

--	--	--	--	--

Time : 3 Hours

**MATHEMATICS & STATISTICS**

Subject Code

H	4	6	0	6
---	---	---	---	---

Total No. of Questions : 36 (Printed Pages : 8)

Maximum Marks : 80

- INSTRUCTIONS :**
- (i) The question paper consists of **36** questions.
  - (ii) Question numbers **1-8** are multiple choice type questions of **1** mark each.
  - (iii) Question numbers **9-16** are very short answer type questions of **1** mark each.
  - (iv) Question numbers **17-22** are short answer type-I questions of **2** marks each.
  - (v) Question numbers **23-28** are short answer type-II questions of **3** marks each.
  - (vi) Question numbers **29-34** are long answer type-I questions of **4** marks each.
  - (vii) Question numbers **35-36** are long answer type-II questions of **5** marks each.
  - (viii) There is no overall choice. However, an internal choice is provided in two questions of **4** marks each and two questions of **5** marks each.
  - (ix) Use of calculator is not permitted.
  - (x) Log tables will be supplied on request.
  - (xi) Graph should be drawn on the answer paper itself.

1. If  $\begin{bmatrix} x+10 & 3 \\ 0 & -4 \end{bmatrix} = \begin{bmatrix} 6 & 3 \\ 0 & 4y \end{bmatrix}$ , then  $x + y = \dots\dots\dots$

- 5
- 3
- -3
- -5

2. If  $A = \begin{bmatrix} 3x & 6 \\ 4 & 2 \end{bmatrix}$  is a singular matrix, then the value of 'x' is  $\dots\dots\dots$

- -4
- -2
- 2
- 4

3. The rate at which the revenue changes with respect to the number of items sold at an instant is known as  $\dots\dots\dots$

- Demand
- Average revenue
- Marginal revenue
- Marginal average revenue

4. If  $y = \log(x + 1)$ , then  $\frac{dy}{dx}$  at  $x = 1$  is  $\dots\dots\dots$

- $\frac{1}{2}$
- 2
- $\log 2$
- $\frac{1}{\log 2}$

5. An annuity in which payments are made at the end of each payment period is called .....

- Ordinary annuity
- Annuity due
- Deferred annuity
- Sinking fund

6. The sum of the order and degree of the differential equation

$$\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 - x^2y^5 = 0 \text{ is } \dots\dots\dots$$

- 2
- 3
- 4
- 5

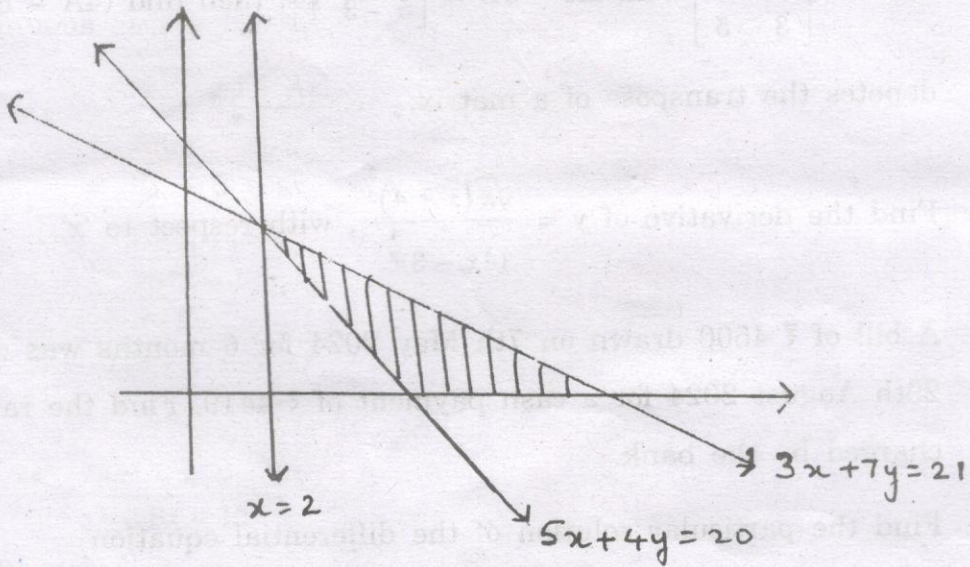
7. If 'A' and 'B' are mutually exclusive events of a sample space 'S', such that

$$P(A) = \frac{1}{2}, P(A \cup B) = \frac{3}{5}, \text{ then } P(B) = \dots\dots\dots$$

- $\frac{1}{10}$
- $\frac{2}{10}$
- $\frac{3}{10}$
- $\frac{5}{10}$

8. Let "L" be the set of all lines in a plane and "R" be a relation defined on the set L by  $\{(L_1, L_2) : L_1 \text{ is perpendicular to } L_2\}$ . Then "R" is .....
- Reflexive
  - Symmetric
  - Transitive
  - Equivalence
9. Using determinants, find the area of triangle ABC whose vertices are A (1, 0), B (0, 2) and C (-3, 2).
10. If  $y = 2^{x^2}$ , find  $\frac{dy}{dx}$
11. Identify the type of matrix  $A = \begin{bmatrix} 0 & -5 & 8 \\ 5 & 0 & 12 \\ -8 & -12 & 0 \end{bmatrix}$
12. A bill was drawn on 20th June 2022 at 3 months after sight and was accepted on presentation on 1st July 2022. It was discounted on 23rd August 2022. Find the legal due date of the bill.
13. Define : Independent events.
14. Evaluate :  $\int_0^1 e^x dx$
15. If  $[x \ 2] \begin{bmatrix} 3 \\ 4 \end{bmatrix} = 2$ , find the value of 'x'.
16. Differentiate '4xy + 5 = 0' with respect to 'x'.

17. Write the constraints for the following shaded region.



18. Define the following terms :

(1) Bill of exchange

(2) Bankers discount

19. If  $x = (t^2 + 1)^3$  and  $y = (2t^2 - 5)^2$ , where 't' is a parameter, find  $\frac{dy}{dx}$ .

20. Verify that  $y = 2e^{3x}$  is the solution of the differential equation  $\frac{d^2y}{dx^2} = \frac{1}{y} \left( \frac{dy}{dx} \right)^2$

21. "X", "Y" and "Z" were partners sharing profit in the ratio 4 : 3 : 2. "Y" retires from the firm and "X" and "Z" decide to share profits in the ratio 3 : 2. Calculate the gaining ratio.

22. Find  $\int \frac{\cos x}{\sqrt{\sin^2 x - 9}} dx$

23. Show that the function  $f : \mathbb{R} \rightarrow \mathbb{R}$  defined by  $f(x) = \frac{2x-3}{4}$ ,  $x \in \mathbb{R}$  is one-one and onto.

24. If  $A^T = \begin{bmatrix} 4 & -2 \\ -1 & 0 \\ 3 & 5 \end{bmatrix}$  and  $2A - 3B = \begin{bmatrix} 2 & 4 & 0 \\ 5 & -3 & 1 \end{bmatrix}$ , then find  $(4A - B)^T$ , where "T" denotes the transpose of a matrix.

25. Find the derivative of  $y = \frac{\sqrt{x}(x+4)^{\frac{3}{2}}}{(4x-3)^{\frac{4}{3}}}$ , with respect to 'x'.

26. A bill of ₹ 4500 drawn on 7th May 2024 for 6 months was discounted on 29th August 2024 for a cash payment of ₹ 4419. Find the rate of interest charged by the bank.

27. Find the particular solution of the differential equation

$$(x^2 - yx^2) dy - (y^2 + x^2 y^2) dx = 0 ; x = y = 2$$

28. Prove that  $\int_0^1 \log\left(\frac{1}{x} - 1\right) dx = 0$

29. Solve the following linear programming problem graphically.

$$\text{Minimize } Z = 20x + 10y$$

Subject to

$$x + 2y \leq 40$$

$$3x + y \geq 30$$

$$4x + 3y \geq 60$$

$$x, y \geq 0$$

30. Solve the following system of linear equations using the matrix method.

$$x + y + z = 3$$

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

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

31. Find the values of the constants 'A' and 'B' if the function  $f(x)$  defined below is continuous at  $x = 0$ .

$$f(x) = \frac{12x \cdot \log(1 + Ax)}{x^2} \quad x < 0$$

$$= 3B + 5 \cos x \quad x = 0$$

$$= \frac{1 - \cos 4x}{x(e^{4x} - 1)} \quad x > 0$$

32. Find :  $\int \frac{5-2x}{(1-x)(2+x)(4+x)} dx$

Or

Find :  $\int \frac{x^3 - 4x^2 - 27x - 20}{x^2 - 6x - 15} dx$

33. Three boxes are given each containing red and black marbles as indicated below :

Box I : 6 red and 4 black marbles

Box II : 4 red and 6 black marbles

Box III : 2 red and 8 black marbles.

A box is chosen at random and a marble is drawn from the box. The marble drawn is red. Find the probability that the marble drawn is from box I.

34. Amit, Rohan and Snehal started a partnership and invested ₹ 1,00,000, ₹ 80,000 and ₹ 1,20,000 respectively. Snehal took a loan of ₹ 70,000 and paid 9% interest to the firm. The firm earned a profit of ₹ 1,43,700, in addition to the interest from the loan. Find each partner's total earnings if the profit is distributed in the ratio of their capital investment.

Or

'A', 'B' and 'C' invested ₹ 20,000, ₹ 18,000 and ₹ 12,000 in a business. 'A' and 'B' receives 12% and 8% of annual profit for services. The remaining profit is divided among 'A', 'B' and 'C' in proportion to their capitals. At the end of the year, 'A' receives altogether ₹ 648 more than 'B'. Find the annual profit.

35. A company is planning to market a new model of a product. From the market survey it is found that the demand function is  $x = -1500p + 30,000$ . The fixed cost to the company for the product is ₹ 28,000 and the cost per unit is ₹ 8. What price should the company charge to obtain maximum profit.

Or

Given the total cost function for 'x' units of a commodity as

$$C(x) = \frac{x^5}{5} + 7x^4 + 4x^2 - 3x + 15.$$

Find (1) Marginal Cost

(2) Average Cost.

Also show that  $\frac{d}{dx}(AC) = \frac{x \cdot MC - C(x)}{x^2}$ , where MC is Marginal Cost and AC is Average Cost.

36. What equal payments made at the beginning of each month for 8 years will pay for a piece of land, priced at ₹ 6,19,600, if the rate of interest is 12% per annum compounded monthly. (Use log tables).

Or

Ms. Pearl wants to collect ₹ 6,10,000 to purchase a car after 16 years. How much money she should deposit at the end of each year in a company paying compound interest at the rate of 16% p.a. (Use log tables).