OSDAV Public School, Kaithal
First Unit Test (May, 2024)
Class : XII
Subject : Mathematics (Applied) **Set A**

Time: 1 hr. **M.M. : 30**

General Instructions:-

All questions are compulsory.

(a) There are 20 questions in this question paper.
(b) SECTION A consists of 12 Multiple Choice questions.
(c) SECTION B consists of 6 questions carrying 2 marks each.
(d) SECTION C consists of 2 questions carrying 3 marks each.

Section A

1. If A = $\begin{bmatrix} 1 & 2 \\ -1 & 5 \end{bmatrix}$ and B = $\begin{bmatrix} 2 & 7 \\ 3 & 8 \end{bmatrix}$ then (A – B)’ is:

   a. $\begin{bmatrix} -1 & -4 \\ 5 & 3 \end{bmatrix}$ b. $\begin{bmatrix} -1 & -4 \\ -5 & -3 \end{bmatrix}$ c. $\begin{bmatrix} -1 & -5 \\ -4 & -3 \end{bmatrix}$ d. None of these

2. If A = $\begin{bmatrix} 1 & 2 \\ \frac{1}{3} & \frac{4}{3} \end{bmatrix}$, B = $\begin{bmatrix} 2 & 2 \\ 1 & 2 \end{bmatrix}$ and |B| = k | A |, then k is equal to:

   a. 3 b. 2 c. 1 d. 0

3. $\frac{dy}{dx}$ if $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

   a. $\frac{-b^2 x}{a^2 y}$ b. $\frac{-a^2 x}{b^2 y}$ c. $\frac{b^2 x}{a^2 y}$ d. $\frac{-b^2 y}{a^2 x}$

4. $\begin{bmatrix} 2x & 1 \\ 5 & x+2y \end{bmatrix} = \begin{bmatrix} 4 & 1 \\ 5 & 0 \end{bmatrix}$ then value of x and y are:

   a. x = 2, y = -1 b. x = -2, y = 1 c. x = 2, y = 1 d. None

5. If A is a square matrix such that A′ = A, then $(I + A)^2 – 3A$ is equal to:
   a. I b. 2A c. 3 I d. A

6. If A = $\begin{bmatrix} 5 & x \\ y & 0 \end{bmatrix}$ and A = A′ then
   a. x=0, y=5 b. x=5, y=0 c. x=y d. None

7. A and B are square matrices of order 3 each such that |A| = 2 and |B| = 2 then |3AB| is equal to:
   a. 108 b. 12 c. 36 d. None

8. A square matrix A of order 3 has |A| = 5 then |A adj A| is equal to:
   a. 125 b. 15 c. 75 d. None

9. If A is singular matrix, then Adj A is :
   a. Non singular b. Singular c. –symmetric d. skew-symmetric

10. A = $\begin{bmatrix} 4 & 6 \\ 7 & 5 \end{bmatrix}$ then A (adj A) = _____

    a. $\begin{bmatrix} 22 & 0 \\ 0 & 22 \end{bmatrix}$ b. $\begin{bmatrix} -22 & 0 \\ 0 & -22 \end{bmatrix}$ c. | | I d. None

11. If y = $\frac{\log x}{x}$, then $\frac{d^2y}{dx^2} = \frac{2\log x - 3}{x^3}$.

a. $\frac{2\log x-3}{x^3}$ b. $\frac{2\log x-3}{x^2}$ c. $\frac{\log x-3}{x^3}$ d. $\frac{2\log x-1}{x^3}$

12. If x = t2 and y = t3 then $\frac{dy}{dx}$ is

a. $\frac{2x}{3y}$ b. $\frac{3y}{2x}$ c. $\frac{3x}{2y}$ d. $\frac{2y}{3x}$

Section B

13. If A = $\begin{bmatrix} 5 & -1 \\ 3 & 2 \end{bmatrix}$ and B = $\begin{bmatrix} -4 & 3 \\ 1 & -2 \end{bmatrix}$ then find the matrix X such that 3A – 2B + 3X = 0

14. Show that the points (b, c+a), (c, a+b) and (a, b+c) are collinear.

15. Find the value of and for which the system of equations:

x + y + z = 6
x + 2y + 3z = 10
x + 2y + λz = μ have infinite number of solutions.

16. If A = $\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ then show that

$A^2 - 4A - 5I = 0$

17. Find the derivative of $\frac{x^2+x}{\sqrt{2x+1}}$

18. Prove that : $\begin{vmatrix} \propto & \beta & \gamma \\ \propto^2 & \beta^2 & \gamma^2 \\ \beta+\gamma & \gamma+\propto & \propto+\beta \end{vmatrix} = (\beta - \gamma)(\gamma - \propto)(\propto - \beta)(\propto + \beta + \gamma)$

Section C

19. If A = $\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and B = $\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$

Find AB. Use it to solve the following system of equations:

x - y = 3
2x + 3y + 4x = 17
y + 2z = 7

20. A manufacturer produces three products: P, Q and R which he sells in two markets. Annual sales volumes are indicated as follows:

Markets	Products		
	P	Q	R
I	10000	2000	18000
II	6000	20000	8000

(a) If unit price of P, Q, R are Rs. 25, Rs. 12.50 and Rs. 15 respectively. Find the total revenue in each market with the help of Matrix Algebra. 2

(b) If the unit costs of the above 3 commodities are Rs. 18, Rs. 12, Rs. 8 respectively. Find the gross profit for two markets. 2

OSDAV Public School, Kaithal
First Unit Test (May, 2024)
Class : XII
Subject : Mathematics (Applied) Set B

Time: 1 hr. **M.M. : 30**

General Instructions:-

All questions are compulsory.

(a) There are 20 questions in this question paper.
(b) SECTION A consists of 12 Multiple Choice questions.
(c) SECTION B consists of 6 questions carrying 2 marks each.
(d) SECTION C consists of 2 questions carrying 3 marks each.

<u>Section A</u>

1. $\frac{dy}{dx}$ if $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

   a. $\frac{-b^2x}{a^2y}$ b. $\frac{-a^2x}{b^2y}$ c. $\frac{b^2x}{a^2y}$ d. $\frac{-b^2y}{a^2x}$

2. A square matrix A of order 3 has |A| = 5 then |A adj A| is equal to:

   a. 125 b. 15 c. 75 d. None

3. If A = $\begin{bmatrix} 1 & 2 \\ \frac{1}{3} & \frac{4}{3} \end{bmatrix}$, B = $\begin{bmatrix} 2 & 2 \\ 1 & 2 \end{bmatrix}$ and |B| = k | A |, then k is equal to:

   a. 3 b. 2 c. 1 d. 0

4. If A is a square matrix such that A′ = A, then $(I + A)^2 - 3A$ is equal to:

   a. I b. 2A c. 3 I d. A

5. If A = $\begin{bmatrix} 1 & 2 \\ -1 & 5 \end{bmatrix}$ and B = $\begin{bmatrix} 2 & 7 \\ 3 & 8 \end{bmatrix}$ then (A – B)’ is:

   a. $\begin{bmatrix} -1 & -4 \\ 5 & 3 \end{bmatrix}$ b. $\begin{bmatrix} -1 & -4 \\ -5 & -3 \end{bmatrix}$ c. $\begin{bmatrix} -1 & -5 \\ -4 & -3 \end{bmatrix}$ d. None of these

6. $\begin{bmatrix} 2x & 1 \\ 5 & x + 2y \end{bmatrix} = \begin{bmatrix} 4 & 1 \\ 5 & 0 \end{bmatrix}$ then value of x and y are:

   a. x = 2, y = -1 b. x = -2, y = 1 c. x = 2, y = 1 d. None

7. A = $\begin{bmatrix} 4 & 6 \\ 7 & 5 \end{bmatrix}$ then A (adj A) = _____

   a. $\begin{bmatrix} 22 & 0 \\ 0 & 22 \end{bmatrix}$ b. $\begin{bmatrix} -22 & 0 \\ 0 & -22 \end{bmatrix}$ c. | | I d. None

8. A and B are square matrices of order 3 each such that |A| = 2 and |B| = 2 then |3AB| is equal to:

   a. 108 b. 12 c. 36 d. None

9. If A = $\begin{bmatrix} 5 & x \\ y & 0 \end{bmatrix}$ and A = A′ then

   a. x=0, y=5 b. x=5, y=0 c. x=y d. None

10. If A is singular matrix, then Adj A is :

    a. Non singular b. Singular c. –symmetric d. skew-symmetric

11. If y = $\frac{\log x}{x}$, then $\frac{d^2y}{dx^2}$ = $\frac{2\log x - 3}{x^3}$.

a. $\frac{2\log x - 3}{x^3}$ b. $\frac{2\log x - 3}{x^2}$ c. $\frac{\log x - 3}{x^3}$ d. $\frac{2\log x - 1}{x^3}$

12. If x = t2 and y = t3 then $\frac{dy}{dx}$ is

a. $\frac{2x}{3y}$ b. $\frac{3y}{2x}$ c. $\frac{3x}{2y}$ d. $\frac{2y}{3x}$

Section B

13. If A = $\begin{bmatrix} 5 & -1 \\ 3 & 2 \end{bmatrix}$ and B = $\begin{bmatrix} -4 & 3 \\ 1 & -2 \end{bmatrix}$ then find the matrix X such that 3A – 2B + 3X = 0

14. Find the value of and for which the system of equations:

x + y + z = 6
x + 2y + 3z = 10
x + 2y + λz = μ have infinite number of solutions.

15. Show that the points (b, c+a), (c, a+b) and (a, b+c) are collinear.

17. Find the derivative of $\frac{x^2 + x}{\sqrt{2x+1}}$

16. If A = $\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ then show that $A^2 - 4A - 5I = 0$

18. Prove that : $\begin{vmatrix} \propto & \beta & \gamma \\ \propto^2 & \beta^2 & \gamma^2 \\ \beta+\gamma & \gamma+\propto & \propto+\beta \end{vmatrix} = (\beta - \gamma)(\gamma - \propto)(\propto - \beta)(\propto + \beta + \gamma)$

Section C

20. A manufacturer produces three products: P, Q and R which he sells in two markets. Annual sales volumes are indicated as follows:

Markets	Products		
	P	Q	R
I	10000	2000	18000
II	6000	20000	8000

(a) If unit price of P, Q, R are Rs. 25, Rs. 12.50 and Rs. 15 respectively. Find the total revenue in each market with the help of Matrix Algebra. 2

(b) If the unit costs of the above 3 commodities are Rs. 18, Rs. 12, Rs. 8 respectively. Find the gross profit for two markets. 2

19. If A = $\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and B = $\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$

Find AB. Use it to solve the following system of equations:

x - y = 3
2x + 3y + 4x = 17
y + 2z = 7

May Unit Test :- 2024-25
Mathematics (Applied) Set A & B

Marking Scheme / Hints to Solutions

Note :- Any other relevant answer not given here in but given by the students, be suitably awarded.

Q. No.	Value points / Key points	Marks alloted to each Key point	Total points
1 5(B)	(b) $\begin{bmatrix} -1 & -4 \\ -5 & -3 \end{bmatrix}$	1	1
2 3(B)	(a) 3	1	1
3 1(B)	a) $-\frac{b^2x}{a^2y}$	1	1
4 6(B)	a) $x=2, y=-1$	1	1
5 4(B)	(a) I	1	1
6 9(B)	(c) $x=y$	1	1
7 6(B)	(a) 108	1	1
8 2(B)	(a) ,125	1	1
9 10(B)	(b) Singular	1	1
10 7(B)	(b) $\begin{bmatrix} -22 & 0 \\ 0 & -22 \end{bmatrix}$	1	1

11	(a) $\dfrac{2\log x - 3}{x^3}$	1	1
12	(b) $\dfrac{3y}{2x}$	1	1

Section B

13	$A = \begin{bmatrix} 5 & -1 \\ 3 & 2 \end{bmatrix} \quad B = \begin{bmatrix} -4 & 3 \\ 1 & -2 \end{bmatrix}$		
	$3A - 2B + 3X = 0$		
	$3X = 2\begin{bmatrix} -4 & 3 \\ 1 & -2 \end{bmatrix} - 3\begin{bmatrix} 5 & -1 \\ 3 & 2 \end{bmatrix}$	1/2	
	$3X = \begin{bmatrix} -8 & 6 \\ 2 & -4 \end{bmatrix} + \begin{bmatrix} -15 & +3 \\ -9 & -6 \end{bmatrix}$	1/2	2
	$3X = \begin{bmatrix} -23 & 9 \\ -7 & -10 \end{bmatrix}$	1/2	
	$X = \begin{bmatrix} -23/3 & 3 \\ -7/3 & -10/3 \end{bmatrix}$	1/2	
14	Let $A(b, c+a), B(c, a+b), C(a, b+c)$		
	ar $\Delta ABC = \dfrac{1}{2}\begin{vmatrix} b & c+a & 1 \\ c & a+b & 1 \\ a & b+c & 1 \end{vmatrix}$	1/2	
	$\dfrac{1}{2}\left\| b(a+\cancel{b}-\cancel{b}-c) - (c+a)(c-a) + 1(bc+c^2-a^2-ab) \right\|$	1/2	2
	$\dfrac{1}{2}\left\| \cancel{ab} - \cancel{bc} - \cancel{c^2} + \cancel{a^2} + \cancel{bc} + \cancel{c^2} - \cancel{a^2} - \cancel{ab} \right\|$	1/2	
	$\dfrac{1}{2}\|0\|$		
	$\therefore$ A, B, C are Collinear	1/2	

15
14(B)

$$D = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 2 & d \end{vmatrix}$$ 1/2

$$1(2d-6)-1(d-3)+1(2-2)$$
$$2d-6-d+3 = d-3$$

$$D_1 = \begin{vmatrix} 6 & 1 & 1 \\ 10 & 2 & 3 \\ \mu & 2 & d \end{vmatrix}$$

$$6(2d-6)-1(10d-3\mu)+1(20-2\mu)$$ 1/2 2
$$12d-36-10d+3\mu+20-2\mu$$
$$2d+\mu-16$$ 1/2

$$D = D_1 = 0$$
$$d = 3 \qquad 2(3)+\mu-16=0$$
$$\mu-10=0$$ 1/2
$$\mu=10$$

16
18(B)

$$A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$$

$$A^2 = \begin{bmatrix} 1+4+4 & 2+2+4 & 2+4+2 \\ 2+2+4 & 4+1+4 & 4+2+2 \\ 2+4+2 & 4+2+2 & 4+4+1 \end{bmatrix}$$

$$A^2 = \begin{bmatrix} 9 & 8 & 8 \\ 8 & 9 & 8 \\ 8 & 8 & 9 \end{bmatrix}$$ 1/2

L.H.S

$A^2 - 4A - 5I$

$$\begin{bmatrix} 9 & 8 & 8 \\ 8 & 9 & 8 \\ 8 & 8 & 9 \end{bmatrix} - \begin{bmatrix} 4 & 8 & 8 \\ 8 & 4 & 8 \\ 8 & 8 & 4 \end{bmatrix} - \begin{bmatrix} 5 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 5 \end{bmatrix}$$ 1/2

$$\begin{bmatrix} 9 & 8 & 8 \\ 8 & 9 & 8 \\ 8 & 8 & 9 \end{bmatrix} - \begin{bmatrix} 9 & 8 & 8 \\ 8 & 9 & 8 \\ 8 & 8 & 9 \end{bmatrix}$$ 1/2 | 2

$$= \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = O$$ 1/2

---

17 Let $y = \dfrac{x^2 + x}{\sqrt{2x+1}}$

$$\frac{dy}{dx} = \frac{\sqrt{2x+1}\,[2x+1] - (x^2+x)\dfrac{1 \times \cancel{2}}{\cancel{2}\sqrt{2x+1}}}{(2x+1)}$$ 1

$$= \frac{(2x+1)(2x+1) - x^2 - x}{(2x+1)^{3/2}}$$ 1/2 | 2

$$= \frac{4x^2 + 1 + 4x - x^2 - x}{(2x+1)^{3/2}}$$

$$= \frac{3x^2 + 3x + 1}{(2x+1)^{3/2}}$$ 1/2

18 $\begin{vmatrix} \alpha & \beta & \gamma \\ \alpha^2 & \beta^2 & \gamma^2 \\ \beta+\gamma & \gamma+\alpha & \alpha+\beta \end{vmatrix} = (\beta-\gamma)(\gamma-\alpha)(\alpha-\beta)(\alpha+\beta+\gamma)$

$R_1 \to R_1 + R_3$

$\begin{vmatrix} \alpha+\beta+\gamma & \alpha+\beta+\gamma & \alpha+\beta+\gamma \\ \alpha^2 & \beta^2 & \gamma^2 \\ \beta+\gamma & \gamma+\alpha & \alpha+\beta \end{vmatrix}$ 1/2

$(\alpha+\beta+\gamma)\begin{vmatrix} 1 & 1 & 1 \\ \alpha^2 & \beta^2 & \gamma^2 \\ \beta+\gamma & \gamma+\alpha & \alpha+\beta \end{vmatrix}$

$C_1 \to C_1 - C_2, \quad C_2 \to C_2 - C_3$

$(\alpha+\beta+\gamma)\begin{vmatrix} 0 & 0 & 1 \\ \alpha^2-\beta^2 & \beta^2-\gamma^2 & \gamma^2 \\ \beta-\alpha & \gamma-\beta & \alpha+\beta \end{vmatrix}$ 1/2 2

$(\alpha+\beta+\gamma)(\alpha-\beta)(\beta-\gamma)\begin{vmatrix} 0 & 0 & 1 \\ \alpha+\beta & \beta+\gamma & \gamma^2 \\ -1 & -1 & \alpha+\beta \end{vmatrix}$ 1/2

$1(-\alpha-\cancel{\beta}+\cancel{\beta}+\gamma)$

$(\alpha+\beta+\gamma)(\alpha-\beta)(\beta-\gamma)(\gamma-\alpha) \to R.H.S$ 1/2

19

20(B)

$$AB = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix} \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} 2+4 & 2-2 & -4+4 \\ 4-12+8 & 4+6-4 & -8-12+20 \\ -4+4 & 2-2 & -4+10 \end{bmatrix}$$

$$= \begin{bmatrix} 6 & 0 & 0 \\ 0 & 6 & 0 \\ 0 & 0 & 6 \end{bmatrix}$$ 1

$AB = 6I$

$A^{-1}AB = 6A^{-1}I$

$B = 6A^{-1} \Rightarrow \frac{1}{6}B = A^{-1}$ 1/2

$x - y = 3$

$2x + 3y + 4z = 17$

$y + 2z = 7$

$$\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ 17 \\ 7 \end{bmatrix}$$

$AX = B$

$X = A^{-1}B$

$$X = \frac{1}{6} \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix} \begin{bmatrix} 3 \\ 17 \\ 7 \end{bmatrix}$$ 1

$$X = \frac{1}{6}\begin{bmatrix} 6+34-28 \\ -12+34-28 \\ 6-17+35 \end{bmatrix}$$

$$X = \frac{1}{6}\begin{bmatrix} 12 \\ -6 \\ 24 \end{bmatrix} = \begin{bmatrix} 2 \\ -1 \\ 4 \end{bmatrix}$$ 1/2 3

$\therefore x = 2,\ y = -1,\ z = 4$

20 A(B)

$$\begin{array}{c|c} & \begin{array}{ccc} P & Q & R \end{array} \\ \begin{array}{c} I \\ II \end{array} & \begin{bmatrix} 10000 & 2000 & 18000 \\ 6000 & 20,000 & 8000 \end{bmatrix} \end{array} \begin{bmatrix} 25 \\ 12.50 \\ 15 \end{bmatrix}$$

(a)

$$\begin{array}{c} I \\ II \end{array}\begin{bmatrix} 250000 + 25000 + 270,000 \\ 150000 + 250000 + 120000 \end{bmatrix}$$

$$\begin{array}{c} I \\ II \end{array}\begin{bmatrix} 545000 \\ 520000 \end{bmatrix}$$ 1

b)

$$\begin{array}{c} I \\ II \end{array}\begin{bmatrix} 10000 & 20000 & 18000 \\ 6000 & 20000 & 8000 \end{bmatrix}\begin{bmatrix} 18 \\ 12 \\ 08 \end{bmatrix}$$

$$\begin{array}{c} I \\ II \end{array}\begin{bmatrix} 180000 + 240000 + 144000 \\ 108000 + 240000 + 64000 \end{bmatrix}$$

$$\begin{array}{c} I \\ II \end{array}\begin{bmatrix} 348000 \\ 412000 \end{bmatrix}$$ 1

Gross profit

$$= \begin{bmatrix} 545000 \\ 520000 \end{bmatrix} - \begin{bmatrix} 348000 \\ 412000 \end{bmatrix}$$

$$= \begin{bmatrix} 197000 \\ 108000 \end{bmatrix}$$

	1	3