jeeinfo
Your JEE Guide

CBSE Class XII · Mathematics (041)

Sample Question Paper 7 · Session 2026-27

Time allowed: 3 hours **Maximum marks: 80**

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission.
This is an original practice paper written to the official CBSE 2026-27 design; it is not issued by CBSE.

General instructions:

1. This question paper contains 38 questions. All questions are compulsory.
2. This question paper is divided into five Sections: A, B, C, D and E.
3. In Section A, Questions 1 to 18 are multiple choice questions (MCQs) and Questions 19 and 20 are Assertion–Reason based questions of 1 mark each.
4. In Section B, Questions 21 to 25 are very short answer (VSA) type questions carrying 2 marks each.
5. In Section C, Questions 26 to 31 are short answer (SA) type questions carrying 3 marks each.
6. In Section D, Questions 32 to 35 are long answer (LA) type questions carrying 5 marks each.
7. In Section E, Questions 36 to 38 are case study based questions carrying 4 marks each.
8. There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one sub-part each in 2 questions of Section E.
9. Draw neat and clean figures wherever required. Take π = 22/7 wherever required, if not stated.
10. Use of calculators is not allowed.

Section A

1.	On the set {1, 2, 3}, the relation R = {(1, 1), (2, 2), (3, 3), (1, 2), (2, 1)} is: (A) an equivalence relation (B) not transitive (C) reflexive but not symmetric (D) symmetric but not reflexive	1
2.	The function f: N → N, f(x) = 2x, is: (A) onto but not one-one (B) neither one-one nor onto (C) one-one and onto (D) one-one but not onto	1
3.	The principal value of $\cot^{-1}(-1)$ is: (A) $\frac{\pi}{4}$ (B) $-\frac{\pi}{4}$ (C) $\frac{3\pi}{4}$ (D) $\frac{5\pi}{4}$	1
4.	$\sin(\tan^{-1} x)$, $\lvert x\rvert < 1$, equals: (A) $\frac{x}{\sqrt{1-x^2}}$ (B) $\frac{x}{\sqrt{1+x^2}}$ (C) $\frac{\sqrt{1+x^2}}{x}$ (D) $\frac{1}{\sqrt{1+x^2}}$	1

5.	If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, then $A + A^T$ is: (A) $\begin{bmatrix} 2 & 5 \\ 5 & 8 \end{bmatrix}$ (B) $\begin{bmatrix} 2 & 4 \\ 6 & 8 \end{bmatrix}$ (C) $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$ (D) $\begin{bmatrix} 2 & 6 \\ 4 & 8 \end{bmatrix}$	1
6.	If A is a square matrix with $A^2 = I$, then A^{-1} is: (A) 2A (B) A^T (C) I (D) A	1
7.	If $\begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix} = \begin{vmatrix} 2x & 4 \\ 6 & x \end{vmatrix}$, then x is: (A) $\sqrt{3}$ (B) $\pm\sqrt{3}$ (C) ±3 (D) 3	1
8.	The function f(x) = |sin x| is not differentiable at: (A) $x = \frac{n\pi}{2}$, n ∈ Z (B) x = 0 only (C) x = nπ, n ∈ Z (D) no point	1
9.	If y = cos(sin x), then $\frac{dy}{dx}$ is: (A) $\sin(\sin x)\cos x$ (B) $-\sin(\cos x)$ (C) $-\cos(\sin x)\sin x$ (D) $-\sin(\sin x)\cos x$	1
10.	The radius of a circle increases at 2 cm/s. When the radius is 10 cm, its area increases at: (A) 20π cm²/s (B) 40π cm²/s (C) 4π cm²/s (D) 100π cm²/s	1
11.	$\int e^{2x}\,dx$ equals: (A) $2e^{2x} + C$ (B) $e^{2x} + C$ (C) $\frac{e^{2x}}{2} + C$ (D) $\frac{e^{x}}{2} + C$	1
12.	$\int_0^2 \sqrt{4 - x^2}\,dx$ equals: (A) π (B) 2π (C) $\frac{\pi}{2}$ (D) 4π	1
13.	The degree of $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^3 = 0$ is: (A) 2 (B) 1 (C) not defined (D) 3	1
14.	The differential equation of the family of lines y = mx through the origin is: (A) $\frac{d^2y}{dx^2} = 0$ only (B) $\frac{dy}{dx} = 0$ (C) $y\frac{dy}{dx} = x$ (D) $x\frac{dy}{dx} = y$	1

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

15.	If $\vec{a}$ is a unit vector and $(\vec{x}-\vec{a})\cdot(\vec{x}+\vec{a})=8$, then $\lvert\vec{x}\rvert$ is: (A) 9 (B) 3 (C) 8 (D) $2\sqrt{2}$	1
16.	The angle between $\hat{i}-\hat{j}$ and $\hat{j}-\hat{k}$ is: (A) $\frac{\pi}{3}$ (B) $\frac{\pi}{2}$ (C) $\frac{2\pi}{3}$ (D) $\frac{\pi}{6}$	1
17.	A die is rolled. Given that the number is greater than 3, the probability that it is even is: (A) $\frac{3}{4}$ (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) $\frac{2}{3}$	1
18.	The corner points of a feasible region are (0, 0), (4, 0), (3, 2) and (0, 3). If Z = ax + by has the same maximum at (4, 0) and (3, 2), then: (A) a = 3b (B) 2a = b (C) a = 2b (D) a = b	1
19.	**Assertion (A):** The matrix $\begin{bmatrix}0 & 2\\ -2 & 0\end{bmatrix}$ is invertible. **Reason (R):** Its determinant is 4, which is non-zero. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.	1
20.	**Assertion (A):** $\int_0^{\pi}\sin x\,dx=2$. **Reason (R):** sin x is an odd function. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.	1

Section B

21.	Show that $2\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{1}{7}=\tan^{-1}\frac{31}{17}$. **OR** Find the value of $\sin^{-1}\frac{1}{\sqrt{2}}-\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$.	2
22.	If x = a cos θ and y = b sin θ, find $\frac{dy}{dx}$.	2
23.	Find two positive numbers whose product is 64 and whose sum is the least. **OR** Find the absolute maximum and minimum values of f(x) = sin x + cos x on [0, π].	2

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

24.	Find the area of the parallelogram whose adjacent sides are $\hat{i} - \hat{j} + 3\hat{k}$ and $2\hat{i} - 7\hat{j} + \hat{k}$.	2
25.	P(A) = 0.4, P(B) = 0.8 and P(B|A) = 0.6. Find P(A|B) and P(A ∪ B).	2

Section C

26.	Find $\int \frac{5x+3}{\sqrt{x^2+4x+10}}\,dx$. **OR** Find $\int x \tan^{-1} x\,dx$.	3
27.	Evaluate $\int_{-1}^{2} \lvert x^3 - x \rvert\,dx$.	3
28.	Solve $\frac{dy}{dx} = (1+x^2)(1+y^2)$. **OR** Solve $\frac{dy}{dx} - 3y = e^{2x}$.	3
29.	Find the shortest distance between $\vec{r} = (\hat{i} + \hat{j}) + \lambda(2\hat{i} - \hat{j} + \hat{k})$ and $\vec{r} = (2\hat{i} + \hat{j} - \hat{k}) + \mu(3\hat{i} - 5\hat{j} + 2\hat{k})$. **OR** Find the angle between the lines $\frac{x+3}{3} = \frac{y-1}{5} = \frac{z+3}{4}$ and $\frac{x+1}{1} = \frac{y-4}{1} = \frac{z-5}{2}$.	3
30.	Solve graphically: maximise Z = 4x + y subject to x + y ≤ 50, 3x + y ≤ 90, x ≥ 0, y ≥ 0.	3
31.	A bag contains 5 white, 7 red and 8 black balls. Two balls are drawn one after the other without replacement. Find the probability that (i) both are red, (ii) the first is white and the second red.	3

Section D

32.	Let L be the set of all lines in a plane and R = {(L_1, L_2): L_1 is perpendicular to L_2}. Show that R is symmetric but neither reflexive nor transitive. **OR** Show that f: R → R, $f(x) = x^3 + x$, is one-one and onto.	5
33.	For $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$, show that $A^3 - 6A^2 + 9A - 4I = O$. Hence find A^{-1}.	5

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

34.	Using integration, find the area of the region bounded by $y = \sqrt{x}$ and y = x. **OR** Using integration, find the area of the circle $x^2 + y^2 = 4$.	5
35.	Evaluate $\int_0^1 \frac{\log(1+x)}{1+x^2}\,dx$.	5

Section E

36.	**Case study 1.** A company's profit (in ₹) from making x units is $P(x) = -5x^2 + 125x + 37500$. (i) Find $P'(x)$. *[1]* (ii) Find the critical point of P. *[1]* (iii) Find the maximum profit. *[2]* **OR** (iii) Is the profit increasing or decreasing when 10 units are made? *[2]*	4
37.	**Case study 2.** In a class, 40% of the students study Mathematics, 30% study Physics and 15% study both. A student is selected at random. (i) Find the probability that the student studies Mathematics or Physics. *[1]* (ii) Find the probability that the student studies neither. *[1]* (iii) Given that the student studies Physics, find the probability that the student also studies Mathematics. *[2]* **OR** (iii) Are the events "studies Mathematics" and "studies Physics" independent? Justify. *[2]*	4
38.	**Case study 3.** Two forces $\vec{F}_1 = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{F}_2 = \hat{i} - \hat{j} + 2\hat{k}$ act on a particle. (i) Find the resultant force and its magnitude. *[2]* (ii) Find the work done by the resultant force when the particle moves from A(1, 0, 0) to B(3, 2, 1). *[2]*	4

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

Answers and Marking Scheme

Marks for each step are shown in brackets. Any correct alternative method gets full credit.

Section A

1. **(A)** an equivalence relation. *Working:* It is reflexive, symmetric and transitive.

2. **(D)** one-one but not onto. *Working:* Odd numbers have no pre-image.

3. **(C)** $\frac{3\pi}{4}$. *Working:* The principal range of $\cot^{-1}$ is (0, π).

4. **(B)** $\frac{x}{\sqrt{1+x^2}}$. *Working:* A right triangle with sides x, 1, $\sqrt{1+x^2}$.

5. **(A)** $\begin{bmatrix} 2 & 5 \\ 5 & 8 \end{bmatrix}$. *Working:* $A^T = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$.

6. **(D)** A. *Working:* A · A = I.

7. **(B)** $\pm\sqrt{3}$. *Working:* $2 - 20 = 2x^2 - 24$, so $x^2 = 3$.

8. **(C)** x = nπ, n ∈ Z. *Working:* Where sin x = 0 the graph has corners.

9. **(D)** $-\sin(\sin x)\cos x$. *Working:* Chain rule.

10. **(B)** 40π cm²/s. *Working:* $2\pi r\frac{dr}{dt} = 2\pi(10)(2)$.

11. **(C)** $\frac{e^{2x}}{2} + C$. *Working:* Standard integral.

12. **(A)** π. *Working:* It is a quarter of the area of a circle of radius 2.

13. **(A)** 2. *Working:* The highest-order derivative is raised to the power 2.

14. **(D)** $x\frac{dy}{dx} = y$. *Working:* Eliminating m = y′ from y = mx.

15. **(B)** 3. *Working:* $|\vec{x}|^2 - 1 = 8$.

16. **(C)** $\frac{2\pi}{3}$. *Working:* $\cos\theta = \frac{-1}{\sqrt{2}\cdot\sqrt{2}} = -\frac{1}{2}$.

17. **(D)** $\frac{2}{3}$. *Working:* Of 4, 5, 6, two are even.

18. **(C)** a = 2b. *Working:* 4a = 3a + 2b.

19. **(A)** Both Assertion (A) and Reason (R) are true and R is the correct explanation of A. *Working:* A square matrix with non-zero determinant is invertible.

20. **(B)** Both A and R are true but R is not the correct explanation of A. *Working:* Both are true, but the oddness of sin x is not the reason; $[-\cos x]_0^{\pi} = 2$.

Section B

21. $2\tan^{-1}\frac{1}{2} = \tan^{-1}\frac{1}{1-\frac{1}{4}} = \tan^{-1}\frac{4}{3}$ (1). $\tan^{-1}\frac{4}{3} + \tan^{-1}\frac{1}{7} = \tan^{-1}\frac{\frac{4}{3}+\frac{1}{7}}{1-\frac{4}{21}} = \tan^{-1}\frac{31}{17}$ (1).

OR $\frac{\pi}{4} - \frac{5\pi}{6}$ (1½) $= -\frac{7\pi}{12}$ (½).

22. $\frac{dx}{d\theta} = -a\sin\theta$, $\frac{dy}{d\theta} = b\cos\theta$ (1). $\frac{dy}{dx} = -\frac{b}{a}\cot\theta$ (1).

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

23. $S = x + \frac{64}{x}$, $S' = 1 - \frac{64}{x^2} = 0$ gives x = 8 (1). $S'' = \frac{128}{x^3} > 0$: minimum; the numbers are 8 and 8 (1).

OR $f'(x) = \cos x - \sin x = 0$ at $x = \frac{\pi}{4}$ (½). f(0) = 1, $f\left(\frac{\pi}{4}\right) = \sqrt{2}$, f(π) = –1 (1). Maximum $\sqrt{2}$, minimum –1 (½).

24. $\vec{a} \times \vec{b} = 20\hat{i} + 5\hat{j} - 5\hat{k}$ (1). Area $= \sqrt{450} = 15\sqrt{2}$ sq. units (1).

25. P(A ∩ B) = 0.4 × 0.6 = 0.24 (½). P(A|B) = 0.24/0.8 = 0.3 (½). P(A ∪ B) = 0.4 + 0.8 – 0.24 = 0.96 (1).

Section C

26. $5x + 3 = \frac{5}{2}(2x + 4) - 7$ (1). Integral $= 5\sqrt{x^2 + 4x + 10} - 7\int \frac{dx}{\sqrt{(x+2)^2+6}}$ (1) $= 5\sqrt{x^2 + 4x + 10} - 7\log\left|x + 2 + \sqrt{x^2 + 4x + 10}\right| + C$ (1).

OR By parts: $\frac{x^2}{2}\tan^{-1} x - \frac{1}{2}\int \frac{x^2}{1+x^2}dx$ (1½) $= \frac{x^2}{2}\tan^{-1} x - \frac{x}{2} + \frac{1}{2}\tan^{-1} x + C$ (1½).

27. $x^3 - x \geq 0$ on [–1, 0], ≤ 0 on [0, 1], ≥ 0 on [1, 2] (1). Integral $= \frac{1}{4} + \frac{1}{4} + \frac{9}{4}$ (1½) $= \frac{11}{4}$ (½).

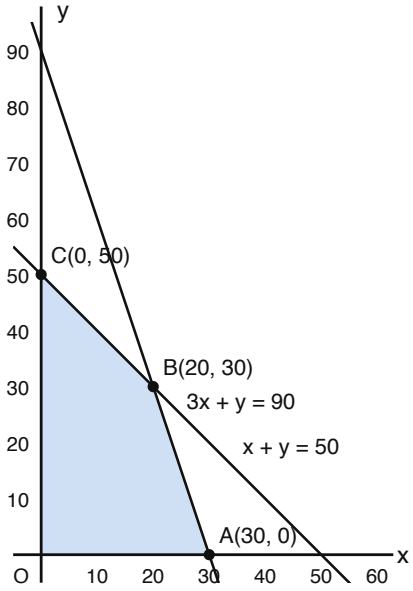
28. $\int \frac{dy}{1+y^2} = \int (1 + x^2)\, dx$ (1). $\tan^{-1} y = x + \frac{x^3}{3} + C$ (2).

OR IF $= e^{-3x}$ (1). $ye^{-3x} = \int e^{-x}dx = -e^{-x} + C$ (1½). $y = -e^{2x} + Ce^{3x}$ (½).

29. $\vec{b}_1 \times \vec{b}_2 = 3\hat{i} - \hat{j} - 7\hat{k}$, magnitude $\sqrt{59}$ (1). $\vec{a}_2 - \vec{a}_1 = \hat{i} - \hat{k}$; dot product = 3 + 7 = 10 (1). SD $= \frac{10}{\sqrt{59}}$ units (1).

OR $\cos\theta = \frac{3+5+8}{\sqrt{50}\sqrt{6}}$ (2) $= \frac{8\sqrt{3}}{15}$, so $\theta = \cos^{-1}\frac{8\sqrt{3}}{15}$ (1).

30. Corners O(0, 0), A(30, 0), B(20, 30), C(0, 50) (1½):



Z = 0, 120, 110, 50 (1). Maximum Z = 120 at (30, 0) (½).

31. (i) $\frac{7}{20} \times \frac{6}{19} = \frac{21}{190}$ (1½). (ii) $\frac{5}{20} \times \frac{7}{19} = \frac{7}{76}$ (1½).

Section D

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

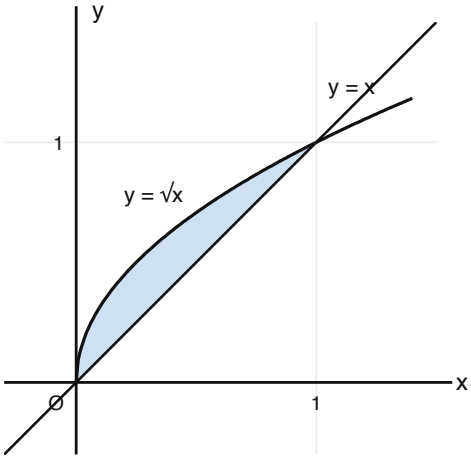
32. No line is perpendicular to itself, so R is not reflexive (1½). If $L_1 \perp L_2$ then $L_2 \perp L_1$, so R is symmetric (1½). If $L_1 \perp L_2$ and $L_2 \perp L_3$, then $L_1 \parallel L_3$, not perpendicular, so R is not transitive (2).

OR $f'(x) = 3x^2 + 1 > 0$, so f is strictly increasing and hence one-one (2). f is continuous, and f(x) → ±∞ as x → ±∞, so it takes every real value (2). Hence f is onto (1).

33. $A^2 = \begin{bmatrix} 6 & -5 & 5 \\ -5 & 6 & -5 \\ 5 & -5 & 6 \end{bmatrix}$ (1), $A^3 = \begin{bmatrix} 22 & -21 & 21 \\ -21 & 22 & -21 \\ 21 & -21 & 22 \end{bmatrix}$ (1); substituting gives O (1).

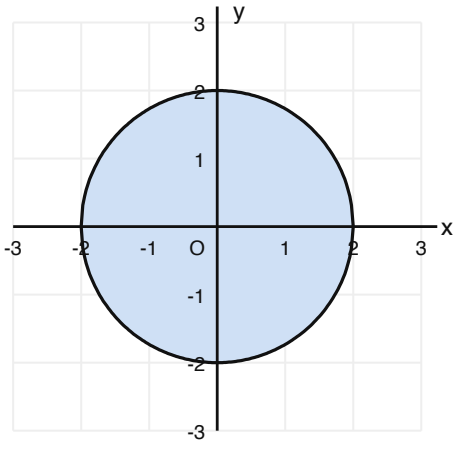
Multiplying by A^{-1}: $A^{-1} = \frac{1}{4}(A^2 - 6A + 9I) = \frac{1}{4}\begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & 1 \\ -1 & 1 & 3 \end{bmatrix}$ (2).

34. They meet at x = 0 and x = 1 (1). Figure (1):



Area $= \int_0^1 (\sqrt{x} - x)\,dx$ (1) $= \frac{2}{3} - \frac{1}{2} = \frac{1}{6}$ sq. units (2).

OR Figure (1):



Area $= 4\int_0^2 \sqrt{4 - x^2}\,dx$ (1) $= 4\left[\frac{x}{2}\sqrt{4 - x^2} + 2\sin^{-1}\frac{x}{2}\right]_0^2$ (2) $= 4\pi$ sq. units (1).

35. Put x = tan θ: $I = \int_0^{\pi/4} \log(1 + \tan\theta)\,d\theta$ (2). Using $\theta \to \frac{\pi}{4} - \theta$: $1 + \tan(\frac{\pi}{4} - \theta) = \frac{2}{1+\tan\theta}$, so $2I = \frac{\pi}{4}\log 2$ (2). $I = \frac{\pi}{8}\log 2$ (1).

Section E

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.

36. (i) –10x + 125.
(ii) x = 12.5.
(iii) $P'' = -10 < 0$; P(12.5) = –781.25 + 1562.5 + 37500 = ₹38 281.25. **OR** P′(10) = 25 > 0, so it is increasing.

37. (i) 0.4 + 0.3 – 0.15 = 0.55.
(ii) 1 – 0.55 = 0.45.
(iii) 0.15/0.3 = 1/2. **OR** 0.4 × 0.3 = 0.12 ≠ 0.15, so they are not independent.

38. (i) $3\hat{i} + 2\hat{j} + \hat{k}$ (1); magnitude $\sqrt{14}$ (1).
(ii) Displacement $2\hat{i} + 2\hat{j} + \hat{k}$ (1); work $= 6 + 4 + 1 = 11$ units (1).

© 2026 JEEInfo (www.jeeinfo.in). Free for personal study only. Do not copy, sell or republish without written permission. Not an official CBSE paper.