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PLEASURE TEST SERIES
PTS-38

For CBSE 2026 Board Exams - Class 12
MATHEMATICS
SUBJECT CODE - 041

a compilation by
O.P. GUPTA
INDIRA AWARD WINNER

General Instructions : Same as given in PTS-01.

SECTION A

*(Question numbers 01 to 20 carry **1 mark** each.)*
*Followings are **multiple choice questions**. Select the correct option in each one of them.*

01. If $A=\left[a_{ij}\right]$ is a symmetric matrix of order n, then

(a) $a_{ij}=-a_{ji}\ \forall\ i, j$ (b) $a_{ij}\neq 0\ \forall\ i, j$ (c) $a_{ij}=a_{ji}\ \forall\ i, j$ (d) $a_{ij}=0$, where $i=j$

02. Let $A=\left[a_{ij}\right]_{2\times 3}$. If product AB is defined then, number of rows in matrix B can be

(a) 2 (b) 3 (c) any real no. (d) any natural no.

03. The area of a parallelogram whose diagonals are represented by $\vec{p}$ and $\vec{q}$, is

(a) $|\vec{p}\times\vec{q}|$ (b) $\frac{1}{2}|\vec{p}\times\vec{q}|$ (c) $\frac{1}{4}|\vec{p}\times\vec{q}|$ (d) $\frac{1}{8}|\vec{p}\times\vec{q}|$

04. If the differentiation of $f(x)=a^{3x}$, $a>0$ w. r. t. x is $k\,a^{3x}\times\log a$. Then value of k is

(a) 3 (b) $\frac{1}{3}$ (c) 1 (d) None of these

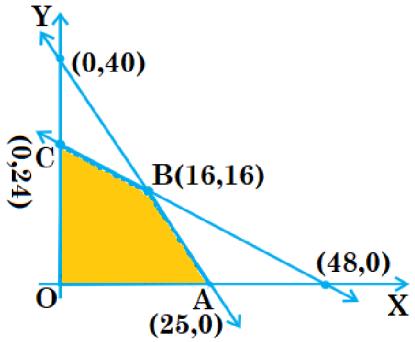
05. $\int\frac{e^{x}-e^{-x}}{e^{x}+e^{-x}}dx=$

(a) $\log\left|e^{x}-e^{-x}\right|+C$ (b) $\log\left|e^{x}+e^{-x}\right|+C$ (c) $\log\left|e^{-x}-e^{x}\right|+C$ (d) $\log\left|e^{2x}+1\right|+x+C$

06. What is the product of order and degree of differential equation $\frac{d}{dx}\left[\left(\frac{dy}{dx}\right)^{4}\right]=0$?

(a) 1 (b) 2 (c) 3 (d) can't be determined

07. Feasible region (shaded) for a LPP is shown in the figure below.



Maximum value of $Z=4x+3y$ occurs at

(a) (25, 0) (b) (16, 16)
(c) (0, 24) (d) (48, 0)

08. If $\vec{a}$ and $\vec{b}$ denote the position vectors of points A and B respectively and P is a point on AB such that $AP=2PB$, then the position vector of P is given by

(a) $\frac{\vec{a}+2\vec{b}}{3}$ (b) $\frac{2\vec{a}+\vec{b}}{3}$ (c) $\frac{\vec{a}+3\vec{b}}{2}$ (d) $\frac{2\vec{a}+2\vec{b}}{3}$

09. $\int_{-1}^{1}(2^{x}-2^{-x})(3^{x}+3^{-x})\,dx=$

(a) 0 (b) 1 (c) –1 (d) Not possible

10. Value of $\begin{vmatrix} x & 0 & 0 \\ 0 & y & 0 \\ 0 & 0 & z \end{vmatrix}$ is

(a) 0 (b) $-xyz$ (c) xyz (d) 1

11. The solution set of the inequality $3x + 5y \le 4$ contains

(a) an open half-plane excluding the origin (b) an open half-plane including (1, 1)

(c) an open half-plane excluding (1, 0) (d) an open half-plane including the origin

12. If A is any matrix such that $A^5 = I$, then value of det.(A^{-1}) is

(a) 0 (b) 1 (c) 2 (d) –1

13. Let A is a symmetric and B is a skew-symmetric matrix, such that $A - B = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$.

Then $|2A|$ is

(a) 9 (b) –2 (c) –9 (d) 2

14. Let A and B be two events such that P (A) = 0.6, P (B) = 0.2, and P (A | B) = 0.5. Then P (A′ | B′) equals

(a) 0.1 (b) 0.3 (c) $\frac{3}{8}$ (d) $\frac{6}{7}$

15. The solution of D.E., $\frac{dy}{dx} = e^{x+y} - 1$ is

(a) $e^{x+y}(x + C) - 1 = 0$ (b) $e^{-x-y}(x + C) - 1 = 0$

(c) $e^{-x-y}(x + C) + 1 = 0$ (d) $e^{x+y}(x + C) + 1 = 0$

16. The angle θ, which increases twice as fast as its sine, is given by

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

17. If two vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}| = \frac{3}{2}$, $|\vec{b}| = 1$ and $\vec{a}.\vec{b} = 2$, then $|2\vec{a} + \vec{b}|$ is equal to

(a) $2\sqrt{3}$ (b) $2\sqrt{2}$ (c) $3\sqrt{2}$ (d) $\frac{\sqrt{57}}{2}$

18. Through which one of the following point, the line $\frac{x-1}{2} = \frac{y+2}{3} = \frac{z-3}{4}$ will pass?

(a) (1, 2, 3) (b) (3, 0, 7) (c) (1, 3, 7) (d) (3, 1, 7)

Followings are ***Assertion-Reason based questions.***

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

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

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

19. **Assertion (A) :** The domain of the function $\sin^{-1}(x - 1)$ is $0 \le x \le 2$.

Reason (R) : For $y = \cos^{-1} x$, we have $0 \le y \le \pi$.

20. **Assertion (A) :** The line $\vec{r} = 2\hat{i} - 3\hat{j} + 4\hat{k} + \lambda(\hat{i} - \hat{j} + \hat{k})$ passes through the point (2, 3, 4).

Reason (R) : The line passing through (x_1, y_1, z_1) and with direction ratios a, b, c is given by $\vec{r} = x_1\hat{i} + y_1\hat{j} + z_1\hat{k} + \lambda(a\hat{i} + b\hat{j} + c\hat{k})$.

SECTION B

*(Question numbers 21 to 25 carry **2 marks** each.)*

21. If $\cos^{-1} x + \cos^{-1} y = 2\pi$, then find the value of $x^{2020} + y^{2022} + \dfrac{1}{x^{2022} \times y^{2024}}$.

OR

Let the relation R in the set $A = \{1,2,3,4,5\}$ given by $R = \{(a,b) : |a-b| \text{ is divisible by } 2\}$ is an equivalence relation. Then obtain the equivalence classes [1] and [2], of relation R.

22. Find whether the function given as $f(x) = \cos\left(2x + \dfrac{\pi}{4}\right)$, is increasing or decreasing in the interval $\dfrac{3\pi}{8} < x < \dfrac{5\pi}{8}$.

23. Let $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{b} = 3\hat{i} - \hat{j} + 2\hat{k}$ be two vectors. Show that the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular to each other.

OR

Find the angle between the following lines :

$\vec{r} = (1+s)\hat{i} + (s-3)\hat{j} + (3-2s)\hat{k}$; $\vec{r} = p\hat{i} + (2p+1)\hat{j} - (p-1)\hat{k}$.

24. Find the derivative of the function $\cos^{-1}\left[\sin\sqrt{\dfrac{1+x}{2}}\right]$ w.r.t. x, at $x = 1$.

25. If $\vec{a}$ and $\vec{b}$ are unit vectors and θ is the angle between them, then prove that $\sin\dfrac{\theta}{2} = \dfrac{1}{2}|\vec{a} - \vec{b}|$.

SECTION C

*(Question numbers 26 to 31 carry **3 marks** each.)*

26. Find : $\displaystyle\int \frac{2x}{(x^2+1)(x^2+2)}\,dx$.

27. At a nephrology clinic, from past records of patients with chronic kidney disease (CKD):

- 70% of the patients also have hypertension (HTN).
- 50% of the patients also have diabetes mellitus (DM).

Assume that having hypertension and having diabetes are independent events among these CKD patients visiting the clinic.

(i) What is the probability that a randomly chosen CKD patient has both hypertension and diabetes?

(ii) What is the probability that a randomly chosen CKD patient has neither hypertension nor diabetes?

(iii) What is the probability that a randomly chosen CKD patient has exactly one of the two conditions?

OR

A bag contains 4 red and 4 black balls, another bag contains 2 red and 6 black balls. One of the two bags is selected at random and two balls are drawn at random (without replacement) from the bag which are both found to be red. Find the probability that the balls are drawn from the first bag.

28. Evaluate : $\displaystyle\int_0^{\frac{\pi}{4}} \frac{dx}{1+\tan x}$.

OR

Evaluate : $\int_1^3 \frac{\sqrt[3]{x}}{\sqrt[3]{x}+\sqrt[3]{4-x}}dx$.

29. Solve the following differential equation : $(y-\sin^2 x)dx+\tan x dy=0$.

OR

Show that the differential equation $x\frac{dy}{dx}=y(\log y-\log x+1)$, $x>0$ is homogeneous.

Hence, solve it also.

30. Solve the following Linear Programming Problem graphically.

Maximize : $D=(x+y)$

Subject to constraints : $2x+3y\le 120,\ 8x+5y\le 400,\ x\ge 0, y\ge 0$.

Also write the point at which D_{max} is obtained.

31. Find : $\int e^x.\sin 2x\,dx$.

SECTION D

*(Question numbers 32 to 35 carry **5 marks** each.)*

32. Find the area bounded by the curve $y=|x-1|$ and $y=1$, using integration.

33. Show that the function $f:\mathbb{R}\to\{x\in\mathbb{R}:-1<x<1\}$ defined by $f(x)=\frac{x}{1+|x|}$, $x\in\mathbb{R}$ is one-one.

OR

Determine whether the relation R defined on the set $\mathbb{R}$ of all real numbers as $R=\{(a,b): a,b\in\mathbb{R}$ and $a-b+\sqrt{3}\in S$, where S is the set of all irrational numbers$\}$, is reflexive, symmetric and transitive.

34. Check whether the lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-4}{5}=\frac{y-1}{2}=z$ are skew or not.

OR

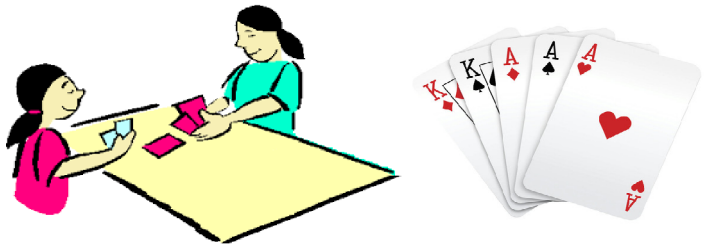
Find the coordinates of the foot of perpendicular drawn from the point A(–1, 8, 4) to the line joining the points B(0, –1, 3) and C(2, –3, –1). Hence, find the image of point A in the line BC.

35. Using matrix method, solve : $2x-3y+5z=13,\ 3x+2y-4z=-2,\ x+y-2z=-2$.

SECTION E

*(Question numbers 36 to 38 carry **4 marks** each.)*
*This section contains **three Case-study / Passage based questions**.*
*First two questions have **three sub-parts** (i), (ii) and (iii) of **marks 1, 1 and 2** respectively.*
*Third question has **two sub-parts** of **2 marks** each.*

36. **CASE STUDY I :** Read the following passage and then answer the questions given below.



On a week-end restriction in Delhi due to G-20 Summit, Soni and Isha could not go nearest mall to have fun. They decided to involve themselves in various indoor activities which included playing with cards as well, apart from some other activities.

Isha found that a card from a pack of 52 playing cards is lost.
From the remaining cards of the pack, two cards are drawn by Soni and she found them to be hearts.

Suppose E_1 be the event that the missing card is a heart; E_2 be the event that the missing card is a non-heart and; E be the event that drawing two heart cards from the remaining cards.

(i) Find $P(E \mid E_1)$ and $P(E_2)$.

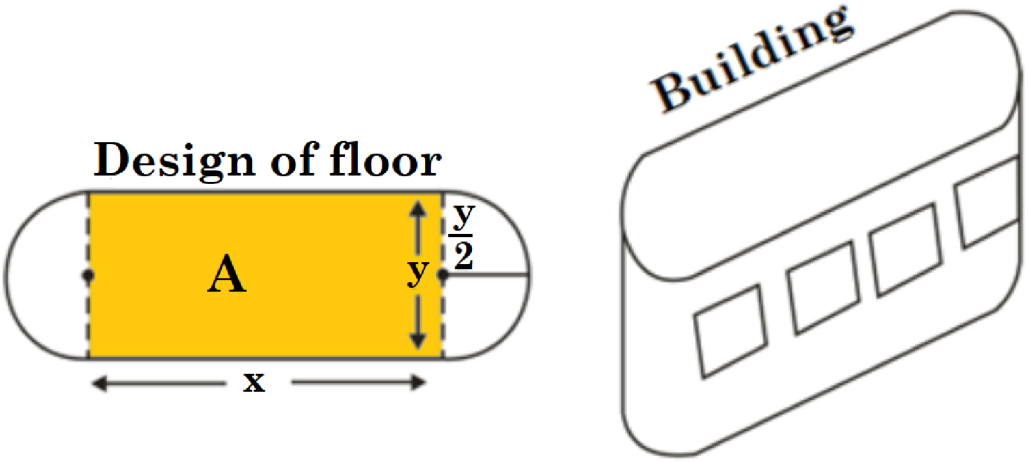
(ii) Find the probability of drawing two hearts from the remaining cards.

(iii) Find the probability of the missing card to be a heart.

OR

(iii) Find the probability of the missing card to be a non-heart.

37. **CASE STUDY II :** Read the following passage and then answer the questions given below.



An architect designs a building for a multi-national company. The floor consists of a rectangular region with semicircular ends having a perimeter of 200 m as shown above.

(i) If x and y represents the length and breadth of the rectangular region, then find the relation between the variables.

(ii) Write the area (A) of the rectangular region, expressed as a function of x.

(iii) Find the maximum value of area (A) of the rectangular region. Use second derivative test.

OR

(iii) The CEO of the multi-national company is interested in finding the area of the 'whole floor' including the semi-circular ends. Obtain an expression in terms of x, representing this area (S).

Also, find $\frac{dS}{dx}$. For maximum value of area (S), what is the condition on x?

38. **CASE STUDY III :** Read the following passage and then answer the questions given below.

The income of a doctor running his private clinic, is given by $I(x) = x^3 - 3x^2 + 3x, 1 \le x \le 30$, where $I(x)$ is the income in ₹ after x days of practice at his clinic.

(i) Is the function $I(x)$ differentiable in the interval $(1,30)$? Justify your answer.
Also determine the critical point (s) of the function $I(x)$.

(ii) The doctor shares his income related information to an insurance agent. Can the agent ensure him for the growth of his income, in a time period of 1 day to 30 days? Justify.

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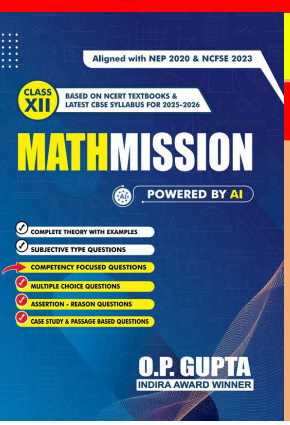

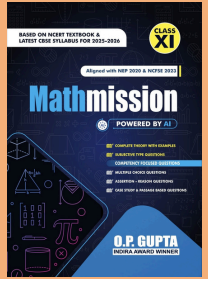

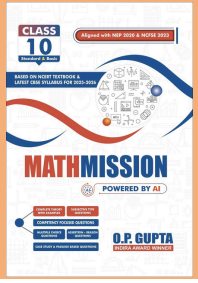

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ABOUT THE AUTHOR

O.P. GUPTA having taught math passionately over a decade, has devoted himself to this subject. Every book, study material or practice sheets, tests he has written, tries to teach serious math in a way that allows the students to learn math without being afraid. Undoubtedly his mathematics books are best sellers on Amazon and Flipkart. His resources have helped students and teachers for a long time across the country. He has contributed in CBSE Question Bank (issued in April 2021). Mr Gupta has been invited by many educational institutions for hosting sessions for the students of senior classes. Being qualified as an electronics & communications engineer, he has pursued his graduation later on with mathematics from University of Delhi due to his passion towards mathematics. He has been honored with the prestigious INDIRA AWARD by the Govt. of Delhi for excellence in education.

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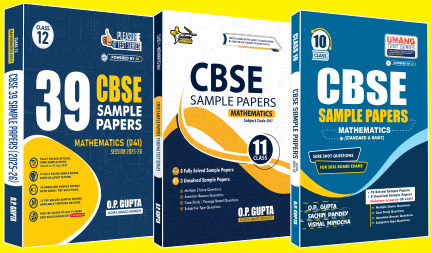

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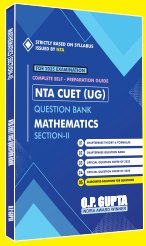

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