CBSE EXAMINATION PAPER-2025

MATHEMATICS

(Solved)

Time allowed : 3 hours   Maximum Marks : 91

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **45 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 23** are multiple choice questions
v. **Section C** – questions number **24 to 30** are very short answer
vi. **Section D** – questions number **31 to 39** are short answer
vii. **Section E** – questions number **40 to 45** 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.

Some students are having a misconception while comparing decimals. For example, a student may mention that 78·56 > 78·9 as 7856 > 789. In order to assess this concept, a decimal comparison test was administered to the students of class VI through the following question :
In the recently held Sports Day in the school, 5 students participated in a javelin throw competition. The distances to which they have thrown the javelin are shown below in the table :

The students were asked to identify who has thrown the javelin the farthest.

Based on the test attempted by the students, the teacher concludes that 40% of the students have the misconception in the concept of decimal comparison and the rest do not have the misconception. 80% of the students having misconception answered Bijoy as the correct answer in the paper. 90% of the students who are identified with not having misconception, did not answer Bijoy as their answer.

> **(1) What is the probability that a student who answered Bijoy is having misconception?**
>
> [2 Marks]

> **(2) What is the probability of a student not having misconception but still answers Bijoy in the test?**
>
> [1 Marks]

> **(3) What is the probability that a randomly selected student answers Bijoy as his answer in the test?**
>
> [1 Marks]

> **(4)**
>
> **What is the probability that a student who answered as Bijoy is amongst students who do not have the misconception?**
>
> [2 Marks]

Question 2.

During a heavy gaming session, the temperature of a student's laptop processor increases significantly. After the session, the processor begins to cool down, and the rate of cooling is proportional to the difference between the processor's temperature and the room temperature (25°C). Initially the processor's temperature is 85°C. The rate of cooling is defined by the equation $d/dt(T(t))=-k(T(t)-25)$, where $T(t)$ represents the temperature of the processor at time t (in minutes) and k is a constant.

(1) Find the expression for temperature T(t) given T(0) = 85°C.

[2 Marks]

(2) How long will it take for the processor's temperature to reach 40°C? Given k = 0.03 and log_e 4 = 1.3863.

[2 Marks]

Question 3.

An engineer a new metro rail network in a city Initially, two metro lines, Line A and Line B, each consisting of multiple stations are designed. The track for Line A is represented byl_1:x-23=y+1-2=z-34 while the track for Line B is represented by l_2:x-12=y-31=z+2-3

(1) Find whether the two metro tracks are parallel.

[1 Marks]

(2) To connect the stations, a pedestrian pathway perpendicular to the two metro lines is to be constructed which passes through point (3,2,1). Determine the equation of the pedestrian walkway.

[2 Marks]

(3) Find the shortest distance between Line A and Line B.

[2 Marks]

(4) Solar panels are to be installed on the rooftop of the metro stations. Determine the equation of the line representing the placement of solar panels on the rooftop of Line A's stations, given that panels are to be positioned parallel to Line A's track (l_1) and pass through the point (1,-2,-3) .

[1 Marks]

Section B

Question 4.

The principal value of $\sin^{-1}(\sin(-10\pi/3))$ is:

[1 Marks]

(A) $-2\pi/3$

(B) $-\pi/3$

(C) $2\pi/3$

(D) $\pi/3$

Question 5.

If A and B are square matrices of the same order such that AB = A and BA = B, then $A^2 + B^2$ is equal to:

[1 Marks]

(A) 2(A + B)

(B) 2BA

(C) BA

(D) A + B

Question 6. For real x, let $f(x) = x^3 + 5x + 1$. Then:

[1 Marks]

(A) f is one-one but not onto on $\mathbb{R}$

(B) f is one-one and onto on $\mathbb{R}$

(C) f is neither one-one nor onto on $\mathbb{R}$

(D) f is onto on $\mathbb{R}$ but not one-one

Question 7.

If $y = \sin^{-1} x$, then $(1-x^2)(d^2y/dx^2) + y$ is equal to:

[1 Marks]

(A) x dy/dx

(B) $-x^2$ dy/dx

(C) -x dy/dx

(D) x^2 dy/dx

Question 8.

The values of λ so that f(x) = sin x - cos x - λx + c decreases for all real x are:

[1 Marks]

(A) $\lambda \geq 1$

(B) $\lambda \geq \sqrt{2}$

(C) $\lambda < 1$

(D) $1 < \lambda < \sqrt{2}$

Question 9.

If P is a point on the line segment joining (3, 6, -1) and (6, 2, -2) with y-coordinate 4, then its z-coordinate is:

[1 Marks]

(A) 0

(B) -3/2

(C) 3/2

(D) 1

Question 10. If M and N are square matrices of order 3 such that det(M) = m and MN = mI, then det(N) is equal to:

[1 Marks]

(A) -1

(B) 1

(C) m^2

(D) $-m^2$

Question 11.

[1 Marks]

(A) -4

(B) -1

(C) -2

(D) -7/2

Question 12.

If f: N → W is defined as

[1 Marks]

(A) neither surjective nor injective

(B) a bijection

(C) surjective only

(D) injective only

Question 13.

The matrix

[1 Marks]

(A) scalar matrix

(B) skew symmetric matrix

(C) diagonal matrix

(D) symmetric matrix

Question 14.

If the sides AB and AC of △ABC are represented by vectors $\hat{j}+\hat{k}$ and $3\hat{i}-\hat{j}+4\hat{k}$ respectively, then the length of the median through A on BC is:

[1 Marks]

(A) $\sqrt{18}$ units

(B) $\sqrt{48}/2$ units

(C) $2\sqrt{2}$ units

(D) $\sqrt{34}/2$ units

Question 15.

The function f defined by

[1 Marks]

(A) $x = 5$

(B) $x = 2$

(C) $x = 1$

(D) $x = 0$

Question 16.

If $f(x) = 2x + \cos x$, then $f'(x)$

[1 Marks]

(A) has a minima at $x = \pi$

(B) has a maxima at $x = \pi$

(C) an increasing function

(D) a decreasing function

Question 17.

The $\int \cos 2x - \cos 2\alpha / \cos x - \cos 2\alpha \, dx$ is equal to:

[1 Marks]

(A) $2(\sin x + x \cos \alpha) + C$

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

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

(D) 2(sin x+sin α)+C

Question 18.

The value of

[1 Marks]

(A) - 4 /π

(B) 4/ π

(C) $\tan^{-1} e$ - 4 /π

(D) $\tan^{-1} e$

Question 19.

The order and degree of the differential equation $(d^2y/dx^2)^2+(dy/dx)^2 = x \sin dy/dx$ are:

[1 Marks]

(A) Order 2, degree 2

(B) Order 2, degree not defined

(C) Order 1, degree not defined

(D) Order 2, degree 1

Question 20.

The area of the region enclosed by the curve y = √x and the lines x = 0, x = 4, and x-axis is:

[1 Marks]

(A) 32/9 sq. units

(B) 16/9 sq. units

(C) 16/3 sq. units

(D) 32/3 sq. units

Question 21. The corner points of the feasible region of a Linear Programming Problem are (0, 2), (3, 0), (6, 0), (6, 8), and (0, 5). If Z = ax + by (a, b > 0) is the objective function and maximum value of Z is obtained at (0, 2) and (3, 0), then the relation between a and b is:

[1 Marks]

(A) a = b

(B) a = 3b

(C) b = 6a

(D) 3a = 2b

Question 22.

Assertion (A): If A and B are two events such that P(A∩B)=0 then A and B are independent events. Reason (R): Two events are independent if the occurrence of one does not effect the occurrence of the other.

[1 Marks]

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

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

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

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

Question 23. Assertion (A): In a Linear Programming Problem, if the feasible region is empty, then the Linear Programming Problem has no solution. Reason (R): A feasible region is defined as the region that satisfies all the constraints.

[1 Marks]

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

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

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

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

Section C

Question 24. Let A and B be two square matrices of order 3 such that det(A) = 3 and det(B) = -4. Find the value of det(-6AB).

[2 Marks]

Question 25. Find the least value of 'a' so that $f(x) = 2x^2 - ax + 3$ is an increasing function on [2, 4].

[2 Marks]

Question 26.

If $f(x) = x + 1/x$, $x \geq 1$ show that f is an increasing function.

[2 Marks]

Question 27.

Simplify $\sin^{-1} (x/\sqrt{1+x^2})$.

[2 Marks]

Question 28.

Find the domain of $\sin^{-1}\sqrt{x - 1}$.

[2 Marks]

Question 29.

Calculate the area of the region bounded by the curve $x^2/9+y^2/4 = 1$ and the x-axis using integration.

[2 Marks]

Question 30. For the curve $y = 5x - 2x^2$, if x increases at the rate of 2 units/s, how fast is the slope of the curve changing when x = 2?

[2 Marks]

Section D

Question 31.

If $f: R^+ \rightarrow R$ is defined as $f(x) = \log_a x$ ($a > 0$ and $a \neq 1$), prove that f is a bijection. (R^+ is the set of all positive real numbers.)

[3 Marks]

Question 32. Let A = {1, 2, 3} and B = {4, 5, 6}. A relation R from A to B is defined as R = {(x, y): x + y = 6, x ∈ A and y ∈ B}. (i) Write all elements of R. (ii) Is R a function? Justify. (iii)

Determine domain and range of R.

[3 Marks]

Question 33.

Find k so that

[3 Marks]

Question 34. Check differentiability of function f(x) = x|x| at x = 0.

[3 Marks]

Question 35.

Evaluate

[3 Marks]

Question 36. Find the probability distribution of the number of boys in families having three children, assuming equal probability of a boy or a girl.

[3 Marks]

Question 37. A coin is tossed twice. Let X be the random variable defined as number of heads minus number of tails. Find the probability distribution of X and its mean.

[3 Marks]

Question 38.

Find the distance of the point (-1, 5, -10) from the point of intersection of the lines x-1/2= y-2/3 = z-3/4 and x-4/5 =y-1/2=z

[3 Marks]

Question 39.

Solve the Linear Programming Problem using graphical method:

Maximise Z = 100x + 50y

subject to constraints

3x + y ≤600

x + y ≤ 300

y ≤ x + 200

$x \geq 0, y \geq 0$

[3 Marks]

Section E

Question 40.

If A is a 3 x 3 invertible matrix, show that for any scalar $k \neq 0$, $(kA)^{-1} = 1/k\ A^{-1}$ det(A). Hence calculate $\det(3A)^{-1}$, Where

[5 Marks]

Question 41.

The relation between the height of the plant (y cm) with respect to exposure to sunlight is governed by the equation $y = 4x - 1/2\ x^2$ where x is the number of days exposed to sunlight. (i) Find the rate of growth of the plant with respect to sunlight. (ii) In how many days will the plant attain its maximum height? What is the maximum height?

[5 Marks]

Question 42.

Find: $\int \cos x / (4 \sin^2 x)(5-4 \cos^2 x)\, dx$

[5 Marks]

Question 43.

Evaluate

[5 Marks]

Question 44.

Show that the area of a parallelogram whose diagonals are represented by [illegible] and [illegible] is given by 12|[illegible]| Also find the area of a parallelogram whose diagonals are $2\hat{i}-\hat{j}+\hat{k}$ and $\hat{i}+3\hat{j}-\hat{k}$

[5 Marks]

Question 45.

Find the equation of a line in vector and cartesian form which passes through the point (1,2,−4) and is perpendicular to the lines $x-8/3=y+19/-16=z-10/7$, and

$\vec{r}=15\hat{i}+29\hat{j}+5\hat{k}+\lambda(3\hat{i}+8\hat{j}-5\hat{k})$

.

[5 Marks]