TECHNO INDIA GROUP PUBLIC SCHOOL

MOCK TEST **CLASS-XII**

MATHEMATICS

SET–3

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.
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** with sub parts of the values of **1, 1** and **2 marks each** respectively.
8. All Questions are compulsory. However, an internal choice in **2 Question** of **Section B**, **2 Questions** of **Section C** and **2 Questions** of **Section D** has been provided. An internal choice has been provided in all the **2 marks** questions of **Section E**.
9. Draw neat and clean figures wherever required.
10. Take $\pi = \frac{22}{7}$ wherever required if not stated.
11. Use of calculators is not allowed.

SECTION A

Section A consists of 20 questions of 1 mark each.

1.	The number of possible matrices of order 2 × 2 with each entry, 1, 2 or 3 is Ⓐ 27 Ⓑ 9 Ⓒ 81 Ⓓ 3	[1]
2.	If the points (x_1, y_1), (x_2, y_2) and $(x_1 + x_2, y_1 + y_2)$ are collinear then x_1y_2 is equal to Ⓐ x_2y_1 Ⓑ x_1y_1 Ⓒ x_2y_2 Ⓓ x_1y_2	[1]
3.	If $\vec{a}$, $\vec{b}$, $\vec{c}$ are mutually perpendicular unit vectors then $\lvert\vec{a}+\vec{b}+\vec{c}\rvert =$ Ⓐ 1 Ⓑ $\sqrt{2}$ Ⓒ $\sqrt{3}$ Ⓓ 2	[1]

4.	The value of b for which the function $f(x)=\begin{cases} 5x-4, & 0<x\le 1 \\ 4x^2+3bx, & 1<x<2 \end{cases}$ is continuous at every point of its domain is Ⓐ -1 Ⓑ 0 Ⓒ $\frac{13}{3}$ Ⓓ 1	[1]
5.	If $\int x \sin x\, dx = -x\cos x + \alpha$, then α is equal to Ⓐ $\sin x + C$ Ⓑ $\cos x + C$ Ⓒ C Ⓓ None of these	[1]
6.	The cable of a uniformly loaded suspension bridge hangs in the form of a parabola given by $x^2 = 2y$. Then, the area of the region bounded by parabola $x^2 = 2y$ and the line $y = 3$ is [Conceptual Application] Ⓐ $2\sqrt{6}$ sq units Ⓑ $4\sqrt{6}$ sq units Ⓒ $\sqrt{6}$ sq units Ⓓ 4 sq units	[1]
7.	For maximising $Z = 3x + 2y$ under constraints $x + 2y \le 10$, $3x + y \le 15$, $x \ge 0$ and $y \ge 0$, which of the following is not a corner point of feasible region? Ⓐ (0, 5) Ⓑ (4, 5) Ⓒ (5, 0) Ⓓ (0, 0)	[1]
8.	ABCD is a parallelogram with AC and BD as diagonals. Then $\overrightarrow{AC} - \overrightarrow{BD} =$ Ⓐ $4\,\overrightarrow{AB}$ Ⓑ $3\,\overrightarrow{AB}$ Ⓒ $2\,\overrightarrow{AB}$ Ⓓ $\overrightarrow{AB}$	[1]
9.	The value of $\int \frac{\cos\sqrt{x}}{\sqrt{x}}\,dx$ is Ⓐ $2\cos\sqrt{x} + C$ Ⓑ $\sqrt{\frac{\cos x}{x}} + C$ Ⓒ $\sin\sqrt{x} + C$ Ⓓ $2\sin\sqrt{x} + C$	[1]
10.	If $A = \begin{bmatrix} 5 & x \\ y & 0 \end{bmatrix}$ and $A = A^T$, then Ⓐ $x = 0, y = 5$ Ⓑ $x + y = 5$ Ⓒ $x = y$ Ⓓ None of these	[1]
11.	The region represented by the inequation system $x, y \ge 0$, $y \le 6$, $x + y \le 3$ is Ⓐ unbounded in first quadrant. Ⓑ unbounded in first and second quadrants Ⓒ bounded in first quadrant Ⓓ None of these	[1]
12.	Which of the following is correct ? Ⓐ Determinant is a square matrix Ⓑ Determinant is a number associated to a matrix Ⓒ Determinant is a number associated to a square matrix. Ⓓ None of these	[1]
13.	If A and B are two matrices such that AB = B and BA = A then $A^2 + B^2$ is equal to Ⓐ 2AB Ⓑ 2BA Ⓒ A + B Ⓓ AB	[1]
14.	Let A and B be two given independent events such that P(A) = p and P(B) = q and P (exactly one of A, B) = $\frac{2}{3}$, then value of $3p + 3q - 6pq$ is Ⓐ 2 Ⓑ -2 Ⓒ 4 Ⓓ -4	[1]

15.	Integrating factor of the differential equation $\cos x \frac{dy}{dx} + y \sin x = 1$ is Ⓐ $\cos x$ Ⓑ $\tan x$ Ⓒ $\sec x$ Ⓓ $\sin x$	[1]
16.	If $f(x) = (x+1)^{\cot x}$ be continuous at $x = 0$ then $f(0)$ is equal to Ⓐ 0 Ⓑ $\frac{1}{e}$ Ⓒ e Ⓓ None of these	[1]
17.	If θ is an acute angle and the vector $(\sin\theta)\,\hat{i} + (\cos\theta)\,\hat{j}$ is perpendicular to the vector $\hat{i} - \sqrt{3}\,\hat{j}$, then $\theta =$ Ⓐ $\frac{\pi}{6}$ Ⓑ $\frac{\pi}{5}$ Ⓒ $\frac{\pi}{4}$ Ⓓ $\frac{\pi}{3}$	[1]
18.	If equation of a line is $5x - 3 = 15y + 7 = 3 - 10z$, then direction cosine along x-axis is Ⓐ $\frac{2}{9}$ Ⓑ $\frac{6}{7}$ Ⓒ $\frac{-2}{7}$ Ⓓ 1	[1]
	Assertion Reason based Questions : **Directions:** Questions 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. (A) Both A and 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.	
19.	**Assertion:** $\sin^{-1}\left[\sin\left(\frac{2\pi}{3}\right)\right] = \frac{2\pi}{3}$ **Reason:** $\sin^{-1}[\sin(\theta)] = \theta$, if $\theta \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$.	[1]
20.	**Assertion:** The acute angle between the line $\vec{r} = \hat{i} + \hat{j} + 2\hat{k} + \lambda(\hat{i} - \hat{j})$ and the x-axis is $\frac{\pi}{4}$. **Reason:** The acute angle θ between the lines $\vec{r} = x_1\hat{i} + y_1\hat{j} + z_1\hat{k} + \lambda(a_1\hat{i} + b_1\hat{j} + c_1\hat{k})$ and $\vec{r} = x_2\hat{i} + y_2\hat{j} + z_2\hat{k} + \mu(a_2\hat{i} + b_2\hat{j} + c_2\hat{k})$ is given by $\cos\theta = \frac{\lvert a_1a_2 + b_1b_2 + c_1c_2 \rvert}{\sqrt{a_1^2 + b_1^2 + c_1^2}\,\sqrt{a_1^2 + b_1^2 + c_1^2}}$	[1]

SECTION B

Section B consists of 5 questions of 2 marks each.

21.	Evaluate $2\tan^{-1}\left(\sqrt{3}\right) - \operatorname{cosec}^{-1}\left(\frac{2}{\sqrt{3}}\right)$.	[2]

	OR (B) Find the domain of $y = \sin^{-1}(x^2 - 4)$.	
22.	(A) The revenue function for a certain commadity is given by $R(x) = 3x^2 - 5x + 9$, x represents number of units sold. Find the marginal revenue when x = 5.	[2]
23.	Find the angle between the vectors $\vec{a} = \hat{i} - 2\hat{j}$ and $\vec{b} = \hat{j} + 3\hat{k}$ using cross product of vectors. **OR** (B) Find a vector whose magnitude is 5 units and is along the vector $2\hat{i} - \hat{j} + 2\hat{k}$.	[2]
24.	Find the integrating factor for the differential equation $(1 + y^2)\,dx - (\tan^{-1}y - x)\,dy = 0$.	[2]
25.	If $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} \neq \vec{0}$. Show that $\vec{a} + \vec{c} = t\,\vec{b}$, where t is a scalar.	[2]

SECTION C

Section C consists of 6 questions of 3 marks each

26.	(A) Evaluate : $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} (3x^3 + \tan^5 x - \sin^7 x + 9)dx$.	[3]
27.	Find the probability of getting a total of 9 in a throw of two dice, if it is known hat number 5 occurs on the first dice. **OR** A bag contains 5 red and 3 blue balls. If two balls are drawn at random with replacement, find the probability of getting (a) one red ball (b) at least one red ball.	[3]
28.	Evalutate : $\int_0^{\frac{\pi}{4}} \log(1+\tan x)dx$. Evaluate : $\int_0^3 (\lvert x\rvert + \lvert x-2\rvert)dx$.	[3]
29.	Solve the differential equation $x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x$. **OR** Solve the differential equation $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$.	[3]
30.	Solve the following LPP graphically : Maximise $Z = 2x - y + 5$, Subject to constraints $3x + 4y \leq 60$, $x + 3y \leq 30$, $x \geq 0$, $y \geq 0$.	[3]
31.	Evaluate : $\int \frac{1}{1+\tan x}dx$.	[3]

SECTION D

Section D consists of 4 questions of 5 marks each

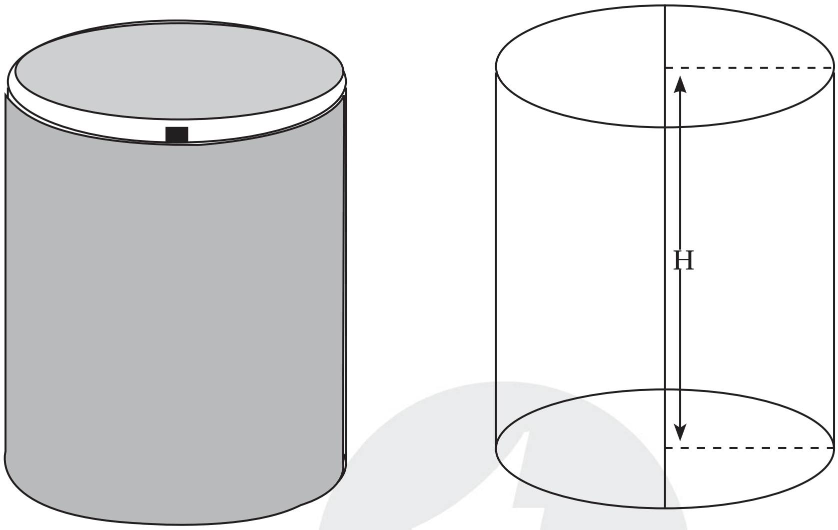
32.	(A) If area bounded by the parabola $y^2 = 16ax$ and the line $y = mx$ is $\frac{a^2}{12}$ square units, then find the value of m, using integration.	[5]

33.	Let R be a relation defined in set A = {1, 2, 3, 4, 5,6, 7, 8, 9} as R = {(a, b) ∈A × A : a, b are both even or both odd. Show that R is an equivalence relation. Also, find the equivalence class related to [9]. **OR** Show that the function $f : R - \{-1\} \rightarrow R - \{2\}$ defined as $f(x) = \frac{2x}{x+1}$ is bijective.	[5]
34.	Find whether the following pair of lines $\vec{r} = (\hat{i} - \hat{j}) + \lambda(2\hat{i} + \hat{k})$ and $\vec{r} = (2\hat{i} - \hat{j}) + \mu(\hat{i} - \hat{j} - \hat{k})$ are intersecting or not. **OR** If $\vec{a} = 3\hat{i} + \hat{j}$ and $\vec{b} = 2\hat{i} - \hat{j} + 3\hat{k}$, then represent $\vec{b}$ as $\vec{b}_1 + \vec{b}_2$, where b_1 is parallel to $\vec{a}$ and $\vec{b}_2$ is perpendicular to $\vec{a}$.	[5]
35.	(A) The equation of the path traced by a roller-coaster is given by $y = ax^3 + bx^2 + cx - 27$ (where a, b, c ∈ R and a ≠ 0) If the roller coaster passes through the points (–1, 0), (–2, 35) and (1, –40), then find the values of a, b and c by solving the system of linear equations in a, b and c, using matrix method.	[5]

SECTION E

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 wo subparts of 2 marks each)

36.	**Case Study - 1** Read the following passage and answer the questions given below. A student has to prepare for board examination and has choice of books published by Publishers 1 : X, Publisher 2 : Y and Publisher 3 : Z. The chances of selection of books by Publisher 1, publisher 2 and publisher 3 by a student are in the ratio of 4 : 2 : 1. The probabilities that student will improve her/his performance in board exam by studying books of Publisher 1, Publisher 2 and Publisher 3 are 0.9, 0.8 and 0.6 respectively. Based on the above information answer the following question. (i) What is the probability that books of publisher 1 : X? (ii) What is the probability that books of publisher 3 : Z are selected and performance is improved in board? (iii) If it is known that performance is improved in the boards, what is the probability that books of publisher 2 : Y were selected ? OR (iii) What is the probability that student selected books of publisher 1 : X for revision given that student improved performance in boards ?	[1] [1] [2]
37.	**Case Study - 2** Read the following passage and answer the questions given below : In a 400 metre race, two athletes Milkha Singh and Otis David are running on the rack along the lines $\vec{r} = 3\hat{i} + 2\hat{j} - 4\hat{k} + \lambda(\hat{i} + 2\hat{j} + 2\hat{k})$ and $\vec{r} = 5\hat{i} - 2\hat{j} + \mu(3\hat{i} + 2\hat{j} + 6\hat{k})$ respectively. (i) Find the Cartesian equation of the line along which Milkha Singh is running.	[1] [1] [2]

	(ii) Find the direction cosines of the line along which Otis David is running. (iii) Find the point of intersection, where both Milkha Singh and Otis David meet together. OR (iii) Find the shortest distance between Milkha Singh and Otis David.	
38.	Read the following passage and answer the questions given below.  XYZ Ltd. wants to manufacture right circular cylindrical dustbin with height H and radius R which is open at the top and has given surface area. (i) Find the surface area of dustbin in terms of radius at critical point where its volume is maximum. (ii) Find the relationship between height and radius of the dustbin, when the volume is maximum.	[1] [1] [2]