CBSE EXAMINATION PAPER-2025

MATHEMATICS

(Solved)

Time allowed : 3 hours | Maximum Marks : 67

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **31 questions.** All questions are **compulsory.**

ii. This question paper is divided into **5 sections.**

iii. **Section A** – questions number **1 to 4** are case based questions

iv. **Section B** – questions number **5 to 15** are multiple choice questions

v. **Section C** – questions number **16 to 17** are very short answer

vi. **Section D** – questions number **18 to 26** are short answer

vii. **Section E** – questions number **27 to 31** are long answer

viii. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

ix. Use of calculator is NOT allowed.

Section A

Question 1. A school is organizing a debate competition with participants as speakers $S = \{S_1, S_2, S_3, S_4\}$ and judges $J = \{J_1, J_2, J_3\}$. Each speaker can be assigned one judge. Let R be a relation from set S to J defined as $R = \{(x, y) : \text{speaker x is judged by judge y}, x \in S, y \in J\}$.

(1) How many relations can be there from S to J?

[1 Marks]

(2)

A student identifies a function from S to J as f = $\{(S_1, J_1), (S_2, J_2), (S_3, J_2), (S_4, J_3)\}$ Check if it is bijective.

[1 Marks]

(3)

How many one-one functions can be there from set S to set J?

[1 Marks]

(4)

Another student considers a relation $R_1 = \{(S_1, S_2), (S_2, S_1)\}$ in set S. Write minimum ordered pairs to be included in R_1 so that R_1 is reflexive but not symmetric.

[1 Marks]

Question 2. Three persons viz. Amber, Bonzi and Comet are manufacturing cars which run on petrol and on battery as well. Their production share in the market is 60%, 30% and 10% respectively. Of their respective production capacities, 20%, 10% and 5% cars respectively are electric (or battery operated).

(1) What is the probability that a randomly selected car is an electric car?

[1 Marks]

(2)

What is the probability that a randomly selected car is a petrol car?

[1 Marks]

(3)

A car is selected at random and is found to be electric. What is the probability that it was manufactured by Amber or Bonzi?

[1 Marks]

(4)

A car is selected at random and is found to be electric. What is the probability that it was manufactured by Comet?

[1 Marks]

Question 3. A small town is analyzing the pattern of a new street light installation. The lights are set up in such a way that the intensity of light at any point x metres from the start of the street can be modelled by $f(x)=e^x \sin x$ where x is in metres.

Question 4. A small town is analyzing the pattern of a new street light installation. The lights are set up in such a way that the intensity of light at any point x metres from the start of the street can be modelled by $f(x)=e^x \sin x$, where x is in metres.

(1) Find the intervals on which the f(x) is increasing or decreasing, $x \in [0, \square]$.

[2 Marks]

(2)

Verify, whether each critical point when

$x \in [0,\pi]$ is a point of local maximum or local minimum or a point of inflexion.

[2 Marks]

(3)

Verify, whether each critical point when

$x \in [0,\pi]$ is a point of local maximum or local minimum or a point of inflexion.

[2 Marks]

Section B

Question 5.

The function $f(x)=x^2-4x+6$ is increasing in the interval

[1 Marks]

(A) $[2,\infty)$

(B) $[1,2]$

(C) $(-\infty,2]$

(D) $(0,2)$

Question 6.

If a line makes angles of $3\pi/4$, $\pi/3$ and θ with the positive directions of x, y and z-axis respectively, then θ is

[1 Marks]

(A) $\pm \pi/3$

(B) $\pi/3$ only

(C) $-\pi/3$ only

(D) $\pi/6$

Question 7.

Which of the following can be both a symmetric and skew-symmetric matrix?

[1 Marks]

(A) Diagonal Matrix

(B) Unit Matrix

(C) Row Matrix

(D) Null Matrix

Question 8.

The equation of a line parallel to the vector 3i^+j^+2k^ and passing through the point (4, -3, 7) is:

[1 Marks]

(A) x=4t+3 y=-3t+1, z=7t+2

(B) x=3t+4, y=t+3, z=2t+7

(C) x=3t+4, y=t-3 z=2t+7

(D) x=3t+4, y=-t+3 z=2t+7

Question 9.

A cylindrical tank of radius 10 cm is being filled with sugar at the rate of 100 π cm^3/s. The rate, at which the height of the sugar inside the tank is increasing, is:

[1 Marks]

(A) 1 cm/s

(B) 0.1 cm/s

(C) 0.5 cm/s

(D) 1.1 cm/s

Question 10.

[1 Marks]

(A) 2π/3

(B) π/4

(C) π/2

(D) π/3

Question 11.

The line x=1+5μ, y=-5+μ, z=-6-3μ passes through which of the following point?

[1 Marks]

(A) (1,-5, 6)

(B) (1,-5,-6)

(C) (-1,-5, 6)

(D) (1, 5, 6)

Question 12.

The area of the shaded region (figure) represented by the curves $y=x^2$, $0 \leq x \leq 2$ and y-axis is given by

[1 Marks]

(A)

(B)

(C)

(D)

Question 13.

A factory produces two products X and Y. The profit earned by selling X and Y is represented by the objective function $Z=5x+7y$, where x and y are the number of units of X and Y respectively sold. Which of the following statement is correct?

(A) The objective function maximizes the difference of the profit earned from products X and Y.

(B) The objective function measures the total production of products X and Y.

(C) The objective function maximizes the combined profit earned from selling X and Y.

(D) The objective function ensures the company produces more of product X than product Y.

Question 14.

If A and B are square matrices of order m such that $A^2-B^2=(A-B)\ (A+B)$, then which of the following is always correct?

[1 Marks]

(A) A=B

(B) AB=BA

(C) A=I or B=I

(D) A=0 or B=0

Question 15.

If p and q are respectively the order and degree of the differential equation $d/dx\ (dy/dx)^3=0$, then (p-q) is

[1 Marks]

(A) 0

(B) 3

(C) 1

(D) 2

Section C

Question 16.

Find the values of 'a' for which $f(x) = \sin x - ax + b$ is increasing on R.

[2 Marks]

Question 17.

Check the differentiability of f(x) at x = -2,

[2 Marks]

Section D

Question 18.

Solve the differential equation $2(y+3)-xy\ dy/dx= 0$; given $y\ (1) = -2$.

[3 Marks]

Question 19. Let R be a relation defined over N, where N is the set of natural numbers, defined as "mRn if and only if m is a multiple of n, m, n ∈ N." Find whether R is reflexive, symmetric and transitive or not.

[3 Marks]

Question 20.

Solve the following linear programming problem graphically: Minimise Z = x - 5y subject to the constraints:

$x - y \geq 0$,

$-x + 2y \geq 2$,

$x \geq 3, y \leq 4, y \geq 0$,

[3 Marks]

Question 21.

If $y = \log (\sqrt{x}+1/\sqrt{x})^2$, then show that $x(x+1)^2 y_2 + (x+1)^2 y_1 = 2$.

[3 Marks]

Question 22.

If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, $-1 < x < 1$, and $x \neq y$, then prove that $dy/dx = -1/(1+x)^2$.

[3 Marks]

Question 23.

A die numbered 1 to 6 is biased such that $P(2) = 3/10$ and probability of other numbers is equal. Find the mean of the number of times number 2 appears on the die if the die is thrown twice.

[3 Marks]

Question 24.

Two dice are thrown. Define events $A = \{(x,y) \mid x + y = 9\}$, $B = \{(x,y) \mid x \neq 3\}$, where (x,y) denote a point in the sample space. Check if events A and B are independent or mutually exclusive.

[3 Marks]

Question 25.

Find

[4 Marks]

Question 26.

Solve the following differential equation:

$(1+x^2)\, dy/dx + 2xy = 4x^2$.

[3 Marks]

Section E

Question 27.

Using integration, find the area of the region bounded by the line y = 5x + 2, the x-axis and the ordinates x = -2 and x = 2.

[5 Marks]

Question 28.

solve the system of linear equations.

x-y+z=4

x-2y-2z=9

2x+y+3z=1

[5 Marks]

Question 29.

Hence, solve the system of linear equations:

x - 2y = 10,

2x -y - z = 8

-2y +z = 7

[5 Marks]

Question 30.

Find: $\int x^2 + x + 1/(x+2)(x^2+1)\, dx$

[5 Marks]

Question 31.

Find the image A' of the point A(2, 1, 2) in the line $l: \vec{r} = 4\hat{i} + 2\hat{j} + 2\hat{k} + \lambda(\hat{i} - \hat{j} - \hat{k})$. Also, find the equation of line joining AA'. Find the foot of perpendicular from point A on the line l.

[5 Marks]