12 MAT 01 QP

Pre- Board- II Examination, Class XII- 2025-26
Chennai Region

Class : XII — Maximum marks: 80

Subject : Mathematics — Duration : 3 hours

Qns	General Instructions:
	1. This Question paper contains38 questions. All questions are **compulsory** 2. Question paper is divided into **FIVE** sections – Sections A, B, C, D and E. 3. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each. 4. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each. 5. Section C has 6 Short Answer (SA)-type questions of 3 marks each. 6. Section D has 4 Long Answer (LA)-type questions of 5 marks each. 7. Section E has 3 source based/case based/passage based/integrated units of assessment of 4 marks each with sub-parts. 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 2 questions in Section-E 9. Use of calculator is **NOT** allowed. **SECTION-A** **This section comprises of 20 Multiple Choice questions (MCQs) of 1 mark each**
1.	Find number on One-One function f:A →B such that n(A)=5 and n(B)= 3 (A) 5 (B) 4 (C) 0 (D) 3
2.	If $A = \begin{bmatrix} 7 & 0 & x \\ 0 & 7 & 0 \\ 0 & 0 & y \end{bmatrix}$ is a scalar matrix, then y^x is equal to (A) 0 (B) 1 (C) 7 (D) ± 7
3.	If $P(A \cup B) = 0.9$ and $P(A \cap B) = 0.4$, then $P(\overline{A}) + P(\overline{B})$ is : (A) 0.3 (B) 1 (C) 1.3 (D) 0.7
4.	The line $x = 1 + 5\mu, y = -5 + \mu, z = -6 - 3\mu$ passes through which of the following point? (A) $(1, -5, 6)$ (B) $(1, 5, 6)$ (C) $(1, -5, -6)$ (D) $(-1, -5, 6)$
5.	For the curve $\sqrt{x} + \sqrt{y} = 1$,then $\frac{dy}{dx}$ at $\left(\frac{1}{4}, \frac{1}{4}\right)$ is (A) 1 (B) -1 (C) 2 (D) -2
6.	If $\sin(xy) = 1$, then $\frac{dy}{dx}$ is equal to : (A) $\frac{x}{y}$ (B) $-\frac{x}{y}$ (C) $\frac{y}{x}$ (D) $-\frac{y}{x}$
7.	If A and B are two square matrices each of order 3 with $\|A\| = 3$ and $\|B\| = 5$, then $\|2AB\|$ is : (A) 30 (B) 120 (C) 15 (D) 225
8.	If $A = \begin{bmatrix} 0 & 1 & c \\ -1 & a & -b \\ 2 & 3 & 0 \end{bmatrix}$ is a skew-symmetric matrix then the value of $a + b + c =$ (A) 4 (B) 2 (C) 3 (D) 1
9.	If the radius of a circle is increasing at the rate of 0.5 cm/s, then the rate of increase of its circumference is (A) $\frac{2\pi}{3}$ cm/s (B) πcm/s (C) $\frac{4\pi}{3}$ cm/s (D) 2π cm/s

10.	$\int \frac{3\cos\sqrt{x}}{\sqrt{x}}dx$ is equal to : (A) $-6\sin\sqrt{x}+C$ (B) $-6\cos\sqrt{x}+C$ (C) $6\cos\sqrt{x}+C$ (D) $6\sin\sqrt{x}+C$
11.	The sum of the order and degree of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]^3=\frac{d^2y}{dx^2}$ is : (A) 2 (B) $\frac{5}{2}$ (C) 3 (D) 4
12.	The number of arbitrary constants in the particular solution of the differential equation $\log\left(\frac{dy}{dx}\right)=3x+4y; y(0)=0$ is/are (A) 2 (B) 1 (C) 0 (D) 3
13.	If a line makes angles of $90°, 135°$ and $45°$ with the x, y and z axes respectively, then its direction cosines are (A) $0, -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ (B) $-\frac{1}{\sqrt{2}}, 0, \frac{1}{\sqrt{2}}$ (C) $\frac{1}{\sqrt{2}}, 0, -\frac{1}{\sqrt{2}}$ (D) $0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$
14.	In $\triangle ABC, \overrightarrow{AB}=\hat{i}+\hat{j}+2\hat{k}$ and $\overrightarrow{AC}=3\hat{i}-\hat{j}+4\hat{k}$. If D is mid-point of BC, then vector $\overrightarrow{AD}$ is equal to : (A)$4\hat{i}+6\hat{k}$ (B) $2\hat{i}-2\hat{j}+2\hat{k}$ (C) $\hat{i}-\hat{j}+\hat{k}$ (D) $2\hat{i}+3\hat{k}$
15.	The value of $(\hat{i}\times\hat{j})\cdot\hat{j}+(\hat{j}\times\hat{i})\cdot\hat{k}$ is : (A) 2 (B) 0 (C) 1 (D) -1
16.	Distance of the point (α,β,γ) from y-axis is (A) β (B) $\lvert\beta\rvert$ (C) $\lvert\beta\rvert+\lvert\gamma\rvert$ (D) $\sqrt{\alpha^2+\gamma^2}$
17.	A is a matrix of order 2×3 and B is a matrix of order 3×2., $C = AB \; and \; D = BA$, then order of CD is (A) 3×3 (B) 2×2 (C) 3×2 (D) CD not defined
18.	An LPP, if the objective function Z = ax + by has same maximum at two corner points of the feasible region, then the number of points at which maximum value of Z occurs is (A) 0 (B) 1 (C) 2 (D) infinite
	ASSERTION-REASON BASED QUSETIONS In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices. (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(A):** Every scalar matrix is a diagonal matrix. **Reason (R) :** In a diagonal matrix, all the diagonal elements are 0 .
20	**Assertion (A)**: $\left\langle\frac{1}{\sqrt{5}},\frac{1}{\sqrt{5}},\frac{1}{\sqrt{5}}\right\rangle$ cannot be the direction cosines of a line. **Reason (R)**: If l, m, n are the direction cosines of a line, then $l^2+m^2+n^2=1$.

	SECTION B (This section comprises of very short answer type questions (VSA) of 2 marks each)
21.	(a) Find the domain of function $f(x) = \cos^{-1}(x^2 - 4)$. **OR** (b)Evaluate : $\sec^2\left(\tan^{-1}\frac{1}{2}\right) + \text{cosec}^2\left(\cot^{-1}\frac{1}{3}\right)$
22.	If the function $f(x)$ given by $f(x) = \begin{cases} 3ax + b, & \text{if } x > 1 \\ 11, & \text{if } x = 1 \\ 5ax - 2b, & \text{if } x < 1 \end{cases}$ is continuous at $x = 1$, Find the values of a and b.
23.	(a) Find the intervals in which the function f given by f (x) $=-x^2 + 6x+100$, for all x €R is a) Increasing b) decreasing **OR** A spherical balloon is being inflated by pumping in 16 cm^3 /s of gas. At the instant When balloon contains 36π cm^3 of gas, how fast is its radius increasing?
24.	Find : $\int \frac{dx}{x^2-6x+13}$
25.	Evaluate, $\int_{-1}^{1} \frac{x^3+\|x\|+1}{x^2+2\|x\|+1}\, dx$
	SECTION C (This section comprises of short answer type questions (SA) of 3 marks each)
26.	If $x = a \sec\theta$, $y = b \tan\theta$ $find$ $\frac{d^2y}{dx^2}$ at $x = \frac{\pi}{6}$ **OR** If $y = x^x$, prove that $\frac{d^2y}{dx^2} - \frac{1}{y}\left(\frac{dy}{dx}\right)^2 - \frac{y}{x} = 0$.
27	Find: $\int \frac{(x^2+1)e^x}{(x+1)^2} dx$
28.	Evaluate: $\int_{-1}^{2} \|x^3 - x\| dx$ **OR** Evaluate: $\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x} dx$
29.	Let $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{c} \cdot \vec{d} = 18$.

30.	In a rough sketch, mark the region bounded by $y = 1 + \|x + 1\|, x = -2,\ x = 2$ and $y = 0$. Using integration, find the area of the marked region. **OR** Using integration, find the area of the region bounded by curve: $4x^2 = y$ and the line $y = 8x + 12$.
31.	A speaks truth in 60% of the cases and B in 70% of the cases. In what percentage of cases, they are likely to (i) contradict each other (ii) agree with each other, in stating the same fact?
	SECTION D **(This section comprises of long answer-type questions (LA) of 5 marks each)**
32.	Let A = {1 ,2, 3 ,4…….9} and R be the relation in A X A defined by (a,b) R (c,d) If a + d = b + c in A×A . Prove that R is an equivalence relation and also obtain the equivalence class [(2, 5)]. OR Check whether a function $f: \mathbb{R} \to \left[-\frac{1}{2}, \frac{1}{2}\right]$ defined as $f(x) = \frac{x}{1+x^2}$ is one-one and onto or not.
33.	**(a)** If A = $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}$, B = $\begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$, find AB and use hence to solve the following equations: x – y + z = 4, x – 2y - 2z = 9, 2x + y + 3z =1 **OR** (b) If A = $\begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$ find A^{-1} and hence solve the following equation. x + 2y + z = 4, -x + y + z = 0, x- 3y + z = 2
34.	Find the particular solution of the differential equation $\left[x\sin^2\left(\frac{y}{x}\right) - y\right]dx + xdy = 0; y = \frac{\pi}{4}$ when $x = 1$
35.	Find the distance of the point (1, -1, -10) from the line $\frac{x-4}{1} = \frac{y+3}{-4} = \frac{z+1}{7}$ measured parallel to $\frac{x-1}{2} = \frac{y+1}{-3} = \frac{z+10}{8}$.
	SECTION E This section comprises of 3 case-study/passage-based questions of 4 marks each.
36.	A magazine company circulates its magazine on a monthly basis in a city. It has 10,000 readers on its list and collects fixed charges of ₹ 4,000 per reader annually. The company proposes to increase the annual subscription, but on the basis of a survey result, it predicted

that for every increase of ₹ 5 , ten readers will discontinue the service of this magazine company.

Based on the above information, answer the following questions:

(i) Let the company increase ₹x, then find the function R(x) representing the earnings of the company. (1M)

(ii) Find $\frac{d}{dx}(R(x))$. (1M)

(iii) (a) What subscription increase will bring maximum earnings for the company? (2M)

OR

(iii) (b) What will be the maximum value of R(x) ? (2M)

37. Case study -II

The month of September is celebrated as the Rashtriya Poshan Maah across the country. Following a healthy and well-balanced diet is crucial in order to supply the body with the proper nutrients it needs. A balanced diet also keeps us mentally fit and promotes improved level of energy.

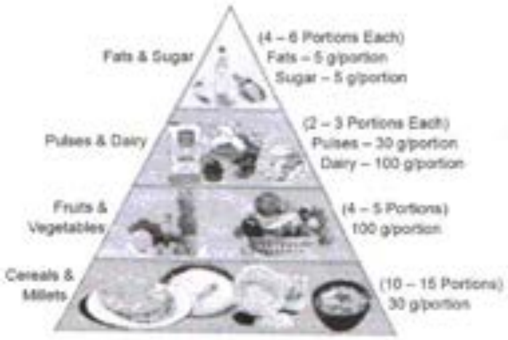

Figure-1

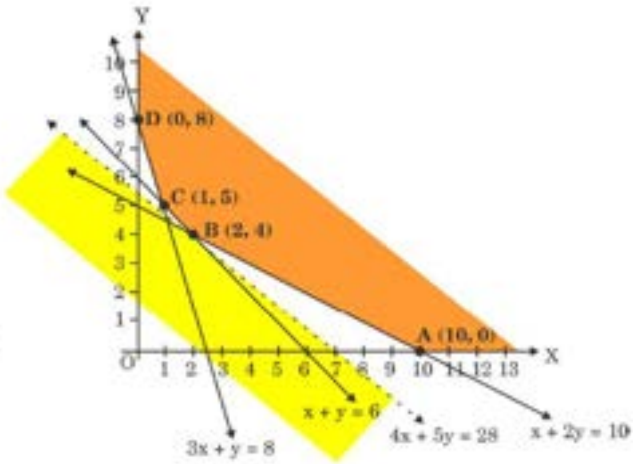

Figure-2

A dietician wishes to minimize the cost of a diet involving two types of foods, food X(xkg) and food Y(ykg) which are available at the rate of ₹16/kg and ₹20/kg respectively. The feasible region satisfying the constraints is shown in Figure-2.

On the basis of the above information, answer the following questions :

(i) Identify and write all the constraints which determine the given feasible region

in Figure-2. (1 M)

(ii) Identify and write objective function determine the given open half region

in Figure-2 (1 M)

(iii)(a) find the values of x and y at which cost is minimum. Also, find minimum cost assuming that minimum cost is possible for the given unbounded region. (2M)

	OR (iii)(b) If the objective is to minimize cost $Z = 16x + 20y$, find the values of x and y at which cost is minimum. Also, find minimum cost assuming that minimum cost is possible for the given unbounded region. (2M)
38.	Case Study -III Assume that the chances of a patient having a heart attack is 40%. Assuming that a meditation and yoga course reduces the risk of heart attack by 30% and prescription of certain drug reduces its chance by 25%. At a time a patient can choose any one of the two options with equal probabilities.  It is given that after going through one of the two options. Based upon the above information, answer the following questions : (i) The patient selected at random find the probability that the patient suffers a heart attack. (2M) (ii) If the patient selected at random is the patient suffers a heart attack. Find the probability that the patient followed a course of meditation and yoga (2M)

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