Series: CBSE / SGP/ 2021-02 (Unsolved) **Code No. 041**

Roll No. | | | | | | | |

- Please check that this question paper contains **4** printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains **38** questions.
- **Please write down the Serial Number of the question before attempting it.**
- 15 minutes time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

MATHEMATICS–XII
Sample Guess Paper 2 (Unsolved)

Time Allowed: 3 hours *Maximum Marks: 80*

General Instructions:

Same as in Sample Guess Paper 1 (Unsolved).

PART A

SECTION I

All questions are compulsory. In case of internal choices attempt anyone.

1. Given the Set L, set of lines in a plane, a relation R in Set L is defined as R = $\{(l_1, l_2) : l_1, l_2 \in L, l_1$ perpendicular $l_2\}$ show that relation is not reflexive.

Or

Show that the function f in the set N, the set of Natural Numbers defined as $f(x) = y = 3x$ is not onto.

2. Given set A = {1, 2, 3} and a relation R = {(1, 2), (2, 1)} which ordered pair should be removed so that relation is transitive.

3. The relation R in set of natural numbers N is defined as R = $\{(x, y) \in N \times N : x + y = 5\}$. Is relation R a function.

Or

The relation R in the set of natural numbers N is defined as R = $\{(x, y) \in N \times N : x + y$ is a natural number$\}$. Is relation R symmetric.

4. Write the possible orders of a matrix having 18 elements.

5. Given matrices a and b of order $m \times 4$ and $3 \times n$ respectively. If $2a + 5b$ is defined then write its order.

Or

If matrix $A = \begin{bmatrix} 0 & 2 \\ -1 & 4 \end{bmatrix}$ and matrix $B = \begin{bmatrix} 0 & 2a \\ b & -24 \end{bmatrix}$. Find the values of k, a and b, if $kA = B$.

6. Given determinant $\Delta = \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$ and A_{ij} represents cofactor of an element a_{ij} then find value of Δ.

7. Evaluate $\int \frac{1}{e^x + 1} dx$

Or

Evaluate $\int \tan^2 (3 - 4x)\, dx$

8. Find the area bounded by the curve $y = e^x$ the x-axis and between $x = -1$ and $x = 2$.

9. Solve the differential equation $\cos\left(\frac{dy}{dx}\right) = a$.

Or

Which method can be used to solve the differential equation $\frac{dy}{dx} = x \sin y$.

10. Given $\vec{a} = 4\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = p\hat{i} - 3\hat{j} + 6\hat{k}$ then find the value of p if $\vec{a}$ is parallel to $\vec{b}$.

11. Given vector $\vec{a} = 2\hat{i} - \hat{j} + 3\hat{k}$. Write another vector $\vec{b}$ with the same absolute components and $\vec{a} \neq \vec{b}$.

12. If $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} - 2\hat{j} + \hat{k}$ are two vectors, then find $|\vec{a} \times \vec{b}|$.

13. Find the y-intercept cut by plane $4x - 3y + 2z - 9$.

14. Find the distance between parallel planes $x + 2y - z + 4 = 0$ and $2x + 4y - 2z + 9 = 0$.

15. If event A and B are independent P(A) = .35, P(A ∪ B) = .60 then find P(B).

16. If A is subset of B then find P(B | A). Given that A and B are events such that P(A) ≠ 0.

SECTION II

Both the case-study based questions are compulsory. Attempt any 4 sub parts from each question. Each question carries 1 mark.

17. Case Study— Mr. Gupta wants to buy a cabinet with a square base and vertical sides, is to contain 2048 cubic feet. On the top and bottom of the cabinet he has to apply waterproof paint and the sides have to be applied with termite proof paint. For painting the top and bottom costs ₹20 per square feet and the cost for the sides is ₹5 per square feet.

Based on the above information answer the following:

(*i*) If the dimensions of the cabinet are taken as x as the base length and y as the height, then

(*a*) $x = \frac{2048}{y^2}$ (*b*) $y = \frac{2048}{x}$ (*c*) $y = \frac{2048}{x^2}$ (*d*) $y = \frac{2048}{4x}$

(*ii*) If we want to represent the required cost 'C' as a function of x, then choose the correct representation from the following.

(*a*) $C = 20x^2 + \frac{2048}{x}$ (*b*) $C = 40x^2 + \frac{40960}{x}$

(*c*) $C = 40x^2 + \frac{40960}{x^2}$ (*d*) $C = 20x^2 + \frac{8192}{x^2}$

(*iii*) The least cost for painting the cabinet is

(*a*) ₹29200 (*b*) ₹7680 (*c*) ₹19200 (*d*) ₹7860

(*iv*) To minimize the cost of painting Mr. Gupta should buy the cabinet whose dimensions are

(*a*) $x = 8, y = 32$ (*b*) $x = 8, y = 16$ (*c*) $x = 4, y = 64$ (*d*) $x = 16, y = 8$

(*v*) If Mr. Gupta decides to buy another cabinet with same base and height twice than that he brought earlier, with volume 16384 cubic feet. Then the dimensions of the cabinet will be

(*a*) $x = 8, y = 16$ (*b*) $x = 4, y = 64$ (*c*) $x = 16, y = 32$ (*d*) $x = 8, y = 32$

18. Case Study— Riya has two boxes, I and II. Box I contains 3 red and 6 black balls. Box II contains 5 red and n black balls.

One of the two boxes, box I and box II is selected by her friend Kashish at random and then Kashish draws a ball at random, which is found to be red.

Based on the given information answer the following:

(*i*) Riya notices that the probability of the red ball taken out from the box II to be $\frac{3}{5}$. Then Kashish asks her about the value of *n*. The value of '*n*' is

(*a*) 1 (*b*) 3 (*c*) 5 (*d*) 6

(*ii*) The probability that box 1 is selected given that the ball drawn is found to be red is,

(*a*) $\frac{3}{5}$ (*b*) $\frac{2}{5}$ (*c*) $\frac{1}{5}$ (*d*) 1

(*iii*) What is the probability that the ball drawn is found to be red?

(*a*) $\frac{5}{12}$ (*b*) $\frac{7}{12}$ (*c*) $\frac{5}{21}$ (*d*) $\frac{12}{5}$

(*iv*) Let A be the event of getting a red ball from the box. Also let E_1 and E_2 be the events that box I and box II is selected, respectively, the value of $\sum_{i=1}^{i=2} P(E|A)$ is

(*a*) 1 (*b*) $\frac{1}{2}$ (*c*) 1 (*d*) $\frac{1}{10}$

(*v*) Refer to (*iv*) part, the value of $\sum_{i=1}^{i=2} P(E_1)$ is

(*a*) 0 (*b*) $\frac{1}{2}$ (*c*) $\frac{1}{10}$ (*d*) 1

PART B

SECTION III

All questions are compulsory. In case of internal choices attempt anyone.

19. Find the value of $\tan^2\left(\frac{1}{2}\sin^{-1}\frac{2}{3}\right)$.

20. If $A = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$. Find the value of α such that $A + A = I_2$.

Or

If $\begin{bmatrix} x+3y & y \\ 7-x & 4 \end{bmatrix} = \begin{bmatrix} 4 & -1 \\ 0 & 4 \end{bmatrix}$, find the value of *x* and *y*.

21. For what value of *k* is the function defined by $f(x) = \begin{cases} kx+1, & \text{if } x \le \pi \\ \cos x, & \text{if } x > \pi \end{cases}$.

22. Show that function *f* is given by $f(x) = \tan^{-1}(\sin x + \cos x)$ is decreasing for all $x \in \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$.

23. Evaluate $\int \frac{2\cos x}{(1-\sin x)(1+\sin^2 x)}\,dx$

Or

Evaluate $\int \frac{dx}{5-8x-x^2}$

24. Find the area bounded by the curve $y = \cos x$, $x \in [0, \pi]$.

25. Find equation curve passing through (1, 1) and satisfying the differential equation $\frac{dy}{dx} = \frac{2y}{x}$.

26. If the sum of two unit vectors is a unit vector then find the magnitude of their difference.

27. Find the coordinates of the point where the line through the points A(3, 4, 1) and B(5, 1, 6) crosses the XZ plane. Also find the angle which this line makes with the XZ plane.

28. Let E and F be the events with $P(E) = \frac{3}{5}$, $P(F) = \frac{3}{10}$ and $P(E \cup F) = \frac{7}{10}$. Are E and F independent event.

Or

Two dices are thrown. Find the probability that numbers appeared have a sum 8. If it is known that second dices always exhibits 4.

SECTION IV

All questions are compulsory. In case of internal choices attempt anyone.

29. Let S be the set of all points in a plane and R be the a relation in S defined as R = {(A, B) : d (A, B) < 2 units}, where d (A, B) represents the distance between the points A and B. Is R an equivalence relation.

30. If $x = \frac{1}{y}$ then show that $\frac{dy}{dx} = -\sqrt{\frac{1+x^4}{1+y^4}}$.

31. If $y = \frac{\log x}{x}$ show that $\frac{d^2y}{dx^2} = \frac{2\log x - 3}{x^3}$.

Or

Differentiate $\sin^{-1}\frac{1}{\sqrt{1+x^2}}$ with respect to x.

32. The curve $y = ax^3 + bx^2 + cx + 5$ touches the x-axis at the point P(–2, 0) and cuts the y-axis at a point Q, where its gradient is 3. Find the values of a, b and c.

33. Evaluate $\int_2^3 \frac{x-1}{(x+1)^3} e^x dx$

34. Using integration find the area of the region in first quadrant enclosed by the x-axis the line $y = x$ and circle $x^2 + y^2 = 32$.

Or

Find the area bounded by lines $y = 2x + 1$, $y = 3x + 1$ and $x = 4$ using integration.

35. Solve the differential equation $\frac{dy}{dx} = \sin(x + y) + \cos(x + y)$.

SECTION V

All questions are compulsory. In case of internal choices attempt anyone.

36. If A = $\begin{bmatrix} 2 & 3 & 10 \\ 4 & -6 & 5 \\ 6 & 9 & -20 \end{bmatrix}$. Find A^{-1} and using this solve equation $\frac{2}{x}+\frac{3}{y}+\frac{10}{z} = 2$; $\frac{4}{x}-\frac{6}{y}+\frac{5}{z} = 5$; $\frac{6}{x}+\frac{9}{y}-\frac{20}{z} = -4$.

Or

Determine the product $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}\begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$ and use it to solve the system of equations $x - y + z = 4$; $x - 2y - 2z = 9$, $2x + y + 3z = 1$.

37. If lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-2}{2} = \frac{y+k}{2} = \frac{z}{1}$ intersects then find the value of k and hence find the equation of plane containing these lines.

Or

Prove that the line through A(0, –1, –1) and B(4, 5, 1) intersects the line through C(3, 9, 4) and D(–4, 4, 4).

38. Solve the LPP graphically:

Maximize Z = $5x + 10y$

Subject to constraints:

$2x + y \le 120;\ x + y \ge 60;\ x - 2y \ge 0;\ x, y \ge 0$

Or

Solve the LPP graphically:

Minimize Z = $3x + 9y$

Subject to constraints:

$x + 3y \le 60;\ x + y \ge 10;\ x \le y;\ x, y \ge 0$