SECTION NAME

Sample Maths

DURATION: 0 Hours 30 Minutes **DATE: 2025-03-28**

SYLLABUS

Mathematics: | Relations And Functions, Matrices.

(Mathematics)

1. Let L denotes the set of all straight lines in a plane. Let a relation R be defined by α R β ⇔ α ⊥ β, α, β ∈ L. Then R is

A) reflexive **B)** symmetric

C) transitive **D)** None of these

2. Let R be a relation on the set A of ordered pairs of positive integers defined by (x, y) R(u, v), if and only if xv = yu. Then, R is

A) Reflexive **B)** Symmetric

C) Transitive **D)** An equivalence relation

3. The relation R defined on a set A is anti symmetric if (a, b) ∈ R ⇒ (b, a) ∈ R for

A) Every (a, b) ∈ R **B)** No (a, b) ∈ R

C) No (a, b), a ≠ b, ∈ R **D)** None of these

4. Let X be a family of sets and R be a relation on X defined by 'A is disjoint from B'. Then R is

A) Reflexive **B)** Symmetric

C) Anti-symmetric **D)** Transitive

5. Let R be a relation on a set A such that R = R^{-1}, then R is

A) Reflexive **B)** Symmetric

C) Transitive **D)** None of these

6. $f(x) = x + \sqrt{x^2}$ is a function from R → R, then f(x) is

A) injective **B)** surjective

C) bijective **D)** none of these

7. Let f : (−1, 1) → B be a function defined by $f(x) = \tan^{-1} \frac{2x}{1-x^2}$, then f is both one-one and onto, when B is in the interval

A) $\left(0, \frac{\pi}{2}\right)$ **B)** $\left[0, \frac{\pi}{2}\right)$

C) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ **D)** $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

8. Let $f : \mathbb{R} \to A = \left\{y : 0 \le y < \frac{\pi}{2}\right\}$ be a function such that f(x) = $\tan^{-1}$ (x^2 + x + k), where k is a constant, The minimum value of k for which f is an onto function, is

A) 1 **B)** 0

C) $\frac{1}{4}$ **D)** None of these

9. Consider two functions f : R → R and g : R → R defined as f(x) = x^2 and $g(x) = 2 + x^{\frac{1}{2}}$. Which of the following statements is correct?

A) fog(x) = gof(x) **B)** fog(x) − gof(x)=g(x)

C) fog is an invertible function **D)** gof is an invertible function

10. A function f from the set of natural numbers to integers defined by

$$f(n) = \begin{cases} \frac{n-1}{2}, & \text{when } n \text{ is odd} \\ -\frac{n}{2}, & \text{when } n \text{ is even} \end{cases}$$ is

A) Neither one-one nor onto **B)** One-one but not onto

C) Onto but not one-one **D)** One-one and onto both

11. Let $f(x) = \frac{ax+b}{cx+d}$. Then fof(x) = x provided that

A) d = −a **B)** d = a

C) a = b = c = d = 1 **D)** a = b = 1

12. Consider a binary operation * on N defined as a * b = a^3 + b^3. Choose the correct answer.

A) Is * both associative and commutative? **B)** Is * commutative but not associative?

C) Is * associative but not commutative? **D)** Is * neither commutative nor associative?

13. If f(x) = ax + b and g(x) = cx + d, then f(g(x)) = g(f(x)) is equivalent to

A) f(a) = g(c) **B)** f(b) = g(b)

C) f(d) = g(b) **D)** f(c) = g(a)

14. For $x \in \mathbb{R}$, two real valued functions f(x) and g(x) are such that, $g(x) = \sqrt{x} + 1$ and $fog(x) = x + 3 - \sqrt{x}$. Then f(0) is equal to

A) 1 **B)** 5

C) 0 **D)** −3

15. If $f(x) = 8x^3$ and $g(x) = x^{1/3}$, then

A) fog(x) = 2x **B)** fog = 8x

C) gof(x) = $2x^{1/3}$ **D)** gof(x) = $x^{1/3}$

16. For what values of x and y are the following matrices equal $A = \begin{bmatrix} 2x+1 & 3y \\ 0 & y^2 - 5y \end{bmatrix}$, $B = \begin{bmatrix} x+3 & y^2+2 \\ 0 & -6 \end{bmatrix}$

A) 2, 3 **B)** 3, 4

C) 2, 2 **D)** 3, 3

17.

Column - I (Equal matrices)	Column -II (Values of x, y, z)
A. $\begin{bmatrix} 4 & 3 \\ x & 5 \end{bmatrix} = \begin{bmatrix} y & z \\ 1 & 5 \end{bmatrix}$	1. x = 2. y = 4, z = 0
B. $\begin{bmatrix} x+y & 2 \\ 5+z & xy \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ 5 & 8 \end{bmatrix}$	2. x = 2, y = 4, z = 3
C. $\begin{bmatrix} x+y+z \\ x+z \\ y+z \end{bmatrix} = \begin{bmatrix} 9 \\ 5 \\ 7 \end{bmatrix}$	3. x = 1, y = 4, z = 3

A)

A	B	C
1	2	3

B)

A	B	C
3	2	1

C)

A	B	C
2	1	3

D)

A	B	C
3	1	2

18. Consider the matrices A, B, and C defined as follows:

$A = \begin{bmatrix} 2 & -1 & 5 \\ -6 & 3 & -2 \end{bmatrix}, B = \begin{bmatrix} 1 & -3 \\ 2 & -1 \\ 4 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} -20 & -8 \\ 6 & -9 \end{bmatrix}$

If P = AB + C, then P is a/an

A) identity matrix **B)** scalar matrix

C) symmetric matrix **D)** skew-symmetric matrix

19. A 2 × 2 matrix A = [a_{ij}], whose elements are given by $a_{ij} = \frac{i}{j}$, is

A) $\begin{bmatrix} 1 & 1/2 \\ 2 & 1 \end{bmatrix}$ **B)** $\begin{bmatrix} 1 & 2 \\ 1/2 & 1 \end{bmatrix}$

C) $\begin{bmatrix} 1/2 & 1 \\ 2 & 1 \end{bmatrix}$ **D)** $\begin{bmatrix} 1/2 & 1 \\ 1 & 2 \end{bmatrix}$

20. If a matrix has 8 elements, then which of the following will not be a possible order of the matrix?

A) 1×8 **B)** 2×4

C) 4×2 **D)** 4×4