

XIIth MATHS



Practice Sheet-04

Syllabus : Unit 1 Relations and Functions(NCERT Chapter 1-2)

Unit 2 Algebra (NCERT Chapter 3-4)

Unit 2 Calculus (NCERT Chapter 5 and 6)

SUBJECT: MATHEMATICS

Code : 041

MAX. MARKS : 60

DURATION : 2 hrs.

1. This Question Paper has 5 Sections A-E.
2. **Section A** has 14 MCQs carrying 1 mark each.
3. **Section B** has 3 questions carrying 02 marks each.
4. **Section C** has 4 questions carrying 03 marks each.
5. **Section D** has 2 questions carrying 04 marks each.
6. **Section E** has 4 questions carrying 05 marks each .

Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated

SECTION – A

Questions 1 to 14 carry 1 mark each.

1. If A and B are square matrices of same order then $AB' - BA'$ is a :

(a) skew symmetric matrix (b) symmetric matrix (c) null matrix (d) unit matrix.

2. If $A = \begin{bmatrix} 2 & -1 & 3 \\ 4 & 5 & -6 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & -6 \end{bmatrix}$ then :

(a) only AB is defined (b) Only BA is defined
(c) AB and BA are both defined (d) AB and BA are not defined .

3. If $f(x) = \begin{cases} \frac{x^2-1}{x-1}, & \text{when } x \neq 1 \\ 2k, & \text{when } x = 1 \end{cases}$ is given to be continuous at $x=1$, then the value of k is _____

(a) -1 (b) -2 (c) 1 (d) 2

- 4 . The relation $S = \{(a,b) : a,b \in \mathbb{Z} \text{ and } |a-b| \text{ is divisible by } 4\}$ in the set $A = \{x \in \mathbb{Z} : 0 \leq x \leq 12\}$ is an equivalence relation. The Equivalence class of 1 is

(a) {1,5,8,11} (b) {1,5,9} (c) {2,6,10} (d) $\emptyset$

5. If A and B are matrices of order 3 and $|A|=5$, $|B|=3$ then the value of $|3AB|$ is:

(a) 605 (b) 205 (c) 405 (d) 305

6. Which of the following function is continuous?

- (a) Modulus function (b) signum function
(c) reciprocal function (d) greatest integer function

7. If A is a square matrix of order 3 and $|A| = 5$ then $|-A| = ?$

- (a) 5 (b) -5 (c) 15 (d) 1

8. If $f'(1) = 2$ and $y = f(\log x)$, then find $\frac{dy}{dx}$ at $x = e$.

- (a) $\frac{2}{e}$ (b) $\frac{3}{e}$ (c) $\frac{1}{e}$ (d) $\frac{2}{5e}$

9. The derivative of $2x + y = \sin y$ is:

- (a) $\frac{2}{\cos y}$ (b) $\frac{2}{\cos y + 3}$ (c) $\frac{2}{\cos y}$ (d) none of these

10. If $y = Ae^{5x} + Be^{-5x}$ then $\frac{d^2y}{dx^2} = ?$

- (a) $25y$ (b) $5y$ (c) $-25y$ (d) $15y$

11. If $y = x(x - 3)^2$ decreases for the values of x given by

- (a) $1 < x < 3$ (b) $x < 0$ (c) $x > 0$ (d) $0 < x < \frac{3}{2}$

12. If $x = \sin^3 t$, $y = \cos^3 t$ then $\frac{dy}{dx} = ?$

- (a) $\tan t$ (b) $\cot t$ (c) $-\tan t$ (d) $-\cot t$

13. Assertion (A) : The domain of the function $f(x) = \cos^{-1}\left(\frac{2x}{3}\right)$ is $x \in \left[-\frac{3}{2}, \frac{3}{2}\right]$

Reason (R) : $\cos^{-1} x$ is defined when $-1 \leq x \leq 1$.

- (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(c) (A) is true but (R) is false.
(d) (A) is false but (R) is true.

14. Assertion (A) : If $x = at^2$, $y = 2$ at then $\left(\frac{d^2y}{dx^2}\right)_{x=2} = -\frac{1}{16a}$

Reason (R) : $\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^2 \times \left(\frac{dt}{dx}\right)^2$

- (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(c) (A) is true but (R) is false.
(d) (A) is false but (R) is true.

SECTION – B

Questions 15 to 17 carry 2 mark each.

15. If $(A - 2I)(A - 3I) = 0$, where $A = \begin{bmatrix} 4 & 2 \\ -1 & x \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, find x.

16. Differentiate $\log_{x^2} \sin x$.

17. Find whether the function $f(x) = \cos\left(2x + \frac{\pi}{4}\right)$ is increasing or decreasing in $x \in \left(\frac{3\pi}{8}, \frac{5\pi}{8}\right)$

OR

A spherical ice-ball melts uniformly. When its radius is 10 cm, determine the rate of change of its volume with respect to the radius.

SECTION – C**Questions 18 to 21 carry 3 mark each.**

18. Show that $\tan\left(\frac{1}{2}\sin^{-1}\frac{3}{4}\right) = \frac{4-\sqrt{7}}{3}$

19. Prove that every square matrix can be expressed as sum of symmetric and skew symmetric matrix.

20. If $x = \tan\left(\frac{1}{a}\log y\right)$, show that $(1+x^2)\frac{d^2y}{dx^2} + (2x-a)\frac{dy}{dx} = 0$.

21. The relation R in the set Z of integers given by $R = \{(a,b) : 2 \text{ divides } (a-b)\}$, show that R is an equivalence relation.

Or

Let $f: W \rightarrow W$ be defined as $f(n) = \begin{cases} n+1, & \text{If } n \text{ is even} \\ n-1, & \text{If } n \text{ is odd} \end{cases}$ Where W is the set of all whole numbers.

Show that f is one one and onto function.

SECTION – D**Questions 22 to 23 carry 4 mark each.**

22. Three car dealers, say A, B and C in three type of car, namely Hatchback car, sedan cars, SUV cars. The sale figure of 2021 and 2022 showed that dealer A sold 120 Hatchback, 50 Sedan, 10 SUV cars in 2021 and 300 Hatchback, 150 Sedan, 20 SUV cars in 2022; dealer B sold 100 Hatchback, 30 sedan, 5 SUV cars in 2021 and 200 Hatchback, 50 Sedan, 6 SUV cars in 2022; dealer C sold 90 Hatchback, 40 Sedan, 2 SUV cars in 2021 and 100 Hatchback, 60 Sedan, 5 SUV Cars in 2022. Based on the above information give the answer of the following questions.

(i) Find the matrix form of the total number of cars sold in two given years by each dealer. **(1 Mark)**

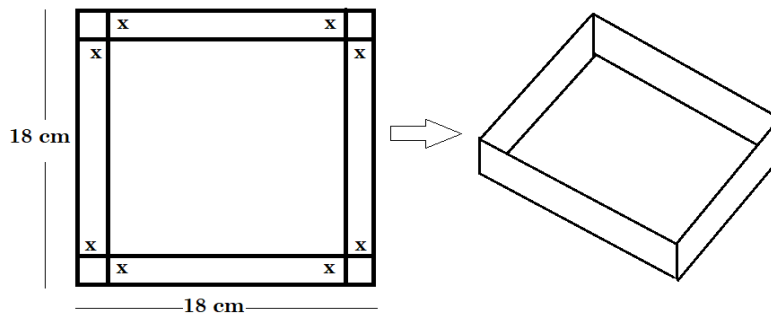
(ii) Find the total sale in year 2023 of all three car, if sale in 2022, is double the sum of last two year for each car. **(1 Mark)**

(iii) If each dealer receive profit of Rs 50,000 on sale of a Hatchback, Rs 1,00,000 on Sale of a Sedan and Rs 2,00,000 on sale of a SUV, then find the matrix form of the amount of profit received in the year 2022 by each dealer. **(2 Mark)**

Or

If each dealer receive loss of Rs 25,000 on sale of a Hatchback, Rs 10,000 on Sale of a Sedan and Rs 75,000 on sale of a SUV, then find the matrix form of the amount of loss received in the year 2022 by each dealer. **(2 Mark)**

- 23.** For an EMC project, a student of Class XII makes an open cardboard box for a jewellery shop from a square sheet of side 18 cm by cutting off squares from each corner and folding up the flaps.



Assume that x be the side of squares cut off from each corner (as shown in the diagram above). Based on the given information, answer the following questions.

- (i) For the open box, find the length, breadth and height in terms of x . **(1 Mark)**
- (ii) Write an expression for the volume of the open box. **(1 Mark)**
- (iii) For what value of x , the open box will have maximum volume? Use derivatives. **(2 Mark)**

OR

- (iii) Find the maximum value of volume of the open box. Use derivatives.

SECTION – E

Questions 24 to 27 carry 5 mark each.

- 24.** Use product $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix} \begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix}$ to solve the system of equations .

$$x - y + 2z = 1, 2y - 3z = 1, 3x - 2y + 4z = 2.$$

- 25.** If $y = (\log x)^x + x^{x \cos x}$ find $\frac{dy}{dx} = ?$

- 26.** A wire of length 28 m is to be cut into two pieces. One of the pieces is to be made into a square and the other into a circle. What should be the length of the two pieces so that the combined area of the square and the circle is minimum?

OR

A particle is moving along the curve represented by the polynomial $f(x) = (x - 2)^2(x - 1)$.

Find the rate at which the particle is moving. What are the critical points of polynomial $f(x)$? Find the interval(s) where $f(x)$ is strictly increasing/decreasing.

- 27.** Prove that the semi vertical angle of the right circular cone of given volume and least curved surface area is $\cot^{-1} \sqrt{2}$

End

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