CBSE Class 12 Mathematics · Sample Paper 4 (2026-27 pattern)

Time: 3 hours · Maximum marks: 80 · CBSE Math Revision (not an official CBSE paper)

General instructions

1. This question paper contains 38 questions. All questions are compulsory.
2. The paper is divided into five sections: A, B, C, D and E.
3. Section A: questions 1–18 are MCQs and questions 19–20 are Assertion–Reason based, 1 mark each.
4. Section B: questions 21–25 are very short answer (VSA) questions of 2 marks each.
5. Section C: questions 26–31 are short answer (SA) questions of 3 marks each.
6. Section D: questions 32–35 are long answer (LA) questions of 5 marks each.
7. Section E: questions 36–38 are case study based questions of 4 marks each, with sub-parts of 1, 1 and 2 marks.
8. There is no overall choice. Internal choice is provided in 2 questions of Section B, 2 of Section C, 2 of Section D and in the 2-mark sub-part of each case study in Section E.
9. Use of calculators is not allowed.

Section A

20 marks

Questions 1 to 20 carry 1 mark each. Questions 1 to 18 are multiple choice questions (MCQs); questions 19 and 20 are Assertion–Reason based questions.

1. The function $f : \mathbb{R} \to \mathbb{R}$, $f(x) = x^3 - x$, is **1**

(a) one-one and onto
(b) one-one but not onto
(c) onto but not one-one
(d) neither one-one nor onto

2. The value of $\sin\left(2\tan^{-1}\frac{1}{3}\right)$ is **1**

(a) $\frac{3}{5}$
(b) $\frac{4}{5}$
(c) $\frac{2}{3}$
(d) $\frac{3}{4}$

3. If A and B are square matrices of the same order with $AB = A$ and $BA = B$, then A^2 equals **1**

(a) A
(b) B
(c) I
(d) O

4. If $\begin{vmatrix} 2x & 3 \\ x & x \end{vmatrix} = 5$, then x equals **1**

(a) $\frac{5}{2}$ or -1
(b) $-\frac{5}{2}$ or 1
(c) $\frac{5}{2}$ only
(d) 1 or 5

5. If A is an invertible matrix of order 3 with $|A| = 5$, then $|A^{-1}\,\mathrm{adj}\,A|$ equals **1**

(a) $\frac{1}{5}$
(b) 5
(c) 25
(d) 125

6. The number of symmetric matrices of order 3×3 whose entries are all 0 or 1 is **1**

(a) 8 **(b)** 32

(c) 64 **(d)** 512

7. For $\Delta = \begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 10 \end{vmatrix}$, with A_{ij} the cofactor of a_{ij}, the value of $a_{11}A_{21} + a_{12}A_{22} + a_{13}A_{23}$ is **1**

(a) 0 **(b)** Δ

(c) $-\Delta$ **(d)** 1

8. The set of all points at which $f(x) = |x-1| + |x-2|$ is not differentiable is **1**

(a) $\{1\}$ **(b)** $\{2\}$

(c) $\{1, 2\}$ **(d)** $\varnothing$

9. For $-1 < x < 1$, $\dfrac{d}{dx}\left(\sin^{-1} x + \cos^{-1} x\right)$ equals **1**

(a) 0 **(b)** $\dfrac{\pi}{2}$

(c) $\dfrac{2}{\sqrt{1-x^2}}$ **(d)** 1

10. If $y = x^{1/x}$, $x > 0$, then $\dfrac{dy}{dx} = 0$ at **1**

(a) $x = 1$ **(b)** $x = e$

(c) $x = \dfrac{1}{e}$ **(d)** $x = e^2$

11. The function $f(x) = xe^{-x^2}$ is strictly increasing on **1**

(a) $\left(-\dfrac{1}{\sqrt{2}}, \dfrac{1}{\sqrt{2}}\right)$ **(b)** $(0, \infty)$

(c) $\mathbb{R}$ **(d)** $\left(\dfrac{1}{\sqrt{2}}, \infty\right)$

12. The points on the curve $y = x^2$ nearest to $\left(0, \dfrac{3}{2}\right)$ are **1**

(a) $(0, 0)$ **(b)** $(\pm 1, 1)$

(c) $(\pm\sqrt{2}, 2)$ **(d)** $\left(\pm\dfrac{1}{\sqrt{2}}, \dfrac{1}{2}\right)$

13. $\displaystyle\int 2^x e^x \, dx$ equals **1**

(a) $2^x e^x + C$ **(b)** $\dfrac{(2e)^x}{\log 2} + C$

(c) $\dfrac{(2e)^x}{1 + \log 2} + C$ **(d)** $\dfrac{2^x e^x}{\log 2 - 1} + C$

14. If $\int_0^a (3x^2 + 2x + 1)\,dx = 14$, then a is **1**

(a) 1 **(b)** 2

(c) 3 **(d)** $\sqrt{14}$

15. The integrating factor of $x\frac{dy}{dx} - y = x^2 \log x\ (x > 0)$ is **1**

(a) x **(b)** $\frac{1}{x}$

(c) $\log x$ **(d)** e^x

16. If $\hat{a}$ and $\hat{b}$ are unit vectors and $\hat{a} + \hat{b}$ is also a unit vector, the angle between $\hat{a}$ and $\hat{b}$ is **1**

(a) $\frac{\pi}{3}$ **(b)** $\frac{\pi}{2}$

(c) $\frac{2\pi}{3}$ **(d)** $\frac{5\pi}{6}$

17. The angle between the lines $x = y = z$ and $\frac{x-1}{1} = \frac{y}{-1} = \frac{z}{0}$ is **1**

(a) 0 **(b)** $\frac{\pi}{4}$

(c) $\frac{\pi}{3}$ **(d)** $\frac{\pi}{2}$

18. The shortest distance between the lines $\vec{r} = \lambda\hat{i}$ and $\vec{r} = \hat{j} + \mu\hat{k}$ is **1**

(a) 0 **(b)** 1

(c) $\sqrt{2}$ **(d)** $\frac{1}{\sqrt{2}}$

19. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option. **1**

Assertion (A): If $\vec{a} \times \vec{b} = \vec{0}$ and $\vec{a} \cdot \vec{b} = 0$, then $\vec{a} = \vec{0}$ or $\vec{b} = \vec{0}$.

Reason (R): For non-zero vectors, $\vec{a} \times \vec{b} = \vec{0}$ means $\vec{a} \parallel \vec{b}$ and $\vec{a} \cdot \vec{b} = 0$ means $\vec{a} \perp \vec{b}$, and two non-zero vectors cannot be both parallel and perpendicular.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

20. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option. **1**

Assertion (A): If $P(A) = 0.5$ and $P(B) = 0.7$, then A and B cannot be mutually exclusive.

Reason (R): For any two events, $P(A \cap B) \leq P(A)$.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

Section B

10 marks

Questions 21 to 25 are very short answer (VSA) type questions carrying 2 marks each. Internal choice is provided in 2 questions.

21. Find the value of x for which $\sin^{-1} x = \cos^{-1} x$. **2**

OR

Give an example of a relation on $A = \{1, 2, 3\}$ that is reflexive and symmetric but not transitive. Justify.

22. For the curve $x = t^2 + t$, $y = t^3 - 3t$, find $\frac{dy}{dx}$ in terms of t, and the points of the curve at which $\frac{dy}{dx} = 0$. **2**

23. The side of an equilateral triangle is increasing at 2 cm/s. Find the rate at which its area is increasing when the side is 10 cm. **2**

24. Evaluate $\int_{-1}^{1} e^{|x|}\, dx$. **2**

OR

Find $\int \frac{dx}{\sqrt{8 + 2x - x^2}}$.

25. For $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + \hat{j} - 2\hat{k}$, show that $\vec{a} + \vec{b}$ is perpendicular to $\vec{a} - \vec{b}$, and explain why this happens. **2**

Section C

18 marks

Questions 26 to 31 are short answer (SA) type questions carrying 3 marks each. Internal choice is provided in 2 questions.

26. If $y = \sqrt{x + \sqrt{x^2 - 1}}$, $x > 1$, show that $(x^2 - 1)\frac{d^2y}{dx^2} + x\frac{dy}{dx} - \frac{y}{4} = 0$. **3**

27. Find $\int (2x + 3)\tan^{-1} x\, dx$. **3**

OR

Find $\int \sqrt{x^2 + 2x + 5}\, dx$.

28. Solve $x^2\frac{dy}{dx} = y^2 + 2xy$, given $y = 1$ when $x = 1$. **3**

29. Find the intervals in which $f(x) = \frac{\log x}{x}$, $x > 0$, is strictly increasing or decreasing. Hence decide which is greater, e^{π} or π^{e}. **3**

30. Find the points on the line $\frac{x - 1}{2} = \frac{y + 2}{-2} = \frac{z - 3}{1}$ at a distance of 6 units from the point $(1, -2, 3)$. Also find the angle the line makes with the z-axis. **3**

31. Two fair dice are thrown. Let X be the absolute difference of the two numbers obtained. Find the probability distribution of X and its mean. **3**

OR

A and B are independent events with $P(A) = 0.3$ and $P(B) = 0.4$. Find the probability that (i) exactly one of them occurs, (ii) neither occurs, (iii) A occurs given that at least one of them occurs.

Section D

20 marks

Questions 32 to 35 are long answer (LA) type questions carrying 5 marks each. Internal choice is provided in 2 questions.

32. An e-commerce hub in Nagpur loads a delivery van with small and large parcels. A small parcel weighs 10 kg and a large one 30 kg; the van can carry at most 600 kg. Each parcel, small or large, takes one slot and the van has 30 slots. The hub must send at least 5 large parcels on every trip. The delivery charge earned is ₹50 per small and ₹120 per large parcel. How many parcels of each kind should be loaded to maximise the charge earned? Formulate and solve graphically. **5**

33. A small firm making solar lanterns in Jaipur finds that when it makes and sells x lanterns a week, the selling price per lantern is ₹$(600 - 3x)$ and the total weekly cost is ₹$(2x^2 + 60x + 1000)$. Find the weekly output that maximises profit, the maximum profit and the price per lantern at that output. **5**

OR

Find the area of the region $\left\{(x, y) : \dfrac{x^2}{16} + \dfrac{y^2}{9} \le 1,\ 0 \le y \le \dfrac{3x}{4}\right\}$.

34. For the lines $L_1 : \vec{r} = (3\hat{i} - \hat{j} + \hat{k}) + \lambda(2\hat{i} - \hat{j})$ and $L_2 : \vec{r} = (2\hat{j} + 4\hat{k}) + \mu(2\hat{i} - \hat{k})$: (a) find the shortest distance between them; (b) find the points P on L_1 and Q on L_2 such that PQ is perpendicular to both lines; (c) verify that PQ equals the shortest distance. **5**

35. Meenakshi invests ₹60,000 in three schemes A, B and C that pay 6%, 7% and 8% simple interest per year. Her total annual interest is ₹4,250, and the amount in scheme C is ₹20,000 less than the amounts in A and B together. Using matrices, find the amount invested in each scheme. **5**

OR

Find A^{-1} for $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$, verify that $AA^{-1} = I$ for the first row, and hence solve $2x - y = 1$, $-x + 2y - z = 0$, $-y + 2z = 1$.

Section E

12 marks

Questions 36 to 38 are case study based questions carrying 4 marks each (1 + 1 + 2). Internal choice is provided in the 2-mark sub-part of each case study.

36. **Divisor chart.** A Class XII group studies the relation $R = \{(a, b) : a \text{ divides } b\}$ on the set $S = \{1, 2, 3, 4, 6, 12\}$ of divisors of 12. **4**

i. Is R reflexive? Justify. *[1 mark]*

ii. Is R symmetric? Justify. *[1 mark]*

iii. Show that R is transitive. Is R an equivalence relation? *[2 marks]*

OR

Find the number of ordered pairs in R. *[2 marks]*

37. **Reservoir inflow.** During a heavy shower, the rate of inflow of water into a village reservoir t hours after it starts is $r(t) = 40 + 6t - 0.3t^2$ kilolitres per hour $(0 \le t \le 20)$. **4**

i. Find the rate of inflow at $t = 5$. *[1 mark]*

ii. At what time is the rate of inflow greatest, and what is it? *[1 mark]*

iii. Find the total inflow in the first 10 hours. *[2 marks]*

OR

Find the total inflow between $t = 10$ and $t = 20$, and compare it with the first 10 hours. *[2 marks]*

38. **Garment quality check.** In a garment unit in Tiruppur, tailors A, B and C stitch 50%, 30% and 20% of the shirts respectively. Of the shirts they stitch, 2%, 3% and 5% respectively are defective. A shirt is picked at random. **4**

i. Find the probability that the shirt was stitched by C and is defective. *[1 mark]*

ii. Find the probability that the shirt is defective. *[1 mark]*

iii. The shirt is found to be defective. Find the probability that it was stitched by A. *[2 marks]*

OR

The shirt is defective. Find the probability that it was not stitched by C. *[2 marks]*