CBSE EXAMINATION PAPER-2025

MATHEMATICS

(Solved)

Time allowed : 3 hours | Maximum Marks : 85

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **44 questions.** All questions are **compulsory.**

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

iii. **Section A** – questions number **1 to 3** are case based questions

iv. **Section B** – questions number **4 to 22** are multiple choice questions

v. **Section C** – questions number **23 to 29** are very short answer

vi. **Section D** – questions number **30 to 38** are short answer

vii. **Section E** – questions number **39 to 44** 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 carpenter needs to make a wooden cuboidal box, closed from all sides, which has a square base and fixed volume. Since he is short of the paint required to paint the box on completion, he wants the surface area to be minimum.

(1) Find the relation between x and y such that the surface area (S) is minimum.

[2 Marks]

(2)

Taking length = breadth = x m and height = y m, express the surface area (S) of the box in terms of x and its volume (V), which is constant

[1 Marks]

(3)

If surface area (S) is constant, the volume (V) $=1/4(Sx-2x^3)$, x being the edge of base. Show that volume (V) is maximum for x $=\sqrt{S/6}$

[2 Marks]

(4)

Find dS/dx.

[1 Marks]

Question 2. Let A be the set of 30 students of class XII in a school. Let f: A → N, N is a set of natural numbers such that function f(x) = Roll Number of student x.

(1) Is f a bijective function?

[1 Marks]

(2) Give reasons to support your answer to (i).

[1 Marks]

(3) Let R be a relation defined by the teacher to plan seating arrangement of students in pairs, where R = {(x, y) : x, y are Roll Numbers of students such that y = 3x}. List elements of R. Is the relation R reflexive, symmetric and transitive? Justify your answer.

[2 Marks]

(4)

Let R be a relation defined by
R = {(x, y): x, y are Roll Numbers of students such that $y = x^3$}.
List the elements of R. Is R a function? Justify your answer.

[2 Marks]

Question 3.

A gardener wanted to plant vegetables in his garden. Hence he bought 10 seeds of brinjal plant, 12 seeds of cabbage plant and 8 seeds of radish plant. The shopkeeper assured him of germination probabilities of brinjal, cabbage and radish to be 25%, 35% and 40% respectively. But before he could plant the seeds, they got mixed up in the bag and he had to sow them randomly.

(1) Calculate the probability that a randomly chosen seed will germinate.

[2 Marks]

(2) What is the probability that a seed is a cabbage seed given that it germinates?

[2 Marks]

Section B

Question 4.

[1 Marks]

(A)

(B)

(C)

(D)

Question 5.

If $P(A \cup B) = 0{\cdot}9$ and $P(A \cap B) = 0{\cdot}4$, then $P(\bar{A}) + P(\bar{B})$ is :

[1 Marks]

(A) 1

(B) 1.3

(C) 0.7

(D) 0.3

Question 6.

[1 Marks]

(A) Only BA is defined.

(B) AB and BA both are not defined.

(C) AB and BA both are defined.

(D) Only AB is defined.

Question 7.

[1 Marks]

(A) 1

(B) -1

(C) ±1

(D) 0

Question 8.

If $A = [a_{ij}]$ is a 3×3 diagonal matrix, such that $a_{11}=1$, $a_{22}=5$ and $a_{33}=-2$ then $|A|$ is :

[1 Marks]

(A) -10

(B) 1

(C) 10

(D) 0

Question 9.

The principal value of $\cot^{-1}(-1/\sqrt{3})$ is :

[1 Marks]

(A) $-2\pi/3$

(B) $-\pi/3$

(C) $2\pi/3$

(D) $\pi/3$

Question 10.

[1 Marks]

(A) 1

(B) 0

(C) -4

(D) -2

Question 11.

If $f(x)=\{[x], x\in R\}$ is the greatest integer function, then the correct statement is:

[1 Marks]

(A) f is neither continuous nor differentiable at x = 2.

(B) f is continuous as well as differentiable at x = 2.

(C) f is not continuous but differentiable at x = 2.

(D) f is continuous but not differentiable at x = 2.

Question 12.

The slope of the curve $y = -x^3 + 3x^2 + 8x - 20$ is maximum at:

[1 Marks]

(A) (-10,1)

(B) (10,1)

(C) (1,10)

(D) (1,-10)

Question 13.

$\int\sqrt{1+\sin x}\, dx$ is equal to

[1 Marks]

(A) $2(-\sin x/2 + \cos x/2) + C$

(B) $-2(\sin x/2 + \cos x/2) + C$

(C) $2(\sin x/2 + \cos x/2) + C$

(D) $2(\sin x/2 - \cos x/2) + C$

Question 14.

[1 Marks]

(A) 0

(B) e

(C) 1-e

(D) e-1

Question 15.

The area of the region enclosed between the curve $y = x\,|x|$, x-axis, and $x = -2$ and $x = 2$ is:

[1 Marks]

(A) 0

(B) 8

(C) 8/3

(D) 16/3

Question 16.

The integrating factor of the differential equation

[1 Marks]

(A)

(B)

(C)

(D)

Question 17.

The sum of the order and degree of the differential equation $[1+(\frac{dy}{dx})^2]^3=\frac{d^2y}{dx^2}$ is:

[1 Marks]

(A) 2

(B) 5/2

(C) 3

(D) 4

Question 18.

For the Linear Programming Problem (LPP) with objective function $Z = 3x + 2y$ subject to constraints

$x + 2y \leq 10$,

$x + y \leq 15$,

$x, y \geq 0$

the correct feasible region is

[1 Marks]

(A) CED

(B) AOEC

(C) ABC

(D) Open unbounded region BCD

Question 19.

Let [illegible] be a position vector whose tip is the point (2,-3). If A[illegible]=[illegible] where coordinates of A are (-4,5), then the coordinates of B are:

[1 Marks]

(A) (-2, -2)

(B) (-2, 2)

(C) (2, -2)

(D) (2,-2)

Question 20.

The respective values of |[illegible]| and |[illegible]|, if given

([illegible])·([illegible])=512 and |[illegible]|=3|[illegible]|, are:

[1 Marks]

(A) 6 and 2

(B) 24 and 8

(C) 3 and 1

(D) 48 and 16

Question 21.

[1 Marks]

(A) 3

(B) 7

(C) ±7

(D) ±3

Question 22. Assertion (A): Let $A=\{x\in R:-1\le x\le 1\}$. If $f:A\to A$ be defined as $f(x)=x^2$ then f is not an onto function. Reason (R): If $y=-1\in A$, then $x=\pm\sqrt{-1}\in/A$.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(C) Assertion (A) is false, but Reason (R) is true.

(D) Assertion (A) is true, but Reason (R) is false.

Section C

Question 23.

Find the domain of the function $f(x) = \cos^{-1}(x^2 - 4)$.

[2 Marks]

Question 24. Surface area of a spherical balloon increases at a rate of 5 mm^2/s. When radius is 8 mm, find the rate at which volume is increasing.

[2 Marks]

Question 25.

Differentiate $(\sin x)/\sqrt{\cos x}$ with respect to x.

[2 Marks]

Question 26.

if $y = 5 \cos x - 3 \sin x$, prove that $d^2y/dx^2 + y = 0$.

[2 Marks]

Question 27.

Find a vector of magnitude 5 which is perpendicular to both the vectors $3\hat{i}-2\hat{j}+\hat{k}$ and $4\hat{i}+3\hat{j}-2\hat{k}$.

[2 Marks]

Question 28.

Let [illegible], [illegible] and [illegible] be three vectors such that [illegible] = [illegible] and [illegible] × [illegible] = [illegible] × [illegible], [illegible] ≠ $\vec{0}$. Show that [illegible] = [illegible]

[2 Marks]

Question 29. A man hangs two lanterns on a wire with endpoints A(4,1,-2) and B(6,2,-3). Find coordinates of points that trisect the wire AB.

[2 Marks]

Section D

Question 30.

Find the value of 'a' for which $f(x) = \sqrt{3} \sin x - \cos x - 2ax + 6$ is decreasing in $\mathbb{R}$.

[3 Marks]

Question 31.

Find $\int 2x/x^2+3(x^2-5)\, dx$

[1 Marks]

Question 32.

Evaluate

[1 Marks]

Question 33.

Find the particular solution of the differential equation

$[x \sin^2(y/x)-y]\, dx+ x\, dy =0$

given that $y =\pi/4$, when $x = 1$.

[3 Marks]

Question 34.

In the Linear Programming Problem (LPP), find the point/points giving maximum value for $Z = 5x + 10y$ subject to constraints:

$x + 2y \leq 120$,

$x + y \geq 60$,

$x - 2y \geq 0$,

$x, y \geq 0$.

[3 Marks]

Question 35.

If ⊠⊠+⊠⊠+⊠⊠=$\vec{0}$ such that |⊠⊠|=3, |⊠⊠|=5, |⊠⊠|=7, then find the angle between ⊠⊠and ⊠⊠

[3 Marks]

Question 36.

If⊠⊠and ⊠⊠are unit vectors inclined with each other at an angle ⊠, then prove that 1/2|⊠⊠⊠⊠|=sin ⊠/2

[3 Marks]

Question 37. The probability that a student buys a colouring book is 0.7 and that she buys a box of colours is 0.2. The probability that she buys a colouring book given that she buys a box of colours is 0.3. Find (i) the probability that the student buys both the colouring book and the box of colours, (ii) the probability that she buys a box of colours given that she buys the colouring book.

[3 Marks]

Question 38. A person has a fruit box with 6 apples and 4 oranges. He picks a fruit three times, each time replacing the previously picked fruit. Find (i) the probability distribution of the number of oranges drawn, (ii) the expectation of the random variable (number of oranges).

[3 Marks]

Section E

Question 39. Sketch a graph of $y = x^2$. Using integration, find the area of the region bounded by $y = 9$, $x = 0$ and $y = x^2$.

[5 Marks]

Question 40. A furniture workshop produces three types of furniture — chairs, tables and beds each day. On a particular day the total number of furniture pieces produced is 45. It was also found that production of beds exceeds that of chairs by 8, while the total production of beds and chairs together is twice the production of tables. Determine the units produced of each type of furniture, using matrix method.

[5 Marks]

Question 41.

For a positive constant 'a', differentiate $a^{t+1/t}$ with respect to $(t+1/t)^a$, where t is a non-zero real number.

[5 Marks]

Question 42.

Find dy/dx if $y^x + x^y + x^x = a^b$, where a and b are constants.

[5 Marks]

Question 43.

Find the foot of the perpendicular drawn from the point (1, 1, 4) on the line x+2/5=y+1/2 = -z+4/-3.

[5 Marks]

Question 44.

Find the point on the line x-1/3 = y+1/2 = z-4/3 at a distance of 2√2 units from the point (1, -1, 2).

[5 Marks]