TECHNO INDIA GROUP PUBLIC SCHOOL

MOCK TEST-1 **2025-2026** **CLASS-XII**

MATHEMATICS

SET 1

Code: 041

Time : 3 hours F.M.: 80

General Instructions:

Read the following instructions very carefully and strictly follow them:

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 no. **1** to **18** are **multiple choice questions (MCQs)** and Questions no. **19** and **20** are **Assertion-Reason based** questions of **1 mark each**.
4. In **Section B**, Questions no. **21** to **25** are **Very Short Answer (VSA)–type** questions, carrying **2 marks each**.
5. In **Section C,** Questions no. **26** to **31** are **Short Answer (SA)–type** questions, carrying **3 marks each**.
6. In **Section D,** Questions no. **32** to **35** are **Long Answer (LA)–type** questions, carrying **5 marks each**.
7. In **Section E,** Questions no. **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 subpart each in 2 questions in Section D and one subpart each in 2 questions of Section E.
9. Use of calculators is **not** allowed.

SECTION A

[1 × 20 = 20]

(This section comprises of multiple choice questions (MCQs) of 1 mark each)

Select the correct option (Question 1 – Question 18):

1.	If A and B are two skew symmetric matrices, then (AB + BA) is: Ⓐ a skew symmetric matrix Ⓑ a symmetric matrix Ⓒ a null matrix Ⓓ an identity matrix	[1]
2.	If $\lvert\vec{a}\rvert = 2$ and $-3 \le K \le 2$, then $\lvert k\vec{a}\rvert \in$: Ⓐ [–6, 4] Ⓑ [0, 4] Ⓒ [4, 6] Ⓓ [0, 6]	[1]

3.	If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$, then A^{-1} is: Ⓐ $\begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$ Ⓑ $30\begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$ Ⓒ $\frac{1}{30}\begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$ Ⓓ $\frac{1}{30}\begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$	[1]
4.	If $f(a - x) = f(x)$ then $\int_0^a x\, f(x)\, dx$ is equal to Ⓐ $\int_0^a f(x)dx$ Ⓑ $a\int_0^a f(x)dx$ Ⓒ $\frac{a}{2}\int_0^a f(x)dx$ Ⓓ 0	[1]
5.	The derivative of 2^x w.r.t. 3^x is: Ⓐ $\left(\frac{3}{2}\right)^x \frac{\log 2}{\log 3}$ Ⓑ $\left(\frac{2}{3}\right)^x \frac{\log 3}{\log 2}$ Ⓒ $\left(\frac{2}{3}\right)^x \frac{\log 2}{\log 3}$ Ⓓ $\left(\frac{3}{2}\right)^x \frac{\log 3}{\log 2}$	[1]
6.	Let E and F be two events such that $P(E) = 0.1$, $P(F) = 0.3$, $P(E \cup F) = 0.4$, then $P(F\|E)$ is: Ⓐ 0.6 Ⓑ 0.4 Ⓒ 0.5 Ⓓ 0	[1]
7.	The restrictions imposed on decision variables involved in an objective function of a linear programming problem are called: Ⓐ feasible solutions Ⓑ constraints Ⓒ optimal solutions Ⓓ infeasible solutions	[1]
8.	If $\left\|\vec{a}\right\| = 3, \left\|\vec{b}\right\| = 4$ and $\left\|\vec{a} + \vec{b}\right\| = 5$, then $\left\|\vec{a} - \vec{b}\right\| =$ Ⓐ 3 Ⓑ 4 Ⓒ 5 Ⓓ 8	[1]
9.	If α, β and γ are the angles which a line makes with positive directions of x, y and z axes respectively, then which of the following is not true? Ⓐ $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$ Ⓑ $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$ Ⓒ $\cos 2\alpha + \cos 2\beta + \cos 2\gamma = -1$ Ⓓ $\cos\alpha + \cos\beta + \cos\gamma = 1$	[1]
10.	$x \log x \frac{dy}{dx} + y = 2 \log x$ is an example of a: Ⓐ variable separable differential equation Ⓑ homogeneous differential equation Ⓒ first order linear differential equation Ⓓ differential equation whose degree is not defined	[1]
11.	$\int x^2 \sec^2(x^3)dx = a \tan(x^3) + C$, then a is equal to Ⓐ 3 Ⓑ $\frac{1}{2}$ Ⓒ 2 Ⓓ $\frac{1}{3}$	[1]

12. If $A = [a_{ij}]$ is an identity matrix, then which of the following is true? [1]

Ⓐ $a_{ij} = \begin{cases} 0, & \text{if } i = j \\ 1, & \text{if } i \neq j \end{cases}$ Ⓑ $a_{ij} = 1, \forall\, i, j$ Ⓒ $a_{ij} = 0, \forall\, i, j$ Ⓓ $a_0 = \begin{cases} 0, & \text{if } i \neq j \\ 1, & \text{if } i = j \end{cases}$

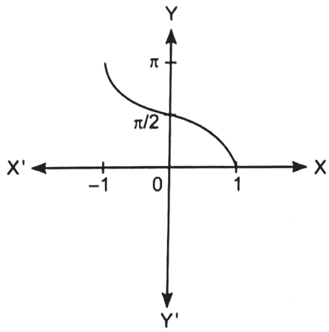
13. If $\begin{vmatrix} 1 & 3 & 1 \\ k & 0 & 1 \\ 0 & 0 & 1 \end{vmatrix} = \pm 6$ then the value of k is: [1]

Ⓐ 2 Ⓑ −2 Ⓒ ± 2 Ⓓ ∓ 2

14. If the sides of a square are decreasing at the rate of 1.5 cm/s, the rate of decrease of its perimeter is: [1]

Ⓐ 1.5 cm/s Ⓑ 6 cm/s Ⓒ 3 cm/s Ⓓ 2.25 cm/s

15. Identify the function shown in figure [1]



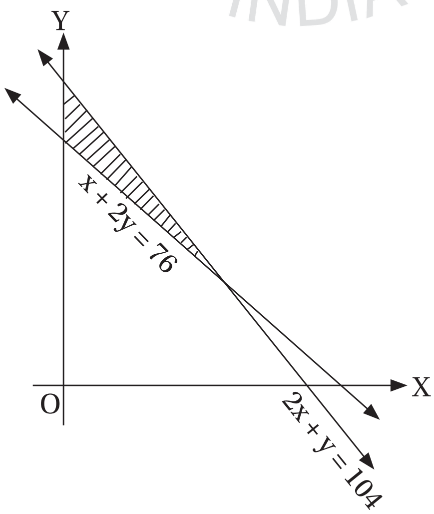
Ⓐ $\sin^{-1}x$ Ⓑ $\cos^{-1}x$ Ⓒ $\tan^{-1}x$ Ⓓ $\sec^{-1}x$

16. A function $f(x) = |1 - x + |x||$ is : [1]

Ⓐ discontinuous at x = 1 only Ⓑ discontinuous at x = 0 only

Ⓒ discontinuous at x = 0, 1 Ⓓ continuous everywhere

17. Of the following, which group of constraints represents the feasible region given below? [1]



Ⓐ $x + 2y \leq 76,\ 2x + y \geq 104,\ x, y \geq 0$ Ⓑ $x + 2y \leq 76,\ 2x + y \leq 104,\ x, y \geq 0$

Ⓒ $x + 2y \geq 76,\ 2x + y \leq 104,\ x, y \geq 0$ Ⓓ $x + 2y \geq 76,\ 2x + y \geq 104,\ x, y \geq 0$

18.	Let $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ be a square matrix such that adj A = A. Then, (a + b + c + d) is equal to: Ⓐ 2a Ⓑ 2b Ⓒ 2c Ⓓ 0	[1]
	ASSERTION-REASON BASED QUESTIONS (Question numbers 19 and 20 are Assertion-Reason based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the options (A), (B), (C) and (D) as given below.) (Ⓐ) Both (A) and (R) are true and (R) is the correct explanation of (A). (Ⓑ) Both (A) and (R) are true but (R) is not the correct explanation of (A). (Ⓒ) (A) is true but (R) is false. (Ⓓ) (A) is false but (R) is true.	
19.	**Assertion:** For non-zero vectors $\vec{a}, \vec{b}$ if $\vec{a} \times \vec{b} = 0$ then $\vec{a} \perp \vec{b}$ **Reason:** If $\vec{a} \perp \vec{b} \Rightarrow \vec{a}.\vec{b} = 0$.	[1]
20.	**Assertion:** The function f : R – $\left\{\left(2n+1\right)\frac{\pi}{2} : n \in Z\right\}$ → (–∞, –1] U [1, ∞) defined by f(x) = sec x is not one-one function in its domain. **Reason:** The line y = 2 meets the graph of the function at more than one point.	[1]

SECTION B

[2 × 5 = 10]

(This section comprises of 5 very short answer (VSA) type questions of 2 marks each.)

21.	Let $\vec{a}$ and $\vec{b}$ be two non-zero vectors. Prove that $\left\|\vec{a} \times \vec{b}\right\| \leq \left\|\vec{a}\right\|\left\|\vec{b}\right\|$. State the condition under which equality holds, i.e., $\left\|\vec{a} \times \vec{b}\right\| = \left\|\vec{a}\right\|\left\|\vec{b}\right\|$.	[2]
22.	(a) If $x = e^{x/y}$, prove that $\frac{dy}{dx} = \frac{\log x - 1}{(\log x)^2}$. **OR** (b) Check the differentiability of f(x) = $\begin{cases} x^2+1, & 0 \leq x < 1 \\ 3-x, & 1 \leq x \leq 2 \end{cases}$ at x = 1.	[2]
23.	(a) Evaluate: $\int_0^{\pi/2} \sin 2x \cos 3x \, dx$ **OR** (b) Given $\frac{d}{dx}F(x) = \frac{1}{\sqrt{2x - x^2}}$ and F(1) = 0, find F(x).	[2]
24.	If f(x + y) = f(x) f(y) ∀x,y ∈ ℝ and f(3) = 5, f′(0) = 1, then using definition of derivative find f′(3).	[2]
25.	Evaluate: $\sec^2\left(\tan^{-1}\frac{1}{2}\right) + \mathrm{cosec}^2\left(\cot^{-1}\frac{1}{3}\right)$	[2]

SECTION C

[3 × 6 = 18]

(This section comprises of 6 short answer (SA) type questions of 3 marks each.)

26.	The chances of P, Q and R getting selected as CEO of a company are in the ratio 4 : 1 : 2 respectively. The probabilities for the company to increase its profits from the previous year under the new CEO, P, Q or R are 0.3, 0.8 and 0.5 respectively. If the company increased the profits from the previous year, find the probability that it is due to the appointment of R as CEO.	[3]
27.	Solve the following linear programming problem graphically: Maximise Z = 4x + 3y, subject to the constraints $x + y \leq 800$ $2x + y \leq 1000$ $x \leq 400$ $x, y \geq 0$.	[3]
28.	Draw the rough sketch of the curve y = 20 cos 2x; (where $\frac{\pi}{6} \leq x \leq \frac{\pi}{3}$). Using integration, find the area of the region bounded by the curve y = 20 cos 2x from the ordinates $x = \frac{\pi}{6}$ to $x = \frac{\pi}{3}$ and the x-axis.	[3]
29.	(a) It is given that function $f(x) = x^4 - 62x^2 + ax + 9$ attains local maximum value at x = 1. Find the value of 'a', hence obtain all other points where the given function f(x) attains local maximum or local minimum values. **OR** (b) The perimeter of a rectangular metallic sheet is 300 cm. It is rolled along one of its sides to form a cylinder. Find the dimensions of the rectangular sheet so that volume of cylinder so formed is maximum.	[3]
30.	(a) Find the points on the line $\frac{x+2}{3} = \frac{y+1}{2} = \frac{z-3}{2}$ at a distance of 5 units from the point P(1, 3, 3). (b) Find the equation of a line passing through the point P(2, –1, 3) and perpendicular to the lines: $\vec{r} = \left(\hat{i} + \hat{j} - \hat{k}\right) + \lambda\left(2\hat{i} - 2\hat{j} + \hat{k}\right)$ and $\vec{r} = \left(2\hat{i} - \hat{j} - 3\hat{k}\right) + \mu\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$.	[3]
31.	(a) If x cos (p + y) + cos p sin(p + y) = 0, prove that $\cos p \frac{dy}{dx} = -\cos^2(p+y)$, where p is a constant. **OR** (b) Find the value of a and b so that function f defined as: $f(x) = \begin{cases} \frac{x-2}{\lvert x-2 \rvert} + a, & \text{if } x < 2 \\ a + b, & \text{if } x = 2 \\ \frac{x-2}{\lvert x-2 \rvert} + b, & \text{if } x > 2 \end{cases}$ is a continuous function.	[3]

SECTION D

[5 × 4 = 20]

(This section comprises of 4 long answer (LA) type questions of 5 marks each)

32.	(a) Find the equation of the line passing through the point of intersection of the lines $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ and $\frac{x-1}{0} = \frac{y}{-3} = \frac{z-7}{2}$ and perpendicular to these given lines. **OR** (b) Two vertices of the parallelogram ABCD are given as A(–1, 2, 1) and B(1, –2, 5). If the equation of the line passing through C and D is $\frac{x-4}{1} = \frac{y+7}{-2} = \frac{z-8}{2}$, then find the distance between sides AB and CD. Hence, find the area of parallelogram ABCD.	[5]
33.	(a) Find: $\int \frac{2+\sin 2x}{1+\cos 2x} e^x \, dx$ **OR** (b) Evaluate: $\int_0^{\pi/4} \frac{1}{\sin x + \cos x} \, dx$	[5]
34.	Show that the differential equation $(xe^{y/x} + y)\, dx = x dy$ is homogeneous. Find the particular solution of this differential equation, given that x = 1 when y = 1.	[5]
35.	Given $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$ verify that BA = 6I, use the result to solve the system of linear equations x – y = 3, 2x + 3y + 4z = 17, y + 2z = 7.	[5]

SECTION E

[4 × 3 = 12]

(This section comprises of 3 case-study/passage-based questions of 4 marks each with subparts. The first two case study questions have three subparts (i), (ii), (iii) of marks 1, 1, 2 respectively. The third case study question has two subparts of 2 marks each)

36.	**Case Study – 1** Sherlin and Danju are playing Ludo at home during Covid–19. While rolling the dice, Sherlin's sister Raji observed and noted that possible outcomes of the throw every time belongs to set {1, 2, 3, 4, 5, 6}. Let A be the set of players while B be the set of all possible outcomes. 	

A = {S, D}, B = {1, 2, 3, 4, 5, 6}

(i) Let $R : B \rightarrow B$ be defined by $R = \{(x, y) : y \text{ is divisible by } x\}$. Show that relation R is reflexive and transitive but not symmetric. [1]

(ii) Let R be a relation on B defined by R = {(1, 2), (2, 2), (1, 3), (3, 4), (3, 1), (4, 3), (5, 5)}. [1]

Then check whether R is an equivalence relation.

(iii) (a) Raji wants to know the number of functions from A to B. How many number of functions are possible? [2]

OR

(b) Raji wants to know the number of relations possible from A to B. How many numbers of relations are possible?

37. **Case Study – 2**

$P(x) = -5x^2 + 125x + 37500$ is the total profit function of a company, where x is the production of the company.

Now answer the following:

(i) What will be the production when the profit is maximum? [1]

(ii) What will be the maximum profit? [1]

(iii) (a) When the production is 2 units what will be the profit of the company? [2]

OR

(b) What will be production of the company when the profit is ₹8250?

38. **Case Study – 3**

A building contractor undertakes a job to construct 4 flats on a plot along with parking area. Due to strike the probability of many construction workers not being present for the job is 0.65. The probability that many are not present and still the work gets completed on time is 0.35. The probability that work will be completed on time when all workers are present is 0.80.

Let: E_1 : represent the event when many workers were not present for the job;

E_2 : represent the event when all workers were present; and

E : represent completing the construction work on time.

Based on the above information, answer the following questions:

(i) What is the probability that construction will be completed on time? [2]

(ii) What is the probability that many workers are not present given that the construction work is completed on time? [2]