CBSE EXAMINATION PAPER-2025

MATHEMATICS

(Solved)

Time allowed : 3 hours | Maximum Marks : 79

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **37 questions.** All questions are **compulsory.**
ii. This question paper is divided into **6 sections.**
iii. **Section A** – questions number **1 to 3** are case based questions
iv. **Section B** – questions number **4 to 4** are

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v. **Section C** – questions number **5 to 18** are multiple choice questions
vi. **Section D** – questions number **19 to 22** are very short answer
vii. **Section E** – questions number **23 to 31** are short answer
viii. **Section F** – questions number **32 to 37** are long answer
ix. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.
x. Use of calculator is NOT allowed.

Section A

Question 1. A technical company is designing a rectangular solar panel installation on a roof using 300 metres of boundary material. The design includes a partition running parallel to one of the sides dividing the area (roof) into two sections. Let the length of the side perpendicular to the partition be x metres and the side parallel to the partition be y metres.

(1) Find the critical points of the area function. Use the second derivative test to determine the critical points for maximum area. Also find the maximum area.

[4 Marks]

(2) Write the equation for the total boundary material used in the boundary and parallel to the partition in terms of x and y.

[1 Marks]

(3) Write the area of the solar panel as a function of x.

[1 Marks]

(4) Using first derivative test, calculate the maximum area the company can enclose with 300 metres of boundary material, considering the parallel partition.

[2 Marks]

Question 2. A class-room teacher writes five relations, each defined on the set A = {1, 2, 3}: R1 = {(2, 3), (3, 2)} R2 = {(1, 2), (1, 3), (3, 2)} R3 = {(1, 2), (3, 3), (2, 2)} R4 = {(1, 1), (1, 2), (3, 3), (2, 2)} R5 = {(1, 1), (1, 2), (3, 3), (2, 2), (2, 3), (3, 2)} Students are asked to answer the following about these relations.

(1) Identify the relation which is reflexive and transitive but not symmetric.

[1 Marks]

(2) Identify the relation which is reflexive and symmetric but not transitive.

[1 Marks]

(3) Identify the relations which are symmetric but neither reflexive nor transitive.

[1 Marks]

(4) What pairs should be added to the relation R1 to make it an equivalence relation?

[1 Marks]

Question 3.

A bank offers loan to its customers on different types of interest namely, fixed rate, floating rate and variable rate. From the past data with the bank, it is known that a customer avails loan on fixed rate, floating rate or variable rate with probabilities 10%, 20% and 70% respectively. A customer after availing loan can pay the loan or default on loan repayment. The bank data suggests that the probability that a person defaults on loan after availing it at fixed rate, floating rate and variable rate is 5%, 3% and 1% respectively.

(1) What is the probability that a customer after availing the loan will default on the loan repayment?

[2 Marks]

(2)

A customer after availing the loan, defaults on loan repayment. What is the probability that he availed the loan at a variable rate of interest?

[2 Marks]

Section B

Question 4.

Section C

Question 5.

Which of the following is not a homogeneous function of x and y?

[1 Marks]

(A) $y^2 - xy$

(B) $x-3y$

(C) $\tan x - \sec y$

(D) $\sin^2 y/x + y/x$

Question 6.

If $f(x) = |x| + |x - 1|$, then which of the following is correct?

[1 Marks]

(A) $f(x)$ is continuous but not differentiable at $x = 0$ and $x = 1$.

(B) $f(x)$ is differentiable but not continuous at $x = 0$ and $x = 1$.

(C) $f(x)$ is neither continuous nor differentiable at $x = 0$ and $x = 1$.

(D) $f(x)$ is both continuous and differentiable at $x = 0$ and $x = 1$.

Question 7.

If E and F are two independent events such that $P(E) = 2/3$, $P(F) = 3/7$, then $P(E/F)$ is equal to:

[1 Marks]

(A) 1/6

(B) 2/3

(C) 1/2

(D) 7/9

Question 8.

The absolute maximum value of function $f(x) = x^3 - 3x + 2$ in $[0,2]$ is:

[1 Marks]

(A) 5

(B) 0

(C) 2

(D) 4

Question 9.

[1 Marks]

(A) Only AB

(B) Only BA

(C) All AB, AC, and BA

(D) Only AC

Question 10.

If $\int 2^{1/x}/x^2\,dx = k\,2^{1/x} + C$, then k is equal to:

[1 Marks]

(A) -1

(B) -log 2

(C) 1/2

(D) -1/log 2

Question 11.

[1 Marks]

(A) π/3

(B) π/6

(C) π/4

(D) π/2

Question 12.

The integrating factor of differential equation $(x + 2y^3)\,dy/dx = 2y$ is:

[1 Marks]

(A) $e^{y^2/2}$

(B) $1/\sqrt{y}$

(C) e^{-1/y^2}

(D) $1/y^2$

Question 13.

The corner points of the feasible region in graphical representation of LPP are (2, 72), (15, 20), and (40, 15). If Z = 18x + 9y is the objective function, then:

[1 Marks]

(A) Z is maximum at (2, 72), minimum at (15, 20)

(B) Z is maximum at (15, 20), minimum at (40, 15)

(C) Z is maximum at (40, 15), minimum at (15, 20)

(D) Z is maximum at (40, 15), minimum at (2, 72)

Question 14.

If A and B are invertible matrices, then which of the following is not correct?

[1 Marks]

(A) $adj(A) = |A| A^{-1}$

(B) $(AB)^{-1} = B^{-1} A^{-1}$

(C) $(A + B)^{-1} = B^{-1} + A^{-1}$

(D) $|A|^{-1} = |A^{-1}|$

Question 15. If the feasible region of a linear programming problem with objective function Z = ax + by is bounded, then which of the following is correct?

[1 Marks]

(A) It will only have a maximum value.

(B) It will only have a minimum value.

(C) It will have both maximum and minimum values.

(D) It will have neither maximum nor minimum value.

Question 16.

The area of the shaded region bounded by the curves $y^2 = x$, x = 4 and the axis is given by:

[1 Marks]

(A)

(B)

(C)

(D)

Question 17.

[1 Marks]

(A)

(B)

(C)

(D)

Question 18.

[1 Marks]

(A) -1

(B) 2

(C) 0

(D) 1

Section D

Question 19.

If $\tan^{-1} t\ (x^2 + y^2) = a^2$, then find dy/dx.

[2 Marks]

Question 20.

Evaluate $\tan^{-1} [\, 2 \sin (2 \cos^{-1}\sqrt{3}/2)]$

[2 Marks]

Question 21.

Find a vector of magnitude 21 units in the direction opposite to that of A□□where A and B are the points A(2, 1, 3) and B(8, -1, 0) respectively.

[2 Marks]

Question 22.

The diagonals of a parallelogram are given by □□$2\hat{i}-\hat{j}+\hat{k}$ and □□$\hat{i}+3\hat{j}-\hat{k}$. Find the area of the parallelogram.

[2 Marks]

Section E

Question 23. The side of an equilateral triangle is increasing at the rate of 3 cm/s. At what rate is its area increasing when the side of the triangle is 15 cm?

[3 Marks]

Question 24.

Solve the following linear programming problem graphically: Maximise Z = x + 25

subject to the constraints

$x-y \geq 0$

$x-2y \geq -2$

$x \geq 0+ y \geq 0$

[3 Marks]

Question 25.

Find ∫x+sin x / 1+cos x dx

[3 Marks]

Question 26.

Verify that lines given by $\vec{r} = (1-\lambda)\hat{i} + (\lambda-2)\hat{j} + (3-2\lambda)\hat{k}$ and $\vec{r} = (\mu+1)\hat{i} + (2\mu-1)\hat{j} - (2\mu+1)\hat{k}$ are skew lines. Hence, find shortest distance between the lines.

[3 Marks]

Question 27.

During a cricket match, the position of the bowler, the wicket keeper and the leg slip fielder are in a line given by $\vec{a} = 2\hat{i} + 8\hat{j}$, $\vec{b} = 6\hat{i} + 12\hat{j}$ and $\vec{c} = 12\hat{i} + 18\hat{j}$ respectively. Calculate the ratio in which the wicketkeeper divides the line segment joining the bowler and the leg slip fielder.

[3 Marks]

Question 28.

Evaluate

[3 Marks]

Question 29.

The probability distribution for the number of students being absent in a class on a Saturday is as follows

given.

(i) Calculate p,

(ii)Calculate mean of the number of absent students of Saturday

[3 Marks]

Question 30.

For the vacancy advertised in the newspaper, 3000 candidates submitted their applications. From the data it was revealed that two third of the total applicants were females and other were males. The selection for the job was done through a written test. The performance of the applicants indicates that the probability of a male getting a distinction in written test is 0.4 and that a female getting a distinction is 0.35. Find the probability that the candidate chosen at random will have a distinction in the written test.

[3 Marks]

Question 31. Sketch the graph of $y = |x + 3|$ and find the area of the region enclosed by the curve, x-axis, between $x = -6$ and $x = 0$, using integration.

[3 Marks]

Section F

Question 32.

If $\sqrt{(1 - x^2)} + \sqrt{(1 - y^2)} = a(x - y)$, then prove that $dy/dx = \sqrt{(1 - y^2)} / \sqrt{(1 - x^2)}$

[5 Marks]

Question 33.

If $x = a [\cos \theta + \log \tan \theta/2]$ and $y = \sin \theta$, then find d^2y/dx^2 at $\theta = \pi/2$

[5 Marks]

Question 34. Find the absolute maximum and absolute minimum of function $f(x) = 2x^3 - 15x^2 + 36x + 1$ on the interval [1, 5].

[5 Marks]

Question 35.

Find the image A' of the point A (1, 6, 3) in the line x/1=y-1/2=z-2/3. Also, find the equation of the line joining A and A'.

[5 Marks]

Question 36.

Find a point P on the line x+5/1= y+3/4= z-6/-9 such that its distance from point Q(2, 4, 1) is 7 units. Also, find the equation of the line joining P and Q.

[5 Marks]

Question 37.

1. A school wants to allocate students into three clubs: Sports, Music and Drama, under following conditions:
    - The number of students in Sports club should be equal to the sum of the number of students in Music and Drama club.
    - The number of students in Music club should be 20 more than half the number of students in Sports club.
    - The total number of students to be allocated in all three clubs are 180.

Find the number of students allocated to different clubs, using matrix method.

[5 Marks]