CBSE Class 12 Mathematics · Sample Paper 2 (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 $f : \mathbb{N} \to \mathbb{N}$, $f(n) = n + 2$, 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. Which of the following is *not* defined (as a real number)? **1**

(a) $\sin^{-1}(0.5)$
(b) $\cos^{-1}(-1)$
(c) $\tan^{-1}(100)$
(d) $\sec^{-1}(0.5)$

3. If $\begin{bmatrix} x+y & 2 \\ 5 & xy \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ 5 & 8 \end{bmatrix}$, then (x, y) could be **1**

(a) $(1, 7)$
(b) $(3, 3)$
(c) $(2, 4)$
(d) $(-2, -4)$

4. If A is a skew-symmetric matrix of order 3, then $|A|$ is **1**

(a) 0
(b) 1
(c) -1
(d) any real number

5. If A is a square matrix with $A^2 = A$, then $(I + A)^2 - 3A$ equals **1**

(a) I
(b) A
(c) O
(d) $2A$

6. The inverse of $\begin{bmatrix} 2 & 1 \\ 7 & 4 \end{bmatrix}$ is **1**

(a) $\begin{bmatrix} 4 & -1 \\ -7 & 2 \end{bmatrix}$ **(b)** $\begin{bmatrix} 4 & 1 \\ 7 & 2 \end{bmatrix}$

(c) $\begin{bmatrix} -4 & 1 \\ 7 & -2 \end{bmatrix}$ **(d)** $\begin{bmatrix} 2 & -1 \\ -7 & 4 \end{bmatrix}$

7. The points $(2, -3)$, $(k, -1)$ and $(0, 4)$ are collinear when k equals **1**

(a) $\dfrac{7}{10}$ **(b)** $\dfrac{10}{7}$

(c) $-\dfrac{10}{7}$ **(d)** 2

8. The function $f(x) = |x - 3|$, $x \in \mathbb{R}$, is **1**

(a) continuous and differentiable everywhere **(b)** continuous everywhere but not differentiable at $x = 3$

(c) discontinuous at $x = 3$ **(d)** differentiable but not continuous at $x = 3$

9. If $y = \tan^{-1}(e^x)$, then $\dfrac{dy}{dx}$ is **1**

(a) $\dfrac{1}{1 + e^{2x}}$ **(b)** $\dfrac{e^x}{1 + e^{2x}}$

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

10. If $x = t + \dfrac{1}{t}$ and $y = t - \dfrac{1}{t}$, then $\dfrac{dy}{dx}$ is **1**

(a) $\dfrac{t^2 - 1}{t^2 + 1}$ **(b)** $\dfrac{t^2 + 1}{t^2 - 1}$

(c) 1 **(d)** $\dfrac{1}{t^2}$

11. The rate of change of the total surface area of a cube with respect to its edge x, when $x = 4$ cm, is **1**

(a) $24\ \text{cm}^2/\text{cm}$ **(b)** $48\ \text{cm}^2/\text{cm}$

(c) $96\ \text{cm}^2/\text{cm}$ **(d)** $16\ \text{cm}^2/\text{cm}$

12. The maximum value of $f(x) = \sin x + \cos x$ is **1**

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

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

13. $\displaystyle\int \frac{dx}{x \log x}$ equals **1**

(a) $\log|x| + C$ **(b)** $\log|\log x| + C$

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

14. $\int_0^{\pi/2} \cos^2 x \, dx$ equals **1**

(a) $\frac{\pi}{2}$ **(b)** $\frac{\pi}{4}$

(c) 1 **(d)** $\frac{\pi}{8}$

15. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^2 + \sin\left(\frac{dy}{dx}\right) = 0$ is **1**

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

(c) 0 **(d)** not defined

16. The vectors $2\hat{i} + \lambda\hat{j} + \hat{k}$ and $\hat{i} - 2\hat{j} + 3\hat{k}$ are perpendicular when λ equals **1**

(a) $\frac{5}{2}$ **(b)** $-\frac{5}{2}$

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

17. The direction ratios of the line $\frac{x-2}{3} = \frac{2y+1}{4} = \frac{1-z}{5}$ are **1**

(a) $3, 4, 5$ **(b)** $3, 4, -5$

(c) $3, 2, -5$ **(d)** $3, 2, 5$

18. If a line makes angles α, β, γ with the coordinate axes, then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$ equals **1**

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

(c) 3 **(d)** 0

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): For non-zero vectors $\vec{a}$ and $\vec{b}$, if $|\vec{a} \times \vec{b}| = \vec{a} \cdot \vec{b}$, then the angle between them is $\frac{\pi}{4}$.

Reason (R): $|\vec{a} \times \vec{b}| = |\vec{a}||\vec{b}| \sin\theta$ and $\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}| \cos\theta$.

(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): Two mutually exclusive events A and B with $P(A) > 0$ and $P(B) > 0$ cannot be independent.

Reason (R): If A and B are independent, then so are A' and B'.

(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. Let $A = \{1, 2, 3, 4\}$. Give an example of a relation on A that is symmetric and transitive but not reflexive, and justify each property. **2**

OR

Find the value of $\sin^{-1}\left(-\frac{1}{2}\right) + 2\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$.

22. If $y = (\cos x)^{x^2}$, $0 < x < \frac{\pi}{2}$, find $\frac{dy}{dx}$. **2**

23. Find the local maximum value of $f(x) = x^2 e^{-x}$. **2**

24. Evaluate $\int_0^1 x e^{x^2}\, dx$. **2**

OR

Find $\int \frac{\sec^2 x}{\tan^2 x + 4}\, dx$.

25. Find the angle between the lines $\frac{x-1}{1} = \frac{y}{2} = \frac{z+3}{2}$ and $\frac{x+2}{2} = \frac{y-1}{2} = \frac{z}{-1}$. **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 $y = (1 + x^2)\tan^{-1} x$, show that $(1 + x^2)\frac{d^2y}{dx^2} - 2y = 2x$. **3**

27. Find $\int e^x \frac{x^2 + 2x + 2}{(x+2)^2}\, dx$. **3**

OR

Find $\int \frac{dx}{e^x + 2e^{-x} + 3}$.

28. Find the particular solution of $\frac{dy}{dx} = e^x y^2$, given that $y = 1$ when $x = 0$. State the interval of x (containing 0) on which the solution is valid. **3**

29. Using integration, find the area of the region bounded by the parabola $y^2 = 8x$ and the line $x - y = 6$. **3**

30. Find the vector and Cartesian equations of the line through $A(1, 2, -1)$ and $B(3, -2, 5)$. Find the point where this line meets the xy-plane ($z = 0$). **3**

31. Two cards are drawn one after the other without replacement from a box containing 4 red and 6 black cards. Let X be the number of red cards drawn. Find the probability distribution of X and its mean. **3**

OR

Given $P(A) = 0.6$, $P(B) = 0.5$ and $P(A \mid B) = 0.4$, find $P(A \cup B)$, $P(B \mid A)$ and $P(A' \mid B')$.

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 NGO in Odisha packs two kinds of relief kits. Kit P contains 2 kg rice and 1 kg dal and feeds a family of 4; kit Q contains 1 kg rice and 2 kg dal and feeds a family of 5. The NGO has 80 kg of rice and 70 kg of dal, and its volunteers can pack at most 45 kits in all. How many kits of each kind should be packed to feed the greatest number of people? Formulate and solve graphically. **5**

33. A school notice-board poster must have a printed area of $384\ \text{cm}^2$, with margins of 3 cm at the top and bottom and 2 cm on each side. Find the dimensions of the poster that use the least paper, and the least area of paper. **5**

OR

For $f(x) = x^4 - 4x^3 - 2x^2 + 12x + 5$, find the intervals on which f is strictly increasing or decreasing, and find its local maximum and minimum values.

34. The points $A(1, 1, 1)$, $B(2, 3, 3)$ and $C(3, -1, 2)$ are given. (a) Show that $\angle BAC = 90^\circ$. (b) Using the vector product, find the area of $\triangle ABC$. (c) Write the vector equation of the line through A perpendicular to both AB and AC. (d) Find the points on this line at a distance of 6 units from A. **5**

35. At a stationery shop in Bhopal, Anil buys 2 pens, 3 notebooks and 1 geometry box for ₹160; Babita buys 1 pen, 2 notebooks and 2 geometry boxes for ₹170; Chetan buys 3 pens, 1 notebook and 2 geometry boxes for ₹160. Using matrices, find the price of each item. **5**

OR

Let $A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{bmatrix}$. Show that $A^2 - 5A + 4I = O$. Hence find A^{-1}, and use it to solve $2x + y + z = 3$, $x + 2y + z = 1$, $x + y + 2z = 4$.

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. **School records.** In a school with 1500 students, two relations are defined on the set S of students: $R_1 = \{(a, b) : a \text{ and } b \text{ were born in the same month}\}$ and $R_2 = \{(a, b) : a \text{ is taller than } b\}$. **4**

i. Is R_1 symmetric? Justify. *[1 mark]*

ii. Is R_2 reflexive? Justify. *[1 mark]*

iii. Show that R_1 is an equivalence relation, and state the greatest possible number of its equivalence classes. *[2 marks]*

OR

Show that R_2 is transitive but not symmetric. *[2 marks]*

37. **Town population.** The population P (in lakh) of a growing town increases at a rate proportional to the population present. The population was 2 lakh in 2010 and 2.5 lakh in 2020. Let t be the time in years from 2010. **4**

i. Write the differential equation satisfied by P. *[1 mark]*

ii. Solve it to express P in terms of t and k, using $P(0) = 2$. *[1 mark]*

iii. Predict the population in 2030. *[2 marks]*

OR

After how many years (from 2010) will the population double? (Leave in logarithmic form.) *[2 marks]*

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38. **Spin-the-wheel stall.** At a school fair, a wheel is spun once for ₹15. The prize X (in ₹) has the distribution below, where k is a constant. **4**

X	0	10	20	50
$P(X)$	0.4	$3k$	$2k$	k

i. Find k. *[1 mark]*

ii. Find the probability that a player wins at least ₹20. *[1 mark]*

iii. Find the mean prize. Is the stall expected to make money? Explain. *[2 marks]*

OR

Given that the prize is at most ₹20, find the probability that it is at least ₹10. *[2 marks]*