No. of Printed Pages : 10 *AGRO*

I Pre-Board Examination, 2024–25

Sub. : Mathematics

Time : 3.00 Hrs.] **Class – XII** **[M. M. : 80**

General Instructions :

1. *This question paper contains 38 questions. All questions are compulsory.*
2. *The question paper is divided into five 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 internal choices 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 of Section E.*
9. *Use of calculator is not allowed.*

SECTION –A **[1×20=20]**

(This Section comprises of Multiple Choice Questions of 1 mark each)

Q1 The value of $\sin^{-1}\left(\frac{1}{2}\right) + 2\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ is :

(a) $\pi/2$ (b) $-\pi/2$

(c) $3\pi/2$ (d) None of these

Q2 If the sum of all the elements of a 3×3 scalar matrix is 9, then the product of all its elements is:

(a) 0 (b) 9

(c) 27 (d) 729

Q3 If $|A| = |kA|$, where a is a square matrix of order 2 then sum of all possible values of k is :

(a) 0 (b) 1

(c) –1 (d) 2

Q4 If A is a square matrix of order $m \times n$ and B is a matrix such that AB^T and B^TA both are defined then order of matrix B is

(a) $m \times m$ (b) $n \times n$

(c) $m \times n$ (d) $n \times m$

Q5 If A and B are square matrices of order 3 such that $|A| = -1$, $|B| = 3$, then $|3AB|$ is equal to

(a) 9 (b) –9

(c) –81 (d) 81

Q6 Let $A = \begin{bmatrix} 5 & 5k & k \\ 0 & k & 5k \\ 0 & 0 & 5 \end{bmatrix}$ and $|A|^2 = 25$, then value of |k| is

(a) 25 (b) 5

(c) 1 (d) 1/5

Q7 The set of all points where the function $f(x) = x + |x|$ is differentiable, is

(a) $(0, \infty)$ (b) $(-\infty, 0)$

(c) $(-\infty, 0) \cup (0, \infty)$ (d) $(-\infty, \infty)$

Q8 $\int e^x \sec x(1 + \tan x)dx$ is equal to

(a) $e^x \cos x + c$ (b) $e^x \sec x + c$

(c) $e^x \sec x . \tan x + c$ (d) $e^x (1 + \tan x) + c$

Q9 The value of $\int_{-1}^{1} |1 - x| \, dx$

(a) 3 (b) 2

(c) –2 (d) 1

Q10 Area of the region bounded by the curve $y = \cos x$ between $x = 0$ and $x = \pi$ is:

(a) 2 sq. units (b) 4 sq. units

(c) 3 sq. units (d) 1 sq. unit

Q11 The difference of the order and degree of the differential equation $\frac{d^2y}{dx^2} = \cos 3x + \sin 3x$ is :

(a) 0 (b) 1

(c) 2 (d) 3

Q12 The integrating factor of diff equation $x\frac{dy}{dx} - y = x^4 - 3x$ is

(a) x (b) 1/x

(c) –x (d) log x

Q13 If $\left|\vec{a}\right| = 2$, $\left|\vec{b}\right| = 3$ and $\vec{a} \cdot \vec{b} = 2\sqrt{5}$ then find the value of $\left|\vec{a} \times \vec{b}\right|$

(a) ±4 (b) 4

(c) –4 (d) $\sqrt{26}$

Q14 The value of $\left(\hat{i} \times \hat{j}\right).\hat{k} + \left(\hat{j} \times \hat{k}\right).\hat{i} + \left(\hat{i} \times \hat{k}\right).\hat{j}$

(a) 0 (b) 1

(c) 2 (d) 3

Q15 Which of the following is correct

(a) Every LPP admits optimal solution

(b) A LPP admits unique solution.

(c) If a LPP admits two optimal solution, it has infinite number of solutions.

(d) None of these

Q16 The objective function of a LPP is

(a) Constant

(b) a linear function to be optimized

(c) A linear inequality

(d) A quadratic equation

Q17 If the probability for A to fail in an examination is 0.2 and that for B is 0.3. Then the probability that neither fails.

(a) 0.60

(b) 0.40

(c) 0.56

(d) 0

Q18 If $y = \log_e \left(\frac{x^2}{e^2}\right)$ then $\frac{d^2y}{dx^2}$ equals to

(a) $-1/x$

(b) $-1/x^2$

(c) $2/x^2$

(d) $-2/x^2$

ASSERTION-REASON BASED QUESTIONS

In the following questions 19 and 20, 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.

(a)

Q19 Assertion (A) : Let A= {2,4,6}, B={3,5,7,9} and defined a function f = { (2,3),(4,5), (6,7)} from A to B, then f is not onto.

Reason (R) : A function f: A → B is said to be onto, if every element of B is the image of some element of A under f.

Q20 Assertion (A) : If the area of a circle increases at a uniform rate, then its perimeter varies inversely as the radius

(c)

Reason (R) : The rate of change of area of a circle with respect to its perimeter is equal to the radius.

SECTION –B

[This section comprises of Very Short Answer (VSA) type questions of 2 marks each]

Q21 Find the value of k, for which

$$f(x) = \begin{cases} \dfrac{\sqrt{1+kx} - \sqrt{1-kx}}{x} & , \text{ if } -1 \le x < 0 \\ \dfrac{2x+1}{x-1} & , \text{ if } 0 \le x < 1 \end{cases}$$

is continuous at x = 0.

Q22 If x=a cos t and y=b sin t then find d^2y/dx^2.

OR

Differentiate w. r. t. .

Q23 Find the unit vector perpendicular to each of the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ where

$\vec{a} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$.

OR

Find the angle between the unit vectors $\hat{a}$ and $\hat{b}$, given that $\left|\hat{a} + \hat{b}\right| = 1$.

Q24 Find the principal value of $\cot^{-1}\left[2\cos\left(\sin^{-1}\frac{\sqrt{3}}{2}\right)\right]$

Q25 Find the area of the triangle with vertices A (1,1,2), B (2,3,5) & C(1,5,5) by using vector method.

SECTION –C

[This section comprises of Short Answer (SA)-type questions of 3 marks each]

Q26 Find the intervals in which the function $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$ is

(a) Increasing (b) Decreasing (0,1)

Q27 A ladder 5 m long standing on a horizontal floor, leans against a vertical wall . If the top of the ladder slides downwards at the rate of 10 m/sec, then find the rate at which the angle between the floor and the ladder is decreasing when lower end of the ladder is 2 m from the wall.

Q28 Evaluate: $\int \frac{1}{x\left(x^2 + 1\right)} dx$.

OR

Evaluate: $\int_{-5}^{5} |x + 2| dx$

Q29 The cartesian equation of a line is $6x - 2 = 3y + 1 = 2z - 2$. Find the direction cosines of the line. Write down the cartesian and vector equations of a line passing through $(2, -1, -1)$ which are parallel to the given line.

OR

A girl walks 3 km towards west to reach point A and then walks 5 km in a direction 30° east of north and stops at point B. Let the girl starts from O (origin), take i along east and j along north.

(i) Find the scalar components of $\overrightarrow{AB}$.

(ii) Find the unit vector along $\overrightarrow{AB}$.

Q30 A and B throw a die alternatively till one of them gets a '6' and wins the game. Find their respective probabilities of winning, if A starts first.

OR

An urn contains 4 white and 3 red balls. Find the probability distribution of the number of red balls in a random draw of 3 balls. Also find mean of this probability distribution.

Q31 Solve the following LPP graphically

Max $z = 20x + 10y$

subject to constraints

$1.5x + 3y \leq 42$

$3x + y \leq 24$

SECTION – D

[This section comprises of Long Answer (LA)-type questions of 5 marks each]

Q32 Use the product $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}\begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix}$ to solve the system of equations :

$x - y + 2z = 1$

$2y - 3z = 1$

$3x - 2y + 4z = 2$

Q33 Find the area bounded by the curve $y = x|x|$ and the ordinates $x = -2$ and $x=3$.

Q34 Find the foot of perpendicular and image of the point $(1, 2, -3)$ in the line

$$\frac{x+1}{2} = \frac{y-3}{2} = \frac{z}{-1}$$

OR

Find the shortest distance between the lines.

$$\vec{r} = \left(4\hat{i} - \hat{j}\right) + \lambda\left(\hat{i} + 2\hat{j} - 3\hat{k}\right) \text{ and } \vec{r} = \left(\hat{i} - \hat{j} + 2\hat{k}\right) + \mu\left(2\hat{i} + 4\hat{j} - 5\hat{k}\right).$$

Q35. If $y = \left(x + \sqrt{x^2 + 1}\right)^m$, than show that :

$$\left(x^2 + 1\right)\frac{d^2y}{dx^2} + x\frac{dy}{dx} - m^2y = 0$$

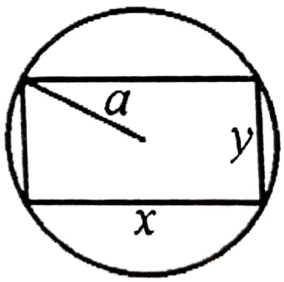
OR

Show that the function $f(x) = 2x - |x|$ is continuous but not differentiable at $x = 0$.

SECTION –E

[This section comprises of 3 case-study/passage based questions of 4 marks each with sub parts]

Q36 Municipal Corporation of Delhi designs a rectangular garden inscribed in a circular piece of land in the middle of the city.



The perimeter of circular land is 44 hectometer.

Answer the following questions based on the above information .

(i) If x and y represents the length and breadth of the rectangular region, find the relation between the variables .

(ii) Find he area of the rectangular region expressed as a function of x(length of rectangle) in hm^2.

(iii) Find the maximum value of area of rectangular region in hm2 .

OR

(iii) When area of rectangular garden is maximum then find the area of the remaining land around it in hm2.

Q37.In two different societies, there are some school going students including boys as well as girls .

Rajesh forms two sets with these students as his college project. Let A= $\{a_1,a_2.a_3.a_4.{}_a5\}$ and B= $\{b_1,b_2,b_3,b_4\}$ where a_i and b_i are school going students of first and second society respectively.

Using the above information answer the following questions

(i) Check whether the mapping f = $\{(a_1,b_1),(a_2,b_3),(a_3,b_2)(a_4,b_4),(a_5,b_4)\}$ is

(a) one one or not (b) onto or not

(ii) Find the number of functions from A to B.

(iii) Write number of one one functions from A to B.

OR

(iii) Write number of onto functions from A to B.

Q38 Read the following passage and answer the questions given below:

In an Office three employees Ram, Shyam and Sohan process a calculation in an excel form. Probability that Ram, Shyam and Sohan process the calculation respectively is 50%, 20% and 30% . Ram has a probability of making a mistake as 0.06, Shyam has probability 0.04 to make a mistake and Sohan has a probability 0.03.

Based on the above information, answer the following questions.

(i) Find the total probability of committing a mistake in processing the calculation.

(ii) The boss wants to do a good check. During check, he selects a calculation form at random from all the days. If the form selected at random has a mistake, find the probability that the form is not processed by Ram.