Academic Year	**:**	**2025 – 2026**
Examination	**:**	**BOARD**
Month	**:**	**MARCH 2026**
CLASS	**:**	**12**

Paper Code : 041

Roll No. | | | | |

Candidates must write the Code on the title page of the answer-book.

Name of the Candidate :

	NOTE
(I)	Please check that this question paper contains **11** printed pages.
(II)	Code Number given on the right-hand side of the question paper should be written on the title page of the answer-book by the candidate.
(III)	Please check that this question paper contains **38** questions.
(IV)	**Please write down the Serial Number of the question in the answer-book before attempting it.**
(V)	The first 15 minutes time has been allotted to read this question paper. The students will read the question paper only and will not write any answer on the answer-book during this period.
(VI)	Please write down the Roll No. and the Name of the Candidate on the top of the question paper, in the space provided, before reading the questions.

MATHEMATICS

Time allowed : Three hours

Maximum Marks : 80

P.T.O.

General Instructions:

Read the following instructions very carefully and strictly follow them:

1. *This Question Paper has 5 Sections A - E.*
2. ***Section A** has 20 MCQs carrying 1 mark each.*
3. ***Section B** has 5 questions carrying 02 marks each.*
4. ***Section C** has 6 questions carrying 03 marks each.*
5. ***Section D** has 4 questions carrying 05 marks each.*
6. ***Section E** has 3 case based integrated units of assessment with sub-parts of the values of 1, 1 and 2 marks each respectively.*
7. ***All Questions are compulsory**. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E.*
8. *Draw neat figures wherever required. Take π = 22/7 wherever required if not stated.*

Section - A

Section A consists of 20 questions of 1 mark each.

1. If $x = e^{x/y}$, then $\frac{dy}{dx}$ is equal to **1**

(A) $\frac{x-y}{x \log x}$

(B) $\frac{y-x}{\log x}$

(C) $\frac{y-x}{x \log x}$

(D) $\frac{x-y}{\log x}$

2. If $P(A \mid B) = 0.3$, $P(A) = 0.4$ and $P(B) = 0.8$, then $P(B \mid A)$ is equals to **1**

(A) 0.6

(B) 0.3

(C) 0.06

(D) 0.4

3. The rate of change of the surface area of the sphere of radius r when the radius is increasing at the rate of 2 cm/s is proportional to **1**

(A) r

(B) r^2

(C) $1/r$

(D) $1/r^2$

4. The function $f: \mathbb{R} \to \mathbb{R}$ defined by $f(x) = x - 4$ is **1**

(A) Bijective

(B) Surjective but not Injective

(C) Injective but not Surjective

(D) Neither Surjective nor Injective

5. The value of $\int_{-1}^{1} \sin x \, dx$ is equal to **1**

(A) 1

(B) 0

(C) –1

(D) None

6. The area bounded by the parabola $y^2 = 8x$ and its latus rectum is **1**

(A) 16/3 sq. units

(B) 32/3 sq. units

(C) 8/3 sq. units

(D) 64/3 sq. units

7. $\int \frac{\cos 2x - \cos 2\theta}{\cos x - \cos \theta} dx$ is equal to **1**

(A) $2(sinx + xcos\theta) + c$

(B) $2(sinx - xcos\theta) + c$

(C) $2(sinx + 2xcos\theta) + c$

(D) $2(sinx - 2xcos\theta) + c$

8. If area of triangle is 35 sq. units with vertices (2, – 6), (5, 4) and (k, 4). Then k is **1**

(A) 12

P.T.O.

(B) –2

(C) –12, –2

(D) 12, –2

9. $\int 2^{2x} \cdot 3^x dx$ is equal to **1**

(A) $\frac{12^x}{\log 12} + C$

(B) $\frac{2^{2x} \cdot 3^x}{\log 2 \cdot \log 3} + C$

(C) $\frac{4 \cdot 6^x}{\log 6} + C$

(D) None of these

10. One hundred identical coins each with probability p showing up heads are tossed once. **1**
If $0 < p < 1$ and the probability of heads on 50 coins is equal to that of heads showing on 51 coins, then the value of p is

(A) 1/2

(B) 49/101

(C) 50/101

(D) 51/101

11. If the matrix A is both symmetric and skew symmetric, then **1**

(A) A is a diagonal matrix

(B) A is a zero matrix

(C) A is a square matrix

(D) None of these

12. If A and B are independent events, then which of the following is not true? **1**

(A) A' and B are independent events.

(B) A and B' are independent events.

(C) A' and B' are independent events.

(D) None of these

13. The function $f(x) = x - [x]$, where $[x]$ denotes the greatest integer function is **1**

(A) continuous at integer points only

(B) continuous everywhere

(C) continuous at non-integer points only

(D) differentiable everywhere

14. If $x + y = 8$, then the maximum value of xy is **1**

(A) 12

(B) 16

(C) 20

(D) 24

15. If $A = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then $(A^2 - 6A)$ is equal to **1**

(A) $3\,I$

(B) $-5\,I$

(C) $5\,I$

(D) $-3\,I$

16. If $x = 2at$ and $y = at$, then $\frac{d^2y}{dx^2}$ is equal to **1**

(A) 1

(B) –1

(C) 0

(D) None of these

17. The solution of differential equation $xdy - ydx = 0$ represents **1**

(A) a rectangular hyperbola

(B) a parabola whose vertex is at origin

(C) a straight line passing through origin

(D) a circle whose centre is at origin

18. If $\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}|$, then $\vec{a}$, $\vec{b}$ are **1**

(A) perpendicular

(B) like parallel

(C) unlike parallel

(D) coincident

DIRECTION: In question numbers 19 and 20, a statement of **Assertion** (**A**) is followed by a statement of **Reason** (**R**). Choose the correct option.

19. ***Assertion*** **A**: The function $f(x) = x^2 - x + 1$ is strictly increasing on $(-1, 1)$. **1**

Reason **R**: If $f(x)$ is continuous on $[a, b]$ and derivable on (a, b), then $f(x)$ is strictly increasing on $[a, b]$ if $f'(x) > 0$ for all $x \in (a, b)$.

(A) Both Assertion (A) and Reason (R) are true, and reason (R) is the correct explanation of assertion (A)

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

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

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

20. ***Assertion*** **A**: The degree of the differential equation **1**

$$\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0$$

is 3.

Reason **R**: The highest power of the highest order derivative involved in a differential equation, when it is written as a polynomial in derivatives, is called its degree.

(A) Both Assertion (A) and Reason (R) are true, and reason (R) is the correct explanation of assertion (A)

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

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

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

Section - B

Section B consists of 5 questions of 2 marks each.

21. If $y = \log \tan\left(\frac{\pi}{4} + \frac{x}{2}\right)$, prove that $\frac{dy}{dx} - \sec x = 0$. **2**

OR

Differentiate x^x w. r. t. x.

22. Show that $2\sin^{-1}\frac{3}{5} = \tan^{-1}\frac{24}{7}$. **2**

23. Solve: $\sec^2 x \tan y\, dx + \sec^2 y \tan x\, dy = 0$ **2**

24. Ten cards numbered 1 to 10 are placed in a box, mixed up thoroughly and then one card is drawn randomly. If it is known that the number on the drawn card is more than 3, what is the probability that it is an even number? **2**

25. If $x = a\tan^3\theta$ and $y = a\sec^3\theta$, then find the value of $\frac{dy}{dx}$. **2**

OR

If $y = \sin x^{\sin x^{\sin x^{\cdots \text{to } \infty}}}$ prove that $\frac{dy}{dx} = \frac{y^2\cot x}{1 - y\log\sin x}$

SECTION C

Section C consists of 6 questions of 3 marks each.

26. Evaluate: $\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix}$ **3**

OR

If $A = \begin{bmatrix} 8 & 0 \\ 4 & -2 \\ 3 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 8 & 0 \\ 4 & -2 \\ 3 & 6 \end{bmatrix}$, find the matrix X such that $2A + 3X = 5B$.

27. Find all the points of discontinuity of the function f defined by **3**

$$f(x) = \begin{cases} x + 2, & \text{if } x < 1 \\ 0, & \text{if } x = 1 \\ x - 2, & \text{if } x > 1 \end{cases}$$

28. Find the area of a triangle having the points $A(1, 1, 1)$, $B(1, 2, 3)$ and $C(2, 3, 1)$ as its vertices. **3**

P.T.O.

29. Find: $\int \frac{2x^2+1}{x^2-3x+2}\,dx$ **3**

OR

Find $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}}\,dx$.

30. Bag I contains 3 red and 4 black balls while another Bag II contains 5 red and 6 black balls. One ball is drawn at random from one of the bags and it is found to be red. Find the probability that it was drawn from Bag II. **3**

31. Verify that the function $y = a\cos x + b\sin x$ where a, b are real numbers is a solution of the differential equation $\frac{d^2y}{dx^2} + y = 0$. **3**

SECTION D

Section D consists of 4 questions of 5 marks each.

32. Find the coordinates of the foot of the perpendicular drawn from the point $A(-1, 8, 4)$ to the line joining points $B(0, -1, 3)$ and $C(2, -3, -1)$. Hence find the image of the point A in the line BC. **5**

33. Let $\mathbb{N}$ be the set of natural numbers and R be the relation on $\mathbb{N} \times \mathbb{N}$ defined by **5**

$(a, b)\ R\ (c, d)$ if and only if $ad = bc$ for all $a, b, c, d \in \mathbb{N}$.

Show that R is an equivalence relation.

OR

Show that the function $f: \mathbb{N} \to \mathbb{N}$ defined by $f(x) = x^2 + x + 1$ is one-one but not onto.

34. Two tailors A and B earn ₹150 and ₹200 per day respectively. A can stitch 6 shirts and 4 pants per day, while B can stitch 10 shirts and 4 pants per day. Formulate the above L.P.P. mathematically and hence solve it to minimize the labour cost to produce at least 60 shirts and 32 pants. **5**

35. Solve the following system of equations by matrix method. **5**

$3x - 2y + 3z = 8$

$2x + y - z = 1$

$4x - 3y + 2z = 4$

OR

If $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$, find A^{-1}. Using A^{-1} solve the system of equations

$2x - 3y + 5z = 11$

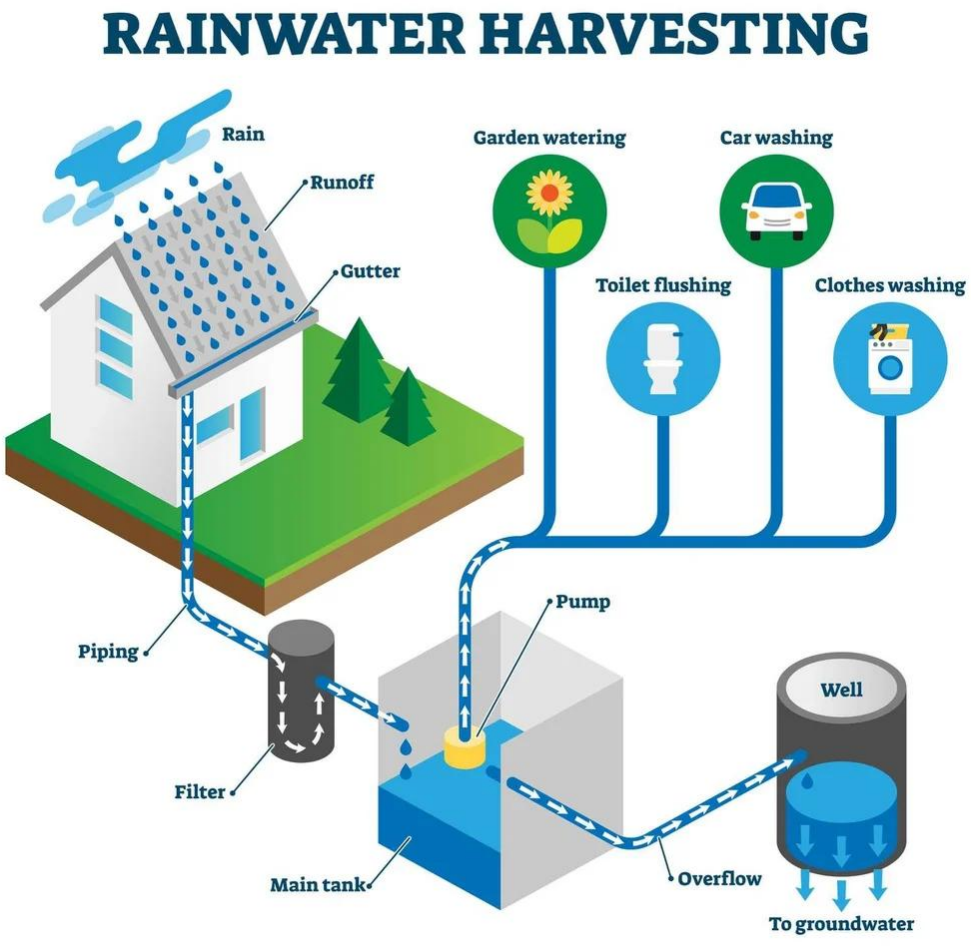
$3x + 2y - 4z = -5$

$x + y - 2z = -3$

SECTION E

This section comprises 3 case study-based questions of 4 marks each.

36. Case Study based – 1



P.T.O.

In order to set up a rain water harvesting system, a tank to collect rain water is to be dug. The tank should have a square base and a capacity of 250 cubic m.

The cost of land is ₹5000 per sq m. and cost of digging increase with depth and for the whole tank it is 40000 h^2, where h is the depth of the tank in metres. x is the side of the square base of the tank in metres.

Based on the above information answer the following questions:

(i) Find the total cost C of digging the tank in terms of x. **2**

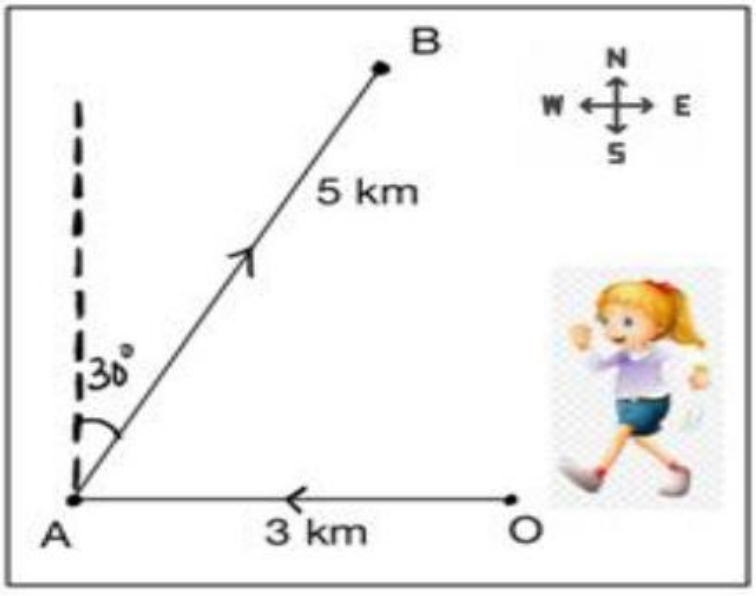
(ii) Find the value of x for which cost C is minimum. **2**

OR

Check whether the cost function $C(x)$ expressed in terms of x increasing or not, where $x > 0$.

37. Case Study based – 2

A girl walks 3 km towards west to reach point A and then walks 5 km in a direction 30° east of north and stops at point B. Let the girl starts from O (origin) and take $\hat{i}$ along east and $\hat{j}$ along north.



Based on the above information, answer the following questions.

(i) Find the scalar components of AB. **1**

(ii) Find the unit vector along AB. **1**

(iii) Find the position vector of point B. **2**

OR

Find the position vector of point A.

38. Case Study based – 3

In an agricultural institute, scientists do experiments with varieties of seeds to grow them in different environments to produce healthy plants and get more yield.

A scientist observed that a particular seed grew very fast after germination. He had recorded growth of plant since germination and he said that its growth can be defined by the function

$$f(x) = \frac{1}{3}x^3 - 4x^2 + 15x + 2$$

where $0 \leq x \leq 10$ where x is the number of days the plant is exposed to sunlight. On the basis of the above information, answer the following questions:

(i) What are the critical points of the function (x)? **2**

(ii) Using second derivative test, find the minimum value of the function. **2**

OR

Find the interval where the function is increasing.

P.T.O.