

XIIth MATHS



Practice Sheet 06

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

Unit 2 Algebra (NCERT Chapter 3-4)

Unit 3 Calculus (NCERT Chapter 5,6,7,8,9)

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 $y = \sin^{-1}(\cos 3x)$, then $\frac{dy}{dx}$ equals to

- (a) -3 (b) 3 (c) 0 (d) $-\frac{1}{3}$

2. The domain of the function $\sin^{-1}(3x - 1)$ is

- (a) $[0, 1]$ (b) $[-1, 1]$ (c) $(-1, 1)$ (d) $[0, \frac{2}{3}]$

3. If $x = t^2 + 1$ and $y = 2at$, then $\frac{d^2y}{dx^2}$ at $t = 1$ equals to

- (a) $\frac{a}{2}$ (b) $\frac{-a}{2}$ (c) -a (d) 0

4. The function $f(x) = \begin{cases} x^2 & \text{for } x < 1 \\ 2 - x & \text{for } x \geq 1 \end{cases}$ is

- (a) not differentiable at $x=1$ (b) differentiable at $x=1$
(c) not continuous at $x=1$ (d) neither continuous nor differentiable at $x=1$

5. The value of k ($k < 0$) for which the function f defined as

$$f(x) = \begin{cases} \frac{1 - \cos kx}{x \sin x} & \text{for } x \neq 0 \\ \frac{1}{2} & \text{for } x = 0 \end{cases} \text{ is continuous as } x = 0 \text{ is}$$

- (a) $\frac{-1}{4}$ (b) -1 (c) $\frac{-1}{3}$ (d) $\frac{-1}{2}$

6. If $y = \log(\cos e^x)$, then $\frac{dy}{dx}$ is

- (a) $\cos e^{x-1}$ (b) $e^{-x} \cos e^x$ (c) $e^x \sin e^x$ (d) $-e^x \tan e^x$

7. Given that A is a nonsingular matrix of order 3 such that $A^2 = 2A$, then value of $|2A|$ is
 (a) 4 (b) 8 (c) 64 (d) 16
8. If A and B are matrices of same order, then $(AB^T - BA^T)$ is
 (a) Skew-symmetric matrix (b) Null matrix
 (c) Symmetric matrix (d) Unit matrix
9. Find the intervals in which the function f given by $f(x) = x^2 - 4x + 6$ is strictly increasing:
 (a) $(-\infty, 2) \cup (2, \infty)$ (b) $(2, \infty)$
 (c) $(-\infty, 2)$ (d) $(-\infty, 2] \cup [2, \infty)$
10. The matrix $\begin{bmatrix} 0 & 3 & 6 \\ -3 & 0 & -9 \\ -6 & 9 & 0 \end{bmatrix}$ is a
 (a) diagonal matrix (b) Symmetric matrix
 (c) skew symmetric matrix (d) scalar matrix
11. Given that $A = [a_{ij}]$ is a square matrix of order 3×3 and $|A| = -3$, then the value of $\sum_{i=1}^3 a_{i2} A_{i2}$ is
 (a) 3 (b) -3 (c) 0 (d) 9
12. The function $f(x) = (x - \sin x)$ decreases for
 (a) all x (b) $x < \frac{\pi}{2}$ (c) $0 < x < \frac{\pi}{4}$ (d) no values of x
13. The value of x for which $(x + x^2)$ is maximum is
 (a) $\frac{3}{4}$ (b) $\frac{-1}{2}$ (c) $\frac{1}{2}$ (d) $-\frac{3}{4}$
14. If $e^x + e^y = e^{x+y}$, then $\frac{dy}{dx}$ is
 (a) e^{y-x} (b) $-e^{y-x}$ (c) e^{x+y} (d) $2e^{x-y}$

SECTION – B

Questions 15 to 17 carry 2 mark each.

15. Find the value of $\sin^2 \left(\cos^{-1} \frac{1}{2} \right) + \cos^2 \left(\sin^{-1} \frac{1}{2} \right)$.
16. Prove that the greatest integer function $f: \mathbb{R} \rightarrow \mathbb{R}$ given by $f(x) = [x]$ is neither one one nor onto.
17. Find $\int \frac{\sin 2x}{\sqrt{9 - \cos^4 x}} dx$.

SECTION – C

Questions 18 to 21 carry 3 mark each.

18. Find the differential of $\sin^2 x$ with respect to $e^{\cos x}$.
19. Solve the differential equation $\frac{dy}{dx} = \left[\frac{x + y \cos x}{1 + \sin x} \right]$

20. If $y^x = e^{y-x}$, prove that $\frac{dy}{dx} = \frac{(1+\log y)^2}{\log y}$.

21. Show that of all the rectangles with a given perimeter, the square has the largest area.

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

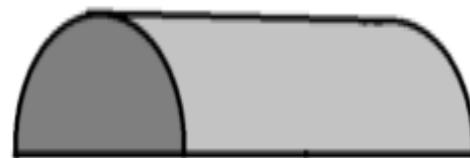
22. On her birthday, Khushi decided to donate some money to children of an orphanage home. If there were 8 children less, everyone would have got Rs 10 more. However, if there were 16 children more, everyone would have got Rs 10 less. Let the number of children be x and the amount distributed by Khushi for one child be Rs y .



Based on the above information, answer the following questions:

- (i) Find the number of children who were given some money by Khushi.
- (ii) How much amount is given to each child by Khushi?
- (iii) How much amount Khushi spends in distributing the money to all the children of the orphanage?

23. Some young entrepreneurs started an industry “Young Achievers” for casting metal into various shapes. They put up an advertisement online stating the same and expecting order to cast metal for toys, sculptures, decorative pieces and more. A group of friends wanted to make innovative toys and hence contacted the “Young Achievers” to order them to cast metal into solid half cylinders with a rectangular base and semi-circular ends.



Based on the above information, answer the following questions:

- (i) Find the volume (V) of the casted half cylinder.
- (ii) For the given half – cylinder of volume V , find the total surface area S is minimum.
- (iii) Find the total surface area S can be expressed in terms of V and r .

SECTION – E
Questions 24 to 27 carry 5 mark each.

24. Make a rough sketch of the region given below and find its area using integration

$$\{(x, y): 0 \leq y \leq x^2 + 3, 0 \leq y \leq 2x + 3, 0 \leq x \leq 3\}$$

25. Find $\int \frac{\sin x}{\sin^3 x + \cos^3 x} dx$.

Or

$$\int_0^\pi \frac{x \tan x}{\sec x + \tan x} dx$$

26. Let $A = \{x: x \in \mathbb{Z}, 0 \leq x \leq 15\}$. Show that $R = \{(a, b): a, b \in A, |a - b| \text{ is multiple of } 7\}$ is an equivalence relation. Also write the equivalence class of [1]

Or

If $\mathbb{N}$ denotes the set of all natural numbers and R be the relation on $\mathbb{N} \times \mathbb{N}$ defined by $(a, b) R (c, d)$, if $ad(b + c) = bc(a + d)$. Show that R is an equivalence relation.

27. If $A = \begin{bmatrix} 3 & 1 & 2 \\ 3 & 2 & -3 \\ 2 & 0 & 1 \end{bmatrix}$, Find A^{-1}

Hence solve the system of equations:

$$3x + 3y + 2z = 1, x + 2y = 4, 2x - 3y - z = 5$$

End

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