Series: CBSE / SGP/ 2021-02 (Solved) **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 **33** 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 (Solved)

Time allowed: 3 hours *Maximum Marks: 80*

General Instructions:

Same as CBSE Sample Question Paper.

PART A

Section I

All questions are compulsory. In case of internal choices attempt any one.

1. State whether the function $f : N \to N$ given by $f(x) = 5x$ is injective, surjective or both.

Or

Let R be the equivalence relation in the set A = {0, 1, 2, 3, 4, 5} given by

$R = \{(a, b) : 2 \text{ divides } (a - b)\}$. Write the equivalence class [0].

2. Differentiate $\sin^2 (x^2)$ w.r.t. x^2.

3. Write total number of one-one functions from set A to set B where A = {1, 2, 3}, B = $\{a, b, c, d\}$.

Or

Write total number of one-one functions from set A to set B where A = {1, 2, 3, 4}, B = $\{a, b, c\}$.

4. For what value of a, $\begin{pmatrix} 2a & -1 \\ -8 & 3 \end{pmatrix}$ is a singular matrix?

5. A square matrix A, of order 3, has $|A| = 5$, find $|A.adj\ A|$.

Or

What is the value of $|3I_3|$, where I_3 is the identity matrix of order 3?

6. For what value of k, the matrix $\begin{bmatrix} 2-k & 3 \\ -5 & 1 \end{bmatrix}$ is not invertible?

7. Write the antiderivative of $\left(3\sqrt{x} + \frac{1}{\sqrt{x}}\right)$.

Or

Evaluate : $\int_0^3 \frac{dx}{9 + x^2}$

8. Evaluate : $\int_{1}^{\sqrt{3}} \frac{dx}{1+x^2}$

9. Evaluate : $\int \frac{x^3 - x^2 + x - 1}{x - 1}\, dx$

Or

Evaluate : $\int_{0}^{1} \frac{2x}{1+x^2}\, dx$

10. Find the distance of the point (a, b, c) from x-axis.

11. In a triangle ABC, the sides AB and BC are represented by vectors $2\hat{i} - \hat{j} + 2\hat{k}$, $\hat{i} + 3\hat{j} + 5\hat{k}$ respectively. Find the vector representing CA.

12. Find the area of the parallelogram, whose diagonals are $\vec{d_1} = 5\hat{i}$ and $\vec{d_2} = 2\hat{j}$.

13. Find the direction cosines of a line, passing through origin and lying in the first octant, making equal angles with the three coordinate axes.

14. If the lines $\frac{x-1}{-2} = \frac{y-4}{3p} = \frac{z-3}{4}$ and $\frac{x-2}{4p} = \frac{y-5}{2} = \frac{z-1}{-7}$ are perpendicular to each other, then find the value of p.

15. If A and B are two events such that P(A) = 0.4, P(B) = 0.8 and P(B/A) = 0.6, then find P(A/B).

16. If A and B are two independent events, then prove that the probability of occurrence of atleast one of A and B is given by 1 – P(A′).P(B ′).

Section II

Both the case-study based questions are compulsory. Attempt any 4 sub-parts from each question (17–21) and (22 – 26). Each question carries 1 mark.

17. Case Study—The given figure shows the newspapers in two languages *i.e.*, Hindi and English. In a Hostel, 60% of the students read the Hindi Newspapers, 40% read the English newspapers and 20% read both Hindi and English newspaper. A student is selected at random:

(*i*) Find the probability that she reads Hindi or English newspaper.

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

(*c*) $\frac{4}{5}$ (*d*) $\frac{2}{5}$

(*ii*) Find the probability that she reads neither Hindi nor English newspaper.

(*a*) $\frac{2}{5}$ (*b*) 0 (*c*) $\frac{4}{5}$ (*d*) $\frac{1}{5}$

(*iii*) If she reads Hindi newspaper, find the probability that she reads English newspaper.

(*a*) $\frac{1}{3}$ (*b*) $\frac{2}{3}$ (*c*) $\frac{4}{10}$ (*d*) $\frac{1}{2}$

(*iv*) If she reads English newspaper, find the probability that she reads Hindi newspaper.

(*a*) $\frac{1}{2}$ (*b*) $\frac{1}{4}$ (*c*) $\frac{2}{10}$ (*c*) $\frac{3}{10}$

(*v*) Check that events Hindi and English independent or not.

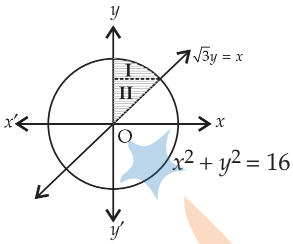
(*a*) Yes (*b*) No

(*c*) Mutually exclusive (*d*) none of the above

18. Case Study— ***Archery School vs. School Competition***

This figure shows an archery board in which an arrow across the middle of the bow is placed with the bowstring in the arrow’s nock.

Vertex CLASSES BEGUSARAI



Answer the following questions:

(i) Equation of the circle is:

(a) $x^2 + y^2 = r^2$ (b) $x^2 - y^2 = r^2$

(c) $(x-h)^2+(y-k)^2=r^2$ (d) None of the above

(ii) Equation of the circle in terms of y is:

(a) $x = \sqrt{16-y^2}$ (b) $x = \sqrt{4-y^2}$ (c) $x = \sqrt{4+y^2}$ (d) $x = \sqrt{y^2+16}$

(iii) Intersection point on y-axis is:

(a) $y = 0$ (b) $y = 4$ (c) $y = 1$ (d) $y = 2$

(iv) Radius of given circle is:

(a) 0 (b) 2 (c) 4 (d) 3

(v) Area of part I is:

(a) $\sqrt{3}$ sq. units (b) $2\sqrt{3}$ sq. units (c) $\frac{4\pi}{\sqrt{3}}$ sq. units (d) $4\sqrt{3}$ sq. units

PART B

Section III

19. Prove that if $\frac{1}{2} \le x \le 1$ then $\cos^{-1} x + \cos^{-1}\left[\frac{x}{2} + \frac{\sqrt{3-3x^2}}{2}\right] = \frac{\pi}{3}$.

20. Let $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 4 & -6 \\ -2 & 4 \end{bmatrix}$. Then compute AB. Hence, solve the following system of equations : $2x + y = 4$; $3x + 2y = 1$.

Or

If $A = \begin{bmatrix} 1 & -2 \\ 2 & 1 \end{bmatrix}$, then using A^{-1}, solve the following system of equations : $x - 2y = -1$, $2x + y = 2$.

21. If $f(x) = \sin 2x - \cos 2x$, find $f'\left(\frac{\pi}{6}\right)$.

22. Find the equations of tangent and normal to the curve $y = \frac{x-7}{(x-2)(x-3)}$ at the point where it cuts the x-axis.

23. Evaluate : $\int \frac{\sin x - \cos x}{\sin x . \cos x} dx$.

Or

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

24. Find the area bounded by the curves $y = \sqrt{x}$, $2y + 3 = x$ and x-axis.

25. Solve the following differential equation : $x \log x \frac{dy}{dx} + y = 2 \log x$.

26. Let $\vec{a} = 4\hat{i} + 5\hat{j} - \hat{k}$, $\vec{b} = \hat{i} - 4\hat{j} + 5\hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j} - \hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and satisfying $\vec{d} . \vec{c} = 21$.

27. Find the values of a so that the following lines are skew:

$$\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-a}{4};\ \frac{x-4}{5}=\frac{y-1}{2}=z.$$

28. Two cards are drawn successively with replacement from a well shuffled pack of 52 cards. Find the probability distribution of the number of diamond cards drawn.

Or

P speaks truth in 70% of the cases and Q in 80% of the cases. In what percent of cases are they likely to agree in stating the same fact?

Section IV

All questions are compulsory. In case of internal choices attempt any one.

29. Let A = {1, 2, 3, …, 9} and R be the relation in A × A defined by (a, b) R (c, d) if $a + d = b + c$ for $a, b, c, d \in$ A. Prove that R is an equivalence relation. Also obtain the equivalence class [(2, 5)].

30. If $x = \sin t$, $y = \sin kt$, show that $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} + k^2y = 0$.

31. If $y^x + x^y + x^x = a^b$, find $\frac{dy}{dx}$.

Or

Find all the points of discontinuity of the function $f(x) = [x^2]$ on [1, 2), where [.] denotes the greatest integer function.

32. Separate the interval $\left[0, \frac{\pi}{2}\right]$ into subintervals in which the function $f(x) = \sin^4 x + \cos^4 x$ is strictly increasing or strictly decreasing.

33. Evaluate : $\int_{-1}^{1/2} |x\cos(\pi x)|\,dx$.

34. Using integration, find the area of the region bounded by the curve $x^2 = 4y$ and the line $x = 4y - 2$.

Or

Using integration, find the area of the region : $\{(x, y) : 0 \le 2y \le x^2, 0 \le y \le x, 0 \le x \le 3\}$

35. Solve the following differential equation :

$$\sqrt{1+x^2+y^2+x^2y^2} + xy\frac{dy}{dx} = 0.$$

Section V

All questions are compulsory. In case of internal choices attempt any one.

36. Using matrices, solve the following system of equations :

$x + 2y + z = 7$, $\quad x + 3z = 11$, $\quad 2x - 3y = 1$.

Or

Using matrices, solve the following system of equations :

$x + y + z = 6$, $\quad x + 2z = 7$, $\quad 3x + y + z = 12$

37. Find the coordinates of the foot of the perpendicular and the perpendicular distance of the point (1, 3, 4) from the plane $2x - y + z + 3 = 0$. Find also, the image of the point in the plane.

Or

Show that the lines $\frac{x+3}{-3}=\frac{y-1}{1}=\frac{z-5}{5}$ and $\frac{x+1}{-1}=\frac{y-2}{2}=\frac{z-5}{3}$ are coplanar. Also find the equation of the plane.

38. Solve the following graphically and also find the maximum profit.

Maximum Profit, Z = $1000x + 600y$

Subject to constraints: $x + y \le 200$; $x \ge 20$; $y > 4x$ and $x \ge 0, y \ge 0$.

Or

Solve the following graphically and also find the maximum profit.

Maximum Profit, Z = $x + y$

Subject to constraints: $2x + 3y \le 120$; $\frac{x}{50}+\frac{y}{80} \le 1$; $x \ge 0, y \ge 0$.