B.K. BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
A CBSE DAY-CUM-BOYS' RESIDENTIAL SCHOOL

PERIODIC TEST-1, 2025-26
MATHEMATICS (041)

Class: XIIA | **Time: 1hr**
Date: 01.07.25 | **Max Marks: 25**
Admission no: | **MARKING KEY** | **Roll no:**

General Instructions:
Question 1 to 5 carries ONE mark each. Questions 6 to 7 carries TWO marks each. Questions 08 to 09 carries THREE marks each. Question 10 to 11 carry FIVE mark each.

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1. Let T be the set of all triangles in the Euclidean plane, and let a relation R on T be defined as a R b if a is congruent to b, ∀ a,b ∈ T. Then R is
   a) Reflexive but not transitive   b) transitive but not symmetric
   c) Equivalence   d) None of these

2. Let us define a relation R in R as aRb if a$\geq b$. Then R is
   a) An equivalence relation   **b) reflexive , transitive but not symmetric**
   c) symmetric, transitive but not reflexive.   d) neither transitive nor reflexive but symmetric.

3. Let f:R→ R be defined by f(x)= $\frac{1}{x}$, ∀ x∈R. Then f is
   a) One-one   b) onto   c) bijective   **d) f is not defined.**

4. Which of the following functions from Z into Z are bijection?
   a) $f(x)= x^3$ **b) f(x)= x+2**   c) f(x) = 2x+1   d) x^2+1

5. If $3\tan^{-1}x + \cot^{-1}x = \pi$, *then x equals*
   a) 0   **b) 1**   c) -1   d) $\frac{1}{2}$

6. Let R= $\{(a, a^3): a \text{ is a prime number less than } 5\}$ *be a relation. find the range of R.*

Ans; a is a prime number less than 5, R=$\{(2,8),(3,27)\}$
Range is (8, 27)

7. Write the principle value of $\tan^{-1}\left[\sin\left(-\frac{\pi}{2}\right)\right]$.

Ans: $\tan^{-1}(-1) = -\tan^{-1}(\tan\frac{\pi}{4}) = -\frac{\pi}{4}$

8. Let f: W→ W be defined as f (n) = $\begin{cases} n+1, \text{if } n \text{ is even} \\ n-1, \text{if } n \text{ is odd} \end{cases}$,show that f is bijective function.

Ans: Let x,y ∈ W, if x and y both are even, f(x) = f(y) or x=y.
If x and y are odd, f(x) = f(y) or x=y.
If x is even and y is odd, x$\neq y$ or f(x) ≠f(y)
If x is odd and y is even, x≠y or f(x) ≠f(y)
Hence, f is one-one.
Range of f is $\{0,1,2,3,4,5,...\}$= codomain
Hence f is onto.

9. Find the principle value of $\tan^{-1}(\sqrt{3}) + \cot^{-1}(-\sqrt{3})$.

Ans: $\frac{\pi}{3} + \cot^{-1}(-\cot\frac{\pi}{6}) = \frac{\pi}{3} + \cot^{-1}(\cot(\pi - \frac{\pi}{6}))$

$\frac{\pi}{3} + \frac{5\pi}{6} = \frac{7\pi}{6}$

10. If Z is the set of all integers and R is the relation on Z defined as R= $\{(a, b): a, b \in Z \text{ and } a - b \text{ is divisible by } 5\}$, Prove that R is equivalence relation.

Ans: Reflexive: for any x∈ Z, we have x-x =0 , which is divisible by 5, Therefore R is reflexive.

Symmetric: for any x,y ∈ Z, we have x-y is divisible and y-x is also divisible by 5, Therefore R is Symmetric.

Transitive: for any x,y,z ∈ Z, we have x-y is divisible by and y-z is also divisible by 5, then x-z is also divisible by 5, Therefore R is Transitive. Hence R is a Equivalence relation.

11. Show that the function f in A= R- $\left\{\frac{2}{3}\right\}$ defined as f(x) = $\frac{4x+3}{6x-4}$ is one-one and onto function.

Ans: To show f in one-one

$f(x_1)=f(x_2)$, $\frac{4x_1+3}{6x_1-4} = \frac{4x_2+3}{6x_2-4}$

$x_1 = x_2$

To show f is onto

Y= f(x)

$y = \frac{4x+3}{6x-4}$

$x = \frac{4y+3}{6y-4} \in B = R - \frac{2}{3}$

for every value of y except y=$\frac{2}{3}$, there is a pre-image x= $\frac{4y+3}{6y-4}$=g(y).

therefore f is onto.

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