INDIAN SCHOOL AL WADI AL KABIR

Unit Test (2024 - 2025)

MARKING SCHEME

Class: XII | Sub: MATHEMATICS (041) | Max Marks: 30

Date: 30.05.2024 | Set-II | Time: 1 hour

General Instructions:

1. This question paper is divided in to 4 sections- A, B, C and D.
2. Section A comprises of 7 questions of 1 mark each.
3. Section B comprises of 3 questions of 2 marks each.
4. Section C comprises of 3 questions of 3 marks each.
5. Section D comprises of 2 case study-based question.
6. Internal choice has been provided.

SECTION – A

1. The domain of the function $cos^{-1}(2x-3)$? (1m)

C [1, 2]

2. If $A=\begin{bmatrix}6 & -2\\ 1 & 0\end{bmatrix}$ $then\ A^{-1}=$ _____. (1m)

C $\begin{bmatrix}0 & 1\\ -\frac{1}{2} & 3\end{bmatrix}$

3. If A = $\begin{bmatrix}a & c & -1\\ b & 0 & 5\\ 1 & -5 & 0\end{bmatrix}$ $is\ a\ skew\ symmetric\ matrix$, then the value of $2a-(b+c)$= (1m)

A 0

4. If the points A (−2, −5), (3, 5), (2, k) are collinear k is: (1m)

D 3

5. The value of the expression $\cos^{-1}(\cos\frac{3\pi}{4})+sin^{-1}\left(sin\frac{3\pi}{4}\right)$ is: (1m)

A π

6. If A= $\begin{bmatrix}5 & 0 & -1\\ 0 & 2 & 0\\ 0 & 10 & -1\end{bmatrix}$ then $|A|+|adjA|=$ (1m)

B 90

7. **Assertion (A):** Let f be the greatest integer function defined from R → R such that f(x) =[x]. then f is neither one to one nor onto. (1m)

Reason (R) : A function f : A → B is said to be one to one function if range of f = B

C) A is true and R is false

SECTION – B

8. Show that a function $f : [0, \infty) \rightarrow R$ defined as f(x) = $x^2 + 6x + 1$ is one-one but not onto

Let $f(x_1) = f(x_2)$ (1m)

Showing $x_1 = x_2$ Hence f is one to one

Show codomain not equal to range (1m)

- **OR** -

Let L be the set of lines and R be the relation defined by

$R = \{(l_1, l_2): l_1 \text{ is perpendicular to } l_2\}$. Check whether the relation R is symmetric and transitive.

Proving nether reflexive nor transitive but symmetric (2m)

9. If $a = \sin^{-1}\left(-\frac{1}{\sqrt{2}}\right) + \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ and $b = \tan^{-1}(1) + \sec^{-1}(2)$ (2m)

then find the value of $a + b$

If $a = \sin^{-1}\left(-\frac{1}{\sqrt{2}}\right) + \cos^{-1}\left(\frac{\sqrt{3}}{2}\right) = -\frac{\pi}{4} + \frac{\pi}{6}$ and $b = \tan^{-1}(1) + \sec^{-}(2) = \frac{\pi}{4} + \frac{\pi}{3}$ 1+1/2

$a + b = \frac{\pi}{2}$ 1/2

10. $A = \begin{bmatrix} 1 & 2 & 3 \\ -1 & 0 & 2 \\ 1 & -5 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 0 & -1 \\ 3 & 2 \end{bmatrix}$ then find AB= $\begin{bmatrix} 10 & 6 \\ 5 & 2 \\ 1 & 7 \end{bmatrix}$ (2m)

SECTION – C

11. Determine whether the relation R on the set real numbers given by (1+1 +1m)

R= {(a b): $a \leq b^3, a, b \in R$} is reflexive, symmetric or transitive.

Neither reflexive nor symmetric nor transitive

12. Using matrices solve the following system of the equations:

$x + 2y - z = 2$ $\quad x - 2y + z = 8$ $\quad 2x - y - z = 7$

$$\begin{bmatrix} 1 & 2 & -1 \\ 1 & -2 & 1 \\ 2 & -1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ 8 \\ 7 \end{bmatrix}$$ (1m)

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{6}\begin{bmatrix} 3 & 3 & 0 \\ 3 & 1 & -2 \\ 3 & 5 & -4 \end{bmatrix} \begin{bmatrix} 2 \\ 8 \\ 7 \end{bmatrix}$$ x=5 y= 0 z= 3 1+1

OR

$A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 3 \\ 1 & 2 & 1 \end{bmatrix}$ then $A^{-1} = -\frac{1}{3}\begin{bmatrix} -5 & 1 & 2 \\ 3 & 0 & -3 \\ -1 & -1 & 1 \end{bmatrix}$ (3m)

13. Find X and Y if $2X + 3Y = \begin{bmatrix} 3 & -2 \\ 5 & 4 \end{bmatrix}$ *and* $3X + 2Y = \begin{bmatrix} -8 & 2 \\ 0 & 6 \end{bmatrix}$.

$X = \begin{bmatrix} -6 & 2 \\ -2 & 2 \end{bmatrix}$ *and* $Y = \begin{bmatrix} 5 & -2 \\ 3 & 0 \end{bmatrix}$ (2+1)

SECTION - D (Case study-based questions)

14. Anil and Binil are required to answer questions based on functions.

Given below are some real valued functions :

a) $f(x) = x^3$, f: R to R

b) $g(x) = \sin x \cdot \cos x$, g: R to R

c) $h(x) = x^2$, h: Z to N

d) $p(x) = 9x^2 + 6x - 1$, p: $[0, \infty]$ to R

Where R , Z and N represents set real numbers, integers and naural numbers respectively.

Based on the functions given above, answer the following questions given to them.

i) Which of the given function(s) is/are bijective? (1m)

$f(x) = x^3$, f: R to R

ii) What is the minimum and maximum values of g(x)? $\left[-\frac{1}{2}, \frac{1}{2}\right]$ (1m)

i) (a) Is p(x) is surjective? If not, modify the co domain so that the function p(x) becomes surjective. Not surjective.

Surjective if Range = codomain=[-1, ∞) (2m)

OR

(b) Prove that $f(x) = \frac{5x+3}{2}$, $f: R \to R$ is bijective.

(Prove one to one and onto)

15. On her birthday Padma decided to donate some money to children of an orphanage

If there are 8 children less, everyone gets ₹ 10 more. However, if there are 16 children more, everyone gets ₹ 10 less.

Let the number of children in the orphanage home be x and the amount to be donated to each child be ₹ y.

Based on the above information, answer the following:

(i) Express the information provided above in system of linear equations

(ii) Express the system of linear equations obtained in (i) as matrix equation.

(iii) (a) Find the number of children (x) and the amount to be donated to each child(y).

-OR-

(b) If A and B are symmetric matrices then prove that AB – BA is a skew symmetric matrix.

i) 10x-8y =80 and -10y +16y =160 (1m)

ii) $\begin{bmatrix} 10 & -8 \\ -10 & 16 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 80 \\ 160 \end{bmatrix}$ ie. $\begin{bmatrix} 5 & -4 \\ -5 & 8 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 40 \\ 80 \end{bmatrix}$ (1m)

iii) a) x= 32 & y= 30 (2m)

b) (AB- BA)' = (AB)' – (BA)' = BA- AB (A and B are symmeric)

= -(AB – BA) Hence AB- BA is skew symmetric

****