CBSE Class 12 Mathematics · Sample Paper 3 (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 relation $R = \{(a, b) : a = b^2\}$ on the set $\mathbb{N}$ of natural numbers is **1**

(a) reflexive only

(b) symmetric only

(c) transitive only

(d) neither reflexive, nor symmetric, nor transitive

2. The domain of the function $\cos^{-1}(x^2 - 4)$ is **1**

(a) $[3, 5]$

(b) $[-\sqrt{5}, \sqrt{5}]$

(c) $[-\sqrt{5}, -\sqrt{3}] \cup [\sqrt{3}, \sqrt{5}]$

(d) $[\sqrt{3}, \sqrt{5}]$

3. If $A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$, then A^n ($n \in \mathbb{N}$) equals **1**

(a) $\begin{bmatrix} 1 & 0 \\ n & 1 \end{bmatrix}$

(b) $\begin{bmatrix} n & 0 \\ n & n \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 0 \\ 1 & n \end{bmatrix}$

(d) $\begin{bmatrix} 1 & n \\ 0 & 1 \end{bmatrix}$

4. If A is a square matrix of order 3 with $|A| = -2$, then $|\text{adj}(2A)|$ is **1**

(a) 16

(b) 64

(c) -256

(d) 256

5. For $A = \begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$, A^{-1} equals **1**

(a) $\frac{1}{19}A$

(b) $19A$

(c) $-\frac{1}{19}A$

(d) A'

6. If $A = \begin{bmatrix} a & b \\ c & -a \end{bmatrix}$ with $a^2 + bc = 1$, then A^2 is **1**

(a) O **(b)** I

(c) A **(d)** $-I$

7. The system $kx + y + z = 1$, $x + ky + z = 1$, $x + y + kz = 1$ fails to have a unique solution exactly when k is **1**

(a) 1 or -2 **(b)** -1 or 2

(c) 1 only **(d)** 0

8. The number of points in the open interval $(-2.5, 1.5)$ at which the greatest integer function $f(x) = [x]$ is discontinuous is **1**

(a) 2 **(b)** 3

(c) 4 **(d)** 5

9. The value of $\frac{d}{dx}(x^x)$ at $x = 1$ is **1**

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

(c) e **(d)** not defined

10. The function $f(x) = x^x$, $x > 0$, has a stationary point at **1**

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

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

11. $\int_{-1}^{1} \log\left(\frac{2-x}{2+x}\right) dx$ equals **1**

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

(c) $2\log 3$ **(d)** $-2\log 3$

12. The general solution of $\frac{dy}{dx} = e^{x-y}$ is **1**

(a) $e^y = e^x + C$ **(b)** $e^{-y} = e^x + C$

(c) $e^{x+y} = C$ **(d)** $y = x + C$

13. For non-zero vectors $\vec{a}$ and $\vec{b}$, if $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$, then **1**

(a) $\vec{a} \parallel \vec{b}$ **(b)** $\vec{a} \perp \vec{b}$

(c) $|\vec{a}| = |\vec{b}|$ **(d)** $\vec{a} = \vec{b}$

14. The vector of magnitude 9 in the direction of $2\hat{i} - \hat{j} + 2\hat{k}$ is **1**

(a) $6\hat{i} - 3\hat{j} + 6\hat{k}$ **(b)** $18\hat{i} - 9\hat{j} + 18\hat{k}$

(c) $2\hat{i} - \hat{j} + 2\hat{k}$ **(d)** $3\hat{i} - 3\hat{j} + 3\hat{k}$

15. The distance between the parallel lines $\vec{r} = \hat{i} + \lambda(2\hat{i} - 3\hat{j} + 6\hat{k})$ and $\vec{r} = 2\hat{j} + \mu(2\hat{i} - 3\hat{j} + 6\hat{k})$ is **1**

(a) $\frac{\sqrt{181}}{7}$ **(b)** $\sqrt{5}$

(c) $\frac{\sqrt{181}}{49}$ **(d)** $\frac{13}{7}$

16. For the LPP: minimise $Z = 3x + 2y$ subject to $x + y \geq 4$, $x \leq 3$, $y \leq 3$, $x, y \geq 0$, the minimum value of Z is **1**

(a) 8 **(b)** 9

(c) 11 **(d)** 15

17. In a minimisation LPP with an unbounded feasible region, the smallest corner-point value of $Z = ax + by$ is m. Then m is the minimum value of Z provided that **1**

(a) the half-plane $ax + by > m$ has no point in common with the feasible region **(b)** the half-plane $ax + by < m$ has no point in common with the feasible region

(c) the feasible region is convex **(d)** $m > 0$

18. Events A and B satisfy $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$ and $P(A \cup B) = \frac{2}{3}$. Then A and B are **1**

(a) mutually exclusive **(b)** independent

(c) both mutually exclusive and independent **(d)** neither mutually exclusive nor independent

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): $\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$ can be the direction cosines of a line.

Reason (R): If l, m, n are the direction cosines of a line, then $l^2 + m^2 + n^2 = 1$.

(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 $P(X = 1) = P(X = 2) = P(X = 3) = \frac{1}{3}$, then the mean of X is 2.

Reason (R): The mean of a random variable X is $E(X) = \sum x_i p_i$.

(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 $\sin^{-1}\left(\sin\frac{3\pi}{5}\right)+\cos^{-1}\left(\cos\frac{7\pi}{5}\right)$. **2**

OR

Show that $f:\mathbb{N}\to\mathbb{N}$, $f(n)=n^2+n+1$, is one-one but not onto.

22. Using a suitable substitution, find $\frac{dy}{dx}$ if $y=\tan^{-1}\left(\sqrt{1+x^2}-x\right)$, $x\in\mathbb{R}$. **2**

23. Find the absolute maximum and minimum values of $f(x)=2x^3-24x+5$ on $[-3,3]$. **2**

OR

Find $\int x^2e^{x^3}\cos\left(e^{x^3}\right)dx$.

24. Find the area of the parallelogram whose diagonals are $\vec{d}_1=2\hat{i}-\hat{j}+3\hat{k}$ and $\vec{d}_2=\hat{i}+3\hat{j}-\hat{k}$. **2**

25. If $P(A)=0.4$, $P(B)=0.3$ and $P(B\mid A)=0.5$, find $P(A\mid B)$ and $P(A\cup B)$. **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. Find the value of k for which $f(x)=\begin{cases}\frac{e^{2x}-1}{\log(1+3x)}, & -\frac{1}{3}<x<0\\ k, & x=0\\ \frac{\sin 2x}{3x}, & x>0\end{cases}$ is continuous at $x=0$. **3**

27. If $x=e^t\cos t$ and $y=e^t\sin t$, find $\frac{d^2y}{dx^2}$ at $t=0$. **3**

28. Find $\int\frac{x^2}{x^4+x^2-2}\,dx$. **3**

OR

Evaluate $\int_0^{\pi}\left|\cos x+\frac{1}{2}\right|dx$.

29. Solve $(1+x^2)\frac{dy}{dx}-2xy=(1+x^2)^2$, given $y(0)=1$. **3**

30. Find the image of the point $P(5,3,1)$ in the line $\frac{x-1}{2}=\frac{y}{1}=\frac{z-2}{-1}$. **3**

31. Minimise $Z = 5x + 3y$ subject to $x + y \geq 6$, $2x + y \geq 8$, $x + 3y \geq 9$, $x, y \geq 0$, by the graphical method. **3**

OR

Maximise $Z = 2x + 3y$ subject to $x + y \leq 8$, $y - x \leq 2$, $x \leq 6$, $x, y \geq 0$, by the graphical method.

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. The path of a ball thrown in a school sports practice is modelled by $y = ax^2 + bx + c$, and it passes through the points $(1, 2)$, $(-1, 6)$ and $(2, 3)$. Form a system of equations in a, b, c and solve it by the matrix method. **5**

OR

Consider the system $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$. (a) Find the values of λ for which it has a unique solution. (b) For $\lambda = 3$, find μ for which it has (i) no solution, (ii) infinitely many solutions. (c) Solve it for $\lambda = 4$, $\mu = 12$.

33. Sketch the region bounded by the parabola $x^2 = 4y$ and the line $y = x + 8$, and find its area by integration. **5**

34. Find $\displaystyle\int \frac{dx}{\sin x\,(1 + 2\cos x)}$. **5**

OR

Evaluate $\displaystyle\int_0^{\pi} \frac{x}{1 + \cos^2 x}\,dx$.

35. Show that the lines $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} - \hat{j} + \hat{k})$ and $\vec{r} = (\hat{i} - \hat{j}) + \mu(\hat{i} + \hat{j} + 2\hat{k})$ intersect, and find their point of intersection. Find the angle between them, and the vector equation of the line through the point of intersection perpendicular to both. **5**

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. **Monsoon commute.** During the monsoon in Mumbai, the probability that it rains on a given morning is 0.3. If it rains, a local train is late with probability 0.6; if it does not rain, the train is late with probability 0.15. **4**

i. Find the probability that it rains and the train is late. *[1 mark]*

ii. Find the probability that the train is late. *[1 mark]*

iii. The train was late. Find the probability that it rained that morning. *[2 marks]*

OR

The train was on time. Find the probability that it rained that morning. *[2 marks]*

37. **Filling a conical tank.** A water tank at a village water-treatment plant is an inverted right circular cone of base radius 5 m and depth 10 m. Water is pumped in at a constant rate of $4\ \text{m}^3/\text{min}$. Let h be the depth of water at time t. **4**

i. Express the volume V of water in terms of h. *[1 mark]*

ii. Find $\dfrac{dV}{dh}$ when $h = 4$ m. *[1 mark]*

iii. Find the rate at which the water level is rising when $h = 4$ m. *[2 marks]*

OR

Find the rate at which the area of the water surface is increasing when $h = 4$ m. *[2 marks]*

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38. **Van routes.** A courier company has three delivery vans $A = \{V_1, V_2, V_3\}$ and four routes $B = \{1, 2, 3, 4\}$. Each day, every van is assigned exactly one route, giving a function $f : A \to B$. **4**

i. How many different functions $f : A \to B$ are there? *[1 mark]*

ii. How many of them are one-one (no two vans on the same route)? *[1 mark]*

iii. How many assignments are not one-one? Can any assignment $f : A \to B$ be onto? Justify. *[2 marks]*

OR

The company now uses a function $g : B \to B$ that is one-one. Show that g must be onto. *[2 marks]*