ROLL NUMBER				

INDIAN SCHOOL MUSCAT
FIRST PERIODIC TEST

APPLIED MATHEMATICS

CLASS: XII   Sub. Code: 241   Time Allotted: 50 min.
19.04.2022   Max. Marks: 20

GENERAL INSTRUCTIONS:
(i) This question paper consists of 10 questions. All questions are compulsory.
(ii) Questions 1 – 3 are MCQ carrying 1 mark each.
(iii) Questions 4 – 7 carry 2 marks each.
(iv) Questions 8 – 10 carry 3 marks each.

SECTION-A

1. The value of k for which the matrix $\begin{bmatrix} 2-k & 4 \\ -5 & 1 \end{bmatrix}$ is not invertible is _____.

2. If $|A| = \begin{vmatrix} 2 & -1 \\ 1 & 0 \end{vmatrix}$ then find $|2A|$.

3. If $\begin{bmatrix} 0 & a & 7 \\ -5 & 0 & 1 \\ b & -1 & 0 \end{bmatrix}$ is a skew symmetric matrix, then find the value of **a** and **b**

SECTION -B

4. Construct a 2 x 2 matrix whose $a_{ij}{}^{th}$ element is given as: $a_{ij} = \dfrac{(i-2j)^2}{2}$

5. If C_{ij} is the cofactor of $a_{ij}{}^{th}$ element of the matrix, then find the value of

   $a_{11}C_{11} + a_{12}C_{12} + a_{13}C_{13}$ for the matrix $\begin{bmatrix} 2 & 0 & 1 \\ 0 & -2 & 1 \\ 1 & 1 & 3 \end{bmatrix}$

6. If A = $\begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$, find 'k' for $A^2 - kA + 7\,I = O$

7. If A = $\begin{bmatrix} x & 2 \\ 2 & x \end{bmatrix}$ and $|A^4| = 625$, find the value(s) of x

SECTION -C

8. Find x, if $\begin{bmatrix} 1 & x & 1 \end{bmatrix} \begin{bmatrix} 1 & 3 & 2 \\ 2 & 5 & 1 \\ 15 & 3 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 2 \\ x \end{bmatrix} = 0.$

9. Consider a matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ -3 & 4 & 2 \\ 6 & -1 & 4 \end{bmatrix}$.

   a) Show that A is a non-invertible matrix.
   b) Find adjoint of A matrix.
   c) Hence show that the following system of equations is inconsistent.
      $x + y + z = 2$, $- 3y + 4x + 2z = 11$ and $6x - y + 4z = 10$.

10. A student is trying to solve the system of linear equations
    $x + y + 3z = 5$, $x - y + z = 3$ and $x + 2y + 2z = 4$, using row reduction method.
    A part of his working is shown below

    $$\begin{pmatrix} 1 & 1 & 3 & | & 5 \\ 1 & -1 & 1 & | & 3 \\ 1 & 2 & 2 & | & 4 \end{pmatrix} = \begin{pmatrix} 1 & 1 & 3 & | & 5 \\ 0 & -2 & -2 & | & -2 \\ 0 & 3 & 1 & | & 1 \end{pmatrix}$$

    $$= \begin{pmatrix} 1 & 1 & 3 & | & 5 \\ 0 & -2 & -2 & | & -2 \\ 0 & 3 & 1 & | & 1 \end{pmatrix} = \begin{pmatrix} 1 & 1 & 3 & | & 5 \\ 0 & 1 & 1 & | & 1 \\ 0 & 0 & -2 & | & -2 \end{pmatrix}$$

    Assuming that his working is correct, use it to complete the row reduction process and hence solve the system of above linear equations.

End of the Question Paper

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SECTION – A

1. The positive value of x for which matrix A = $\begin{bmatrix} x & 9 \\ 4 & x \end{bmatrix}$ is a singular matrix is _____.   (1)

2. If $|A| = \begin{vmatrix} 2 & 2 \\ -1 & 1 \end{vmatrix}$ then find $|2A|$.   (1)

3. If $\begin{bmatrix} 0 & 5 & -3 \\ -5 & a & b \\ 3 & -1 & 0 \end{bmatrix}$ is a skew symmetric matrix, then find the value of **a** and **b**   (1)

SECTION – B

4. Construct a 2 x 2 matrix whose $a_{ij}{}^{th}$ element is given as: $a_{ij} = \dfrac{(i+j)^2}{2}$ (2)

5. If C_{ij} is the cofactor of $a_{ij}{}^{th}$ 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 $\begin{bmatrix} 2 & 0 & -1 \\ 0 & 2 & 1 \\ -1 & 1 & 3 \end{bmatrix}$

6. If A = $\begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$, find 'k' where $A^2 = A + k\,I$ (2)

7. A, B, C, D and E are matrices of order 2 x n, 3 x 3, 2 x p, n x 3, and p x 3 respectively. Justify if the matrix (AD – CD) is defined or not.   (2)

8. Find x, if $[1 \quad 1 \quad x] \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 1 & 0 \end{bmatrix} \begin{bmatrix} x \\ -1 \\ 0 \end{bmatrix} = 0.$ (3)

9. A student is trying to solve the system of linear equations (3)
   $x + y + 3z = 5$, $x - y + z = 3$ and $x + 2y + 2z = 4$, using row reduction method.
   A part of his working is shown below

   $$\begin{pmatrix} 1 & 1 & 3 & | & 5 \\ 1 & -1 & 1 & | & 3 \\ 1 & 2 & 2 & | & 4 \end{pmatrix} = \begin{pmatrix} 1 & 1 & 3 & | & 5 \\ 0 & -2 & -2 & | & -2 \\ 0 & 3 & 1 & | & 1 \end{pmatrix}$$

   $$= \begin{pmatrix} 1 & 1 & 3 & | & 5 \\ 0 & -2 & -2 & | & -2 \\ 0 & 3 & 1 & | & 1 \end{pmatrix}$$

   $$= \begin{pmatrix} 1 & 1 & 3 & | & 5 \\ 0 & 1 & 1 & | & 1 \\ 0 & 0 & -2 & | & -2 \end{pmatrix}$$

   Assuming that his working is correct, use it to complete the row reduction process and hence solve the system of above linear equations.

10. Show that the following system of equations is inconsistent. (3)
    $4x - 5y - 2z = 2$, $-4y + 5x + 2z = -2$ and $2x + 2y + 8z = -1$

End of the Question Paper

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(iv) Questions 8 – 10 carry 3 marks each.

SECTION-A

1. The value of x for which matrix $A = \begin{bmatrix} 5 & -2 \\ 4 & x \end{bmatrix}$ is a singular matrix is _____.

2. If $|A| = \begin{vmatrix} 1 & -1 \\ 1 & 1 \end{vmatrix}$ then find $|3A|$.

3. If $\begin{bmatrix} 0 & 5 & -2 \\ -5 & a & 1 \\ b & -1 & 0 \end{bmatrix}$ is a skew symmetric matrix, then find the value of **a** and **b**.

SECTION - B

4. Construct a 2 x 2 matrix whose a_{ij}th element is given as: $a_{ij} = \dfrac{(2i-j)^2}{2}$

5. If C_{ij} is the cofactor of a_{ij}th element of the matrix, then find the value of
$a_{11} C_{11} + a_{12} C_{12} + a_{13} C_{13}$ for the matrix $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$

6. If $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$, find 'k' for $A^2 = kA - 2I$

7. A, B, C, D and E are matrices of order 2 x n, 3 x 3, 2 x p, n x 3, and p x 3 respectively. If the matrix (EB + DB) is defined, then justify that n = p.

8. Find x, if $\begin{bmatrix} x & -5 & -1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix} \begin{bmatrix} x \\ 4 \\ 1 \end{bmatrix} = O.$

9. A student is trying to solve the system of linear equations
   $x + y + 3z = 5$, $x - y + z = 3$ and $x + 2y + 2z = 4$, using row reduction method.
   A part of his working is shown below

   $$\begin{pmatrix} 1 & 1 & 3 & | & 5 \\ 1 & -1 & 1 & | & 3 \\ 1 & 2 & 2 & | & 4 \end{pmatrix} = \begin{pmatrix} 1 & 1 & 3 & | & 5 \\ 0 & -2 & -2 & | & -2 \\ 0 & 3 & 1 & | & 1 \end{pmatrix}$$

   $$= \begin{pmatrix} 1 & 1 & 3 & | & 5 \\ 0 & -2 & -2 & | & -2 \\ 0 & 3 & 1 & | & 1 \end{pmatrix}$$

   $$= \begin{pmatrix} 1 & 1 & 3 & | & 5 \\ 0 & 1 & 1 & | & 1 \\ 0 & 0 & -2 & | & -2 \end{pmatrix}$$

   Assuming that his working is correct, use it to complete the row reduction process and hence solve the system of above linear equations.

10. Consider a matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 3 & 1 \\ 3 & 5 & 2 \end{bmatrix}$.

    a) Show that A is a non-invertible matrix.
    b) Find adjoint of A matrix.
    c) Hence show that the following system of equations is inconsistent.
       $x + 2y + z = 3$, $3y + 2x + z = 3$ and $3x + 5y + 2z = 1$

End of the Question Paper