmetric and transitive but not reflexive
- (D) Not reflexive, not symmetric and not transitive

3. If vectors $5\hat{i} - \lambda\hat{j} + 2\hat{k}$ and $2\hat{i} + 3\hat{j} + 4\hat{k}$ are perpendicular to each other, then the value of λ is:

- (A) 3
 - (B) 4
 - (C) 6
 - (D) 0
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4. If $x - y = \pi$, then the value of $\frac{dy}{dx}$ is:

- (A) 0
 - (B) π
 - (C) 1
 - (D) x
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5. Direction cosines of the x -axis are:

- (A) (1, 0, 0)
 - (B) (0, 1, 0)
 - (C) (0, 0, 1)
 - (D) (0, 0, 0)
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6. Find the principal value of $\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$.

7. Find the value of $\int_2^3 \frac{1}{x} dx$.

8. Find the angle between vectors $\hat{i} - 2\hat{j} + 3\hat{k}$ and $3\hat{i} - 2\hat{j} + \hat{k}$.

9. Direction ratios of a line are 2, -1 and -2 . Find the direction cosines of the line.

10. If $P(A) = \frac{7}{13}$, $P(B) = \frac{9}{13}$ and $P(A \cap B) = \frac{4}{13}$, then find $P\left(\frac{A}{B}\right)$.

11. If functions $f : R \rightarrow R$ and $g : R \rightarrow R$ are defined respectively as $f(x) = \cos x$ and $g(x) = 3x^2$, then find gof and fog .

12. Find the value of the determinant $\begin{vmatrix} x & a & x+a \\ y & b & y+b \\ z & c & z+c \end{vmatrix}$.

13. If $f(x) = \begin{cases} x+2, & x \neq 0 \\ 1, & x = 0 \end{cases}$, then prove that the function is not continuous at $x = 0$.

14. Find the vector and Cartesian equations of a line which passes through the point $(1, 2, 3)$ and is parallel to the vector $2\hat{i} + 3\hat{j} + 2\hat{k}$.

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

16. If $y = 5 \cos x - 3 \sin x$, then prove that $\frac{d^2y}{dx^2} + y = 0$.

17. Find the projection of vector $\hat{i} + 3\hat{j} + 7\hat{k}$ on vector $7\hat{i} - \hat{j} + 8\hat{k}$.

18. If $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{2}$ and $P(A \cup B) = \frac{2}{3}$, then show that A and B are independent events.

19. Prove that $\tan^{-1} \frac{1}{5} + \tan^{-1} \frac{1}{7} + \tan^{-1} \frac{1}{3} + \tan^{-1} \frac{1}{8} = \frac{\pi}{4}$.

20. If $\cos y = x \cos(a + y)$ and $\cos a \neq \pm 1$, then prove that $\frac{dy}{dx} = \frac{\cos^2(a + y)}{\sin a}$.

21. Solve the differential equation: $(1 + x^2) dy + 2xy dx = \cot x dx$.

22. Maximize $Z = 10x + 3y$ by the graphical method under the following constraints: $x \geq 0$; $y \geq 0$; $5x + 3y \leq 15$; $2x + 5y \leq 10$.

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

24. Find the value of the determinant $\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ a^3 & b^3 & c^3 \end{vmatrix}$.

25. Evaluate $\int \frac{x^2 + 1}{x^2 - 5x + 6} dx$.

26. Prove that vectors $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$ and $3\hat{i} - 4\hat{j} - 4\hat{k}$ are vertices of a right-angled triangle.

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

28. If a die is thrown three times, then find the probability of getting at least one odd number.

29. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$, then find A^{-1} .

30. Solve the following system of equations by using the Matrix Method:

$$x - y + 2z = 7$$

$$3x + 4y - 5z = -5$$

$$2x - y + 3z = 12$$

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

32. Solve the differential equation $(x - y)\frac{dy}{dx} = x + 2y$.

33. Find the value of: $\int_0^{\pi/2} \log \sin x \, dx$.

34. Solve: $\int \left[\sqrt{\cot x} + \sqrt{\tan x} \right] dx$.