RAMANUJAN MATHS CLASSES

P-149, Sekhon Vihar, Delhi Cantt. Delhi 110010

ASSIGNMENT CLASS XII CHAPTER 3 & 4 SESSION 2024-25

Class 12 - Mathematics

Time Allowed: 3 hours **Maximum Marks: 163**

1. If A and B are two matrices such that AB = A and BA = B, then B^2 is equal to **[1]**

 a) 0 b) A

 c) B d) 1

2. If A is a null matrix then **[1]**

 a) A is a cube matrix b) A is not a square matrix

 c) both A is a square matrix and A is not a square matrix d) A is a square matrix

3. For every square matrix A, there exists an identity matrix of same order such that **[1]**

 a) IA = A only b) IA = AI = A

 c) AI = A only d) AI = A = AI

4. If $\begin{bmatrix} x & 2 \\ 3 & x-1 \end{bmatrix}$ is a singular matrix, then the product of all possible values of x is: **[1]**

 a) 6 b) -6

 c) -7 d) 0

5. If the matrix A is both symmetric and skew symmetric, then **[1]**

 a) A is a null matrix b) A is a zero matrix

 c) A is a square matrix d) A is a diagonal matrix

6. If A is a square matrix, then AA is a **[1]**

 a) none of these b) skew-symmetric matrix

 c) symmetric matrix d) diagonal matrix

7. If $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 3 & 2 \\ 4 & 3 & 1 \end{bmatrix}$, $C = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ and $D = \begin{bmatrix} 4 & 6 & 8 \\ 5 & 7 & 9 \end{bmatrix}$, then which of the following is defined? **[1]**

 a) A + B b) C + D

 c) B + C d) B + D

8. Which one of the following is a scalar matrix? **[1]**

 a) $\begin{bmatrix} -8 & 0 \\ 0 & -8 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

 c) $\begin{bmatrix} 3 & 0 \\ 6 & 0 \end{bmatrix}$ d) $\begin{bmatrix} 6 & 0 \\ 0 & 3 \end{bmatrix}$

9. A matrix $A = [a_{ij}]_{n \times n}$ is said to be symmetric if: **[1]**

a) $a_{ij} = -a_{ij}$ b) $a_{ij} = 0$

c) $a_{ij} = 1$ d) $a_{ij} = a_{ij}$

10. If $|A| = 2$, where A is a 2×2 matrix, then $|4A^{-1}|$ equals: **[1]**

a) 4 b) 8

c) $\frac{1}{32}$ d) 2

11. If A is a matrix of order 3×4 and B is a matrix of order 4×3, find the order of the matrix of AB. **[2]**

12. If $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ and $f(x) = x^2 - 4x + 1$, find $f(A)$ **[2]**

13. Construct a matrix $A = [a_{ij}]_{2\times 2}$ whose elements a_{ij} are given by $a_{ij} = e^{2ix} \sin jx$ **[2]**

14. If A is a symmetric matrix and $n \in N$, write whether A^n is symmetric or skew-symmetric or neither of these two. **[2]**

15. Find the value of (x - y) from the matrix equation $2\begin{bmatrix} x & 5 \\ 7 & y-3 \end{bmatrix} + \begin{bmatrix} 3 & -4 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ 15 & 14 \end{bmatrix}$ **[2]**

16. Show that all the diagonal elements of a skew-symmetric matrix are zero. **[2]**

17. Express the matrix $A = \begin{bmatrix} 2 & 3 \\ -1 & 4 \end{bmatrix}$ as the sum of a symmetric matrix and a skew-symmetric matrix **[2]**

18. If A and B are symmetric matrices of the same order, then show that AB is symmetric if and only if A and B commute, that is AB = BA. **[2]**

19. Let A, B be two matrices such that they commute. Show that for any positive integer n, the equation $(AB)^n = A^n B^n$ holds good . **[3]**

20. If $A = \begin{bmatrix} 3 & -5 \\ -4 & 2 \end{bmatrix}$, then find $A^2 - 5A - 14I$. Hence, obtain A^3. **[3]**

21. For the following matrices A and B, verify that $[AB]' = B'A'$; $A = \begin{bmatrix} 1 \\ -4 \\ 3 \end{bmatrix}, B = \begin{bmatrix} -1 & 2 & 1 \end{bmatrix}$. **[3]**

22. Two farmers Ramkishan and Gurcharan Singh cultivates only three varieties of rice namely Basmati, Permal and Naura. The sale (in Rupees) of these varieties of rice by both the farmers in the month of September and October are given by the following matrices A and B. **[3]**

September Sales (in Rupees)

$$A = \begin{array}{c} \begin{array}{ccc} \text{Basmati} & \text{Permal} & \text{Naura} \end{array} \\ \begin{bmatrix} 10{,}000 & 20{,}000 & 30{,}000 \\ 50{,}000 & 30{,}000 & 10{,}000 \end{bmatrix} \end{array} \begin{array}{l} \text{Ramkishan} \\ \text{Gurcharan Singh} \end{array}$$

October Sales (in Rupees)

$$B = \begin{array}{c} \begin{array}{ccc} \text{Basmati} & \text{Permal} & \text{Naura} \end{array} \\ \begin{bmatrix} 5000 & 10{,}000 & 6000 \\ 20{,}000 & 10{,}000 & 10{,}000 \end{bmatrix} \end{array} \begin{array}{l} \text{Ramkishan} \\ \text{Gurcharan Singh} \end{array}$$

i. Find the combined sales in September and October for each farmer in each variety.
ii. Find the decrease in sales from September to October.
iii. If both farmers receive 2% profit on gross sales, compute the profit for each farmer and for each variety sold in October.

23. Let $A = \begin{bmatrix} 2 & 3 \\ -1 & 2 \end{bmatrix}$ and $f(x) = x^2 - 4x + 7$. Show that f(A) = O. Use this result to find A^5 **[3]**

24. Find matrix A such that $\begin{bmatrix} 2 & -1 \\ 1 & 0 \\ -3 & 4 \end{bmatrix} A = \begin{bmatrix} -1 & -8 \\ 1 & -2 \\ 9 & 22 \end{bmatrix}$. **[3]**

25. A trust invested some money in two type of bonds. The first bond pays 10% interest and second bond pays 12% interest. The trust received ₹ 2800 as interest. However, if trust had interchanged money in bonds, they would have got ₹ 100 less as interest. Using matrix method, find the amount invested by the trust. **[3]**

26. A matrix X has a + b rows and a + 2 columns while the matrix Y has b + 1 rows and a + 3 columns. Both matrices XY and YX exist. Find a and b. Can you say XY and YX are of the same type? Are they equal? **[3]**

27. If $A = \begin{bmatrix} 3 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 7 & 3 \end{bmatrix}$ then find a non-zero matrix C such that AC = BC. **[5]**

28. $A = \begin{bmatrix} 0 & -\tan\frac{\alpha}{2} \\ \tan\frac{\alpha}{2} & 0 \end{bmatrix}$, **[5]**

Prove $I + A = (I - A) \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$

29. Let A = $\begin{bmatrix} 3 & 2 & 7 \\ 1 & 4 & 3 \\ -2 & 5 & 8 \end{bmatrix}$. Find matrices X and Y such that X + Y = A, where X is a symmetric and Y is a skew-symmetric matrix. **[5]**

30. If A = $\begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$ is written as B + C, where B is a symmetric matrix and C is a skew-symmetric matrix, then find B. **[5]**

31. If A = $\begin{bmatrix} 9 & 1 \\ 7 & 8 \end{bmatrix}$, B = $\begin{bmatrix} 1 & 5 \\ 7 & 12 \end{bmatrix}$, find matrix C such that 5A + 3B + 2C is a null matrix. **[5]**

32. **Assertion (A):** If $\begin{bmatrix} x & 2 \end{bmatrix} \begin{bmatrix} 2 & 0 \\ -4 & 0 \end{bmatrix} = 0$, then x = 2 **[1]**

Reason (R): If $\begin{bmatrix} x & 2 \end{bmatrix} \begin{bmatrix} 2 & 0 \\ -4 & 0 \end{bmatrix} = 0$, then x = 4.

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.

33. **Assertion (A):** If A = $\begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then the value of k such that A^2 = kA - 2I, is -1. **[1]**

Reason (R): If A and B are square matrices of same order, then (A + B)(A + B) is equal to A^2 + AB + BA + B^2.

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.

34. **Assertion (A):** If A $= \begin{bmatrix} 2 & -2 & 0 \\ 6 & 4 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 \\ 6 \\ 10 \end{bmatrix}$, the $(AB)^T$ = $\begin{bmatrix} -8 & 16 \end{bmatrix}$. **[1]**

Reason (R): AB = $\begin{bmatrix} -8 & 21 \end{bmatrix}$.

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.

35. **Assertion (A):** If $\begin{bmatrix} xy & 4 \\ z+5 & x+y \end{bmatrix} = \begin{bmatrix} 4 & w \\ 0 & 4 \end{bmatrix}$, then x = 2, y = 2, z = -5 and w = 4. **[1]**

Reason (R): Two matrices are equal, if their orders are same and their corresponding elements are equal.

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.

36. **Assertion (A):** If A = $\begin{bmatrix} 2 & 3 & -1 \\ 1 & 4 & 2 \end{bmatrix}$ and B = $\begin{bmatrix} 2 & 3 \\ 4 & 5 \\ 2 & 1 \end{bmatrix}$, then AB and BA both are defined. **[1]**

Reason (R): For the two matrices A and B, the product AB is defined, if number of columns in A is equal to the number of rows in B.

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.

37. If A is a square matrix of order 3 such that |adj A| = 36, find |A| **[1]**

a) ± 6

b) ± 5

c) -6

d) 6

38. Let A be the area of a triangle having vertices (x_1, y_1), (x_2, y_2) and (x_3, y_3). Which of the following is correct? **[1]**

a) $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}^2 = A^2$

b) $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = \pm A$

c) $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = \pm \frac{A}{2}$

d) $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = \pm 2A$

39. The value of k for which the system of equations, x + ky + 3z = 0, 3x + ky – 2z = 0, 2x + 3y – 4z = 0, have a non-trival solution is **[1]**

a) $\frac{33}{2}$

b) $\frac{2}{33}$

c) 33

d) 2

40. If $\Delta = \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$ and A_{ij} is Cofactors of a_{ij}, then value of Δ is given by **[1]**

a) $a_{11} A_{31} + a_{12} A_{32} + a_{13} A_{33}$

b) $a_{21} A_{11} + a_{22} A_{12} + a_{23} A_{13}$

c) $a_{11} A_{11} + a_{21} A_{21} + a_{31} A_{31}$

d) $a_{11} A_{11} + a_{12} A_{21} + a_{13} A_{31}$

41. If A is a non-singular square matrix of order 3 such that A^2 = 3A, then value of |A| is **[1]**

a) 3

b) 9

c) -3

d) 27

42. If A is a non singular matrix and A’ denotes the transpose of A, then **[1]**

a) $|AA'| \neq |A^2|$

b) $|A| - |A'| \neq 0$

c) $|A| + |A'| \neq 0$

d) $|A| \neq |A'|$

43. If a matrix A is such that $3A^3 + 2A^2 + 5A + I = 0$, then A^{-1} is equal to **[1]**

a) $3A^2 - 2A - 5$

b) none of these

c) $3A^2 + 2A + 5$ d) $-(3A^2 + 2A + 5)$

44. If $A^5 = O$ such that $A^n \neq I$ for $1 \leq n \leq 4$, then $(I - A)^{-1}$ equals **[1]**

a) A^3 b) A^4

c) None of these d) I + A

45. If A is a matrix of order 3 and |A| = 8, then |adj A| = **[1]**

a) 2 b) 1

c) 2^6 d) 2^3

46. A square matrix A is invertible, if and only if **[1]**

a) A is singular matrix i.e. $|A| \neq 0$ b) A is singular matrix i.e. |A| = 0

c) A is non-singular matrix i.e. $|A| \neq 0$ d) A is non-singular matrix i.e. |A| = 0

47. Show that the given system of linear equations is inconsistent: **[2]**

2x + 5y = 7

6x + 15y = 13

48. Prove that the determinant $\begin{vmatrix} x & \sin\theta & \cos\theta \\ -\sin\theta & -x & 1 \\ \cos\theta & 1 & x \end{vmatrix}$ is independent of θ. **[2]**

49. For what value of x the matrix $A = \begin{bmatrix} 1 & -2 & 3 \\ 1 & 2 & 1 \\ x & 2 & -3 \end{bmatrix}$ is singular? **[2]**

50. $\begin{vmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{vmatrix}$ Verify that $a_{11}A_{31} + a_{12}A_{32} + a_{13}A_{33} = 0$ **[2]**

51. For what value of x is the matrix $\begin{bmatrix} 6-x & 4 \\ 3-x & 1 \end{bmatrix}$ singular? **[2]**

52. If $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ verify that $A^2 - 4A + I = O$, where I = $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and O = $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$. Hence, find A^{-1} **[2]**

53. Solve the system of equations x + 2y = 3 and 4x + 8y = 12 by using determinants. **[2]**

54. If A is a square matrix of order 3 such that | A | = 3, then find the value of |adj (adj A)|. **[2]**

55. Show that the system of linear equations has infinite number of solutions and solve **[3]**

x + 2y = 5

3x + 6y = 15

56. Solve the system of linear equations by Cramer's rule: **[3]**

2x - y = -2

3x + 4y = 3

57. Write the minors and cofactors of each element of the first column of the matrix and hence evaluate the determinant: A = $\begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}$ **[3]**

58. Use the product $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix} \begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix}$ to solve the system of equations x+ 3z = - 9, - x + 2y - 2z = 4 , 2x - 3y + 4z = -3. **[3]**

59. Show that the points (a + 5, a - 4), (a - 2, a + 3) and (a, a) do not lie on a straight line for any value of a. **[3]**

60. The cost of 4 kg potato, 3 kg wheat and 2 kg rice is ₹ 60. The cost of 1 kg potato, 2 kg wheat and 3 kg rice is ₹ 45. The cost of 6 kg potato, 2 kg wheat and 3 kg rice is ₹ 70. Find the cost of each item per kg by matrix method. **[3]**

61. Two schools P and Q want to award their selected students on the values of Discipline, Politeness and Punctuality. The school P wants to award ₹ x each, ₹ y each and ₹ z each for the three respectively values to its 3, 2 and 1 students with total award money of ₹ 1,000. School Q wants to spend ₹ 1,500 to award its 4, 1 and 3 students on the respective values (by giving the same award money for three values as before). If the total amount of awards for one prize on each value is ₹ 600, using matrices, find the award money for each value. Apart from the above three values, suggest one more value for awards. **[3]**

62. Using matrices, solve the following system of equations **[3]**

$\frac{2}{x}+\frac{3}{y}+\frac{10}{z}=4$

$\frac{4}{x}-\frac{6}{y}+\frac{5}{z}=1$

$\frac{6}{x}+\frac{9}{y}+\frac{-20}{z}=2$

63. Find the matrix A satisfying the matrix equation **[5]**

$\begin{bmatrix}2 & 1\\ 3 & 2\end{bmatrix} A \begin{bmatrix}-3 & 2\\ 5 & -3\end{bmatrix}=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$.

64. Using matrices, solve the following system of equations: **[5]**

$\frac{2}{x}+\frac{3}{y}+\frac{10}{z}=4,$

$\frac{4}{x}-\frac{6}{y}+\frac{5}{z}=1,$

$\frac{6}{x}+\frac{9}{y}+\frac{-20}{z}=2$

65. Show that x = 2 is a root of the equation $\begin{vmatrix}x & -6 & -1\\ 2 & -3x & x-3\\ -3 & 2x & x+2\end{vmatrix}$ = 0 and solve it completely. **[5]**

66. If $A=\begin{bmatrix}1 & 2 & 0\\ -2 & -1 & -2\\ 0 & -1 & 1\end{bmatrix}$, then find the value of A^{-1}. **[5]**

Using A^{-1}, solve the system of linear equations:

x - 2y = 10,

2x - y - z = 8,

-2y +z = 7

67. Find adjoint of the matrix $\begin{vmatrix}1 & -1 & 2\\ 2 & 3 & 5\\ -2 & 0 & 1\end{vmatrix}$ **[5]**

68. **Assertion (A):** The points A(a, b + c), B (b, c + a) and C (c, a + b) are collinear. **[1]**

Reason (R): Area of a triangle with three collinear points is zero.

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.

69. **Assertion (A):** For A = $\begin{bmatrix}4 & 8\\ 0 & 9\end{bmatrix}$, A^{-1} is $\begin{bmatrix}9 & -8\\ 0 & 4\end{bmatrix}$ **[1]**

Reason (R): For A = $=\begin{bmatrix}4 & 8\\ 0 & 9\end{bmatrix}$, A^{-1} is $\frac{1}{36}\begin{bmatrix}9 & -8\\ 0 & 4\end{bmatrix}$.

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.

70. **Assertion (A):** If $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$ then x = ± 6. **[1]**

Reason (R): If A is a skew-symmetric matrix of odd order, then |A| = 0.

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.

71. **Assertion (A):** If A is a 3 $\times$ 3 non-singular matrix, then $|A^{-1} \text{ adj } A| = |A|$. **[1]**

Reason (R): If A and B both are invertible matrices such that B is inverse of A, then AB = BA = I.

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.

72. **Assertion (A):** If A = $\begin{vmatrix} 5-x & x+1 \\ 2 & 4 \end{vmatrix}$, then the matrix A is singular if x = 3. **[1]**

Reason (R): A square matrix is a singular matrix if its determinant is zero.

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.

73. **Assertion (A):** Determinant is a number associated with a square matrix. **[1]**

Reason (R): Determinant is a square matrix.

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.

74. **Assertion (A):** If A = $\begin{bmatrix} 2 & -2 \\ 4 & 3 \end{bmatrix}$, then $A^{-1} = \begin{bmatrix} 3 & -2 \\ 4 & 3 \end{bmatrix}$ **[1]**

Reason (R): A = $\begin{bmatrix} -1 & 5 \\ -3 & 2 \end{bmatrix}$, then $A^{-1} = \begin{bmatrix} \frac{2}{13} & -\frac{5}{13} \\ \frac{3}{13} & -\frac{1}{13} \end{bmatrix}$

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.

75. **Assertion (A):** If Δ is the value of the determinant $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$, then the value of the determinant **[1]**

$\begin{vmatrix} pa_1 & b_1 & qc_1 \\ pa_2 & b_2 & qc_2 \\ pa_3 & b_3 & qc_3 \end{vmatrix}$ is Δpq.

Reason (R): If entries of a row or column in a square matrix **A** are multiplied by a number k $\in$ R, then the determinant of the resultant matrix is k |A|.

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.