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**INDIAN SCHOOL MUSCAT**  
**FIRST PERIODIC TEST (2023-2024)**  
**APPLIED MATHEMATICS**

CLASS: XII

Sub.Code: 241

Time Allotted: 50mts.

13.04.2023

Max .Marks: 20

**GENERAL INSTRUCTIONS:**

- This question paper has three sections.
- Section A contains 3 MCQ and 1 Assertion Reasoning Question, each of 1 mark.
- Section B contains 3 questions of 2 marks each.
- Section C contains 2 questions of 3 marks each.
- Section D contains 1 Case Based Question of 4 marks.
- All questions are compulsory.

**SECTION A**

- The value of  $x$  for which matrix  $A = \begin{pmatrix} 1+x & 7 \\ 3-x & 8 \end{pmatrix}$  is a singular matrix is 1  
 a) 13      b)  $\frac{13}{15}$       c)  $\frac{-29}{15}$       d) 29
- If matrix  $\begin{bmatrix} -2 & x-y & 5 \\ 1 & b & 4 \\ x+y & z & 7 \end{bmatrix}$  is symmetric. Find the values of  $x, y, z$  and  $b$ . 1  
 a)  $x = 3, y = 2, z = -4$  and  $b = -5$   
 b)  $x = 3, y = 2, z = 4$  and  $b$  can be any real number  
 c)  $x = 3, y = 2, z = -4$  and  $b$  can be any real number  
 d)  $x = 3, y = 2, z = 4$  and  $b = 5$
- If  $A = [a_{ij}]$  be a skew-symmetric matrix of order  $n$ , then 1  
 (A)  $a_{ij} = \frac{1}{a_{ji}}$  for all  $i, j$       (B)  $a_{ij} \neq 0$  for all  $i, j$   
 (C)  $a_{ij} = 0$ , where  $i = j$       (D)  $a_{ij} \neq 0$ , where  $i = j$

**ASSERTION-REASON BASED QUESTION**

In question 4, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is not the correct explanation of A.
- A is true but R is false.
- A is false but R is true.

4. **Assertion:** If  $52 \equiv x \pmod{17}$ , then the least positive integral value of  $x = 1$   
**Reason:** If  $a \equiv b \pmod{17}$ , then 17 divides  $(a - b)$  where  $a$  and  $b$  are integers. 1

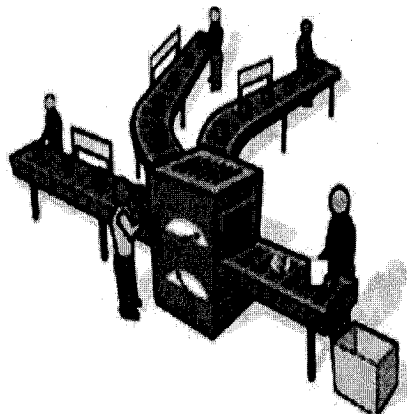
### SECTION B

5. Solve the following system of equations using Cramer's rule. 2  
 $2x - 3y = 3$  ,  $3x + 2y = 11$
6. If  $C_{ij}$  is the cofactor of  $a_{ij}^{\text{th}}$  element of the matrix, then find the value of 2  
 $a_{11}C_{11} + a_{12}C_{12} + a_{13}C_{13}$  for the matrix  $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$
7. Find the value of  $(327689 \times 253217) \pmod{8}$  2

### SECTION C

8. Find the inverse of the matrix  $A = \begin{pmatrix} a & b \\ c & \frac{1+bc}{a} \end{pmatrix}$  and show that 3  
 $aA^{-1} = (a^2 + bc + 1)I_2 - aA$
9. Find the remainder when  $17^{717}$  is divided by 8 3
10. **Read the following text and answer the questions based on the same:**

A factory produces three products every day. Their total hey production on a particular day is 45 tons. It is also found that production of third product exceeds the production of first product by 8 tons while the total production of first and third product is twice the production of the second product.



Based on the given information

- (i) Formulate system of linear equations in 1  
 $x$ ,  $y$  and  $z$ .
- (ii) Express the above equation system in the matrix 1  
form  $AX = B$
- (iii) Evaluate  $A^{-1}$  and hence find the amount of 2  
production of each product?

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SET B



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- All questions are compulsory.

**SECTION A**

1. The value of  $x$  for which matrix  $A = \begin{pmatrix} x & 2 \\ 3-x & 5 \end{pmatrix}$  is a singular matrix is 1  
a) 2      b) -2      c)  $\frac{6}{7}$       d) 13
  
2. If matrix  $\begin{bmatrix} -6 & x+y & 1 \\ 7 & z & 3 \\ x-y & b & 7 \end{bmatrix}$  is symmetric. Find the values of  $x, y, z$  and  $b$ . 1  
a)  $x = 4, y = 3, b = 3$  and  $z = -1$   
b)  $x = 4, y = 3, b = -3$  and  $z$  can be any real number  
c)  $x = 4, y = 3, b = 3$  and  $z$  can be any real number  
d)  $x = 4, y = 3, b = -3$  and  $z = 1$
  
3. If  $A = [a_{ij}]$  be a skew-symmetric matrix of order  $n$ , then 1  
(A)  $a_{ij} = \frac{1}{a_{ji}}$  for all  $i, j$       (B)  $a_{ij} = -a_{ji}$  for all  $i \neq j$   
(C)  $a_{ij} = 0$ , where  $i = j$       (D) both B and C are correct.

**ASSERTION-REASON BASED QUESTION**

In question 4, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

4. **Assertion:** If  $67 \equiv x \pmod{17}$ , then the least positive integral value of  $x = 1$   
**Reason:** If  $a \equiv b \pmod{17}$ , then 17 divides  $(a - b)$  where  $a$  and  $b$  are integers. 1

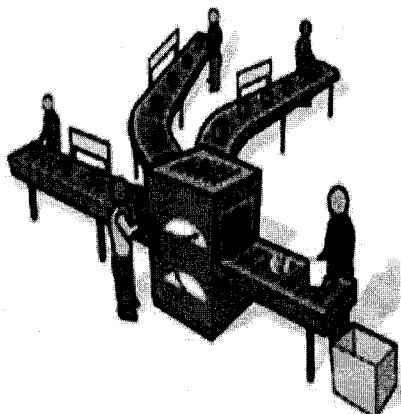
### SECTION B

5. Solve the following system of equations using Cramer's rule. 2  
 $2x - 3y = 7$  ,  $3x + 2y = -9$
6. If  $C_{ij}$  is the cofactor of  $a_{ij}^{\text{th}}$  element of the matrix, then find the value of 2  
 $a_{21} C_{21} + a_{22} C_{22} + a_{23} C_{23}$  for the matrix  $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$
7. Find the value of  $(245689 \times 719217) \pmod{8}$  2

### SECTION C

8. Find the inverse of the matrix  $A = \begin{pmatrix} a & b \\ c & \frac{1+bc}{a} \end{pmatrix}$  and show that 3  
 $aA^{-1} = (a^2 + bc + 1)I_2 - aA$
9. Find the remainder when  $19^{191}$  is divided by 12 3
10. **Read the following text and answer the questions based on the same:**

A factory produces three products everyday. Their total daily production on a particular day is 6 tons. It is also found that production of third product exceeds the production of second product by 1 tons while the total production of first and third product is five times the production of the second product.



Based on the given information

- (i) Formulate system of linear equations in  $x, y$  and  $z$ . 1
- (ii) Express the above equation system in the matrix form  $AX = B$  1
- (iii) Evaluate  $A^{-1}$  and hence find the amount of production of each product? 2

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SET C



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- Section D contains 1 Case Based Question of 4 marks.
- All questions are compulsory.

#### SECTION A

1. The value of  $x$  for which matrix  $A = \begin{pmatrix} 1+x & 2 \\ 3-x & 5 \end{pmatrix}$  is a singular matrix is 1  
a)  $\frac{1}{7}$       b)  $-\frac{1}{3}$       c)  $\frac{1}{3}$       d) 22
2. If matrix  $\begin{bmatrix} -2 & x-y & 8 \\ 4 & b & -3 \\ x+y & z & 2 \end{bmatrix}$  is symmetric. Find the values of  $x, y, z$  and  $b$ . 1  
a)  $x = 6, y = 2, z = -3$  and  $b = -8$   
b)  $x = 6, y = 2, z = 3$  and  $b$  can be any real number  
c)  $x = 6, y = 2, z = -3$  and  $b$  can be any real number  
d)  $x = 6, y = 2, z = 3$  and  $b = 8$
3. If  $A = [a_{ij}]$  be a skew-symmetric matrix of order  $n$ , then 1  
(A)  $a_{ij} = \frac{1}{a_{ji}}$  for all  $i, j$       (B)  $a_{ij} = -a_{ji}$  for all  $i \neq j$   
(C)  $a_{ij} = 0$ , where  $i = j$       (D) both B and C are correct.

#### ASSERTION-REASON BASED QUESTION

In question 4, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is not the correct explanation of A.
- A is true but R is false.
- A is false but R is true.

4. **Assertion:** If  $89 \equiv x \pmod{13}$ , then the least positive integral value of  $x = 11$   
**Reason:** If  $a \equiv b \pmod{13}$ , then 13 divides  $(a - b)$  where  $a$  and  $b$  are integers.

1

### SECTION B

5. Solve the following system of equations using Cramer's rule.  
 $2x - 3y = 11$  ,  $3x + 2y = 10$
6. If  $C_{ij}$  is the cofactor of  $a_{ij}^{\text{th}}$  element of the matrix, then find the value of  
 $a_{12}C_{12} + a_{22}C_{22} + a_{32}C_{32}$  for the matrix  $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$
7. Find the value of  $(645689 \times 178217) \pmod{8}$

2

2

2

### SECTION C

8. Find the inverse of the matrix  $A = \begin{pmatrix} a & b \\ c & \frac{1+bc}{a} \end{pmatrix}$  and show that

3

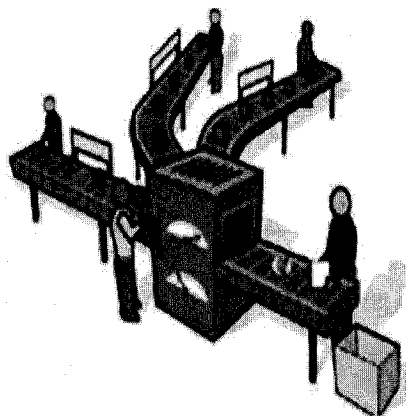
$$aA^{-1} = (a^2 + bc + 1)I_2 - aA$$

9. Find the last digit of  $19^{9^{19}}$ .

3

10. **Read the following text and answer the questions based on the same:**

A factory produces three products every day. Their total daily production on a particular day is 19 tons. It is also found that production of third product exceeds the production of first product by 3 tons while the total production of first and third product is one more than twice the production of the second product.



Based on the given information

- (i) Formulate system of linear equations in  $x$ ,  $y$  and  $z$ .
- (ii) Express the above equation system in the matrix form  $AX = B$
- (iii) Evaluate  $A^{-1}$  and hence find the amount of production of each product?

1

1

2

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