SRI RAGHAVENDRA TUITION CENTER

MATRIX

11th Standard

Maths

Date : 14-07-24

Reg.No. :

Exam Time : 01:30 Hrs

Total Marks : 60

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I. Multiple Choice Question 25 x 1 = 25

1) If $a_{ij} = \frac{1}{2}(3i-2j)$ and A = $[a_{ij}]_{2x2}$ is

(a) $\begin{bmatrix}\frac{1}{2} & 2\\ -\frac{1}{2} & 1\end{bmatrix}$ (b) $\begin{bmatrix}\frac{1}{2} & -\frac{1}{2}\\ 2 & 1\end{bmatrix}$ (c) $\begin{bmatrix}2 & 2\\ \frac{1}{2} & -\frac{1}{2}\end{bmatrix}$ (d) $\begin{bmatrix}-\frac{1}{2} & \frac{1}{2}\\ 1 & 2\end{bmatrix}$

2) What must be the matrix X, if 2x + $\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix} = \begin{bmatrix}3 & 8\\ 7 & 2\end{bmatrix}$?

(a) $\begin{bmatrix}1 & 3\\ 2 & -1\end{bmatrix}$ (b) $\begin{bmatrix}1 & -3\\ 2 & -1\end{bmatrix}$ (c) $\begin{bmatrix}2 & 6\\ 4 & -2\end{bmatrix}$ (d) $\begin{bmatrix}2 & -6\\ 4 & -2\end{bmatrix}$

3) Which one of the following is not true about the matrix $\begin{bmatrix}1 & 0 & 0\\ 0 & 0 & 0\\ 0 & 0 & 5\end{bmatrix}$?

(a) a scalar matrix (b) a diagonal matrix (c) an upper triangular matrix (d) a lower triangular matrix

4) If A and B are two matrices such that A + B and AB are both defined, then

(a) A and B are two matrices not necessarily of same order (b) A and B are square matrices of same order

(c) Number of columns of A is equal to the number of rows of B (d) A = B.

5) If A = $\begin{bmatrix}\lambda & 1\\ -1 & -\lambda\end{bmatrix}$, then for what value of λ, A^2 = O?

(a) 0 (b) ±1 (c) -1 (d) 1

6) If A = $\begin{bmatrix}1 & 2 & 2\\ 2 & 1 & -2\\ a & 2 & b\end{bmatrix}$ is a matrix satisfying the equation AA^T = 9I, where I is 3 $\times$ 3 identity matrix, then the ordered pair (a, b) is equal to

(a) (2, - 1) (b) (- 2, 1) (c) (2, 1) (d) (- 2, - 1)

7) If A = $\begin{bmatrix}1 & -1\\ 2 & -1\end{bmatrix}$, B = $\begin{bmatrix}a & 1\\ b & -1\end{bmatrix}$ and $(A + B)^2 = A^2 + B^2$, then the values of a and b are

(a) a = 4, b = 1 (b) a = 1, b = 4 (c) a = 0, b = 4 (d) a = 2, b = 4

8) If the points (x,−2), (5, 2), (8, 8) are collinear, then x is equal to

(a) -3 (b) $\frac{1}{3}$ (c) 1 (d) 3

9) If A = $\begin{bmatrix}a & x\\ y & a\end{bmatrix}$ and if xy = 1, then det $(A A^T)$ is equal to

(a) $(a-1)^2$ (b) $(a^2+1)^2$ (c) a^2-1 (d) $(a^2-1)^2$

10) If A is a square matrix, then which of the following is not symmetric?

(a) $A + A^T$ (b) AA^T (c) $A^T A$ (d) $A - A^T$

11) If A and B are symmetric matrices of order n, where (A $\neq$ B), then

(a) A + B is skew-symmetric (b) A + B is symmetric (c) A + B is a diagonal matrix (d) A + B is a zero matrix

12) The value of x, for which the matrix A = $\begin{bmatrix} e^{x-2} & e^{7+x} \\ e^{2+x} & e^{2x+3} \end{bmatrix}$ is singular

(a) 9 (b) 8 (c) 7 (d) 6

13) If the square of the matrix $\begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ is the unit matrix of order 2, then α, β and γ should satisfy the relation.

(a) $1 + \alpha^2 + \beta\gamma = 0$ (b) $1 - \alpha^2 - \beta\gamma = 0$ (c) $1 - \alpha^2 + \beta\gamma = 0$ (d) $1 + \alpha^2 - \beta\gamma = 0$

14) If $\begin{vmatrix} 2a & x_1 & y_1 \\ 2b & x_2 & y_2 \\ 2c & x_3 & y_3 \end{vmatrix} = \frac{abc}{2} \neq 0$, then the area of the triangle whose vertices are $\left(\frac{x_1}{a}, \frac{y_1}{a}\right), \left(\frac{x_2}{b}, \frac{y_2}{b}\right), \left(\frac{x_3}{c}, \frac{y_3}{c}\right)$ is

(a) $\frac{1}{4}$ (b) $\frac{1}{4}abc$ (c) $\frac{1}{8}$ (d) $\frac{1}{8}abc$

15) If a $\neq$ b, b, c satisfy $\begin{vmatrix} a & 2b & 2c \\ 3 & b & c \\ 4 & a & b \end{vmatrix} = 0$, then abc =

(a) a + b + c (b) 0 (c) b^3 (d) ab + bc

16) If $\triangle = \begin{vmatrix} a & b & c \\ x & y & z \\ p & q & r \end{vmatrix}$, then $\begin{vmatrix} ka & kb & kc \\ kx & ky & kz \\ kp & kq & kr \end{vmatrix}$ is

(a) $\triangle$ (b) $k\triangle$ (c) $3k\triangle$ (d) $k^3\triangle$

17) A root of the equation $\begin{vmatrix} 3-x & -6 & 3 \\ -6 & 3-x & 3 \\ 3 & 3 & -6-x \end{vmatrix} = 0 \; is$

(a) 6 (b) 3 (c) 0 (d) -6

18) The value of the determinant of A = $\begin{bmatrix} 0 & a & -b \\ -a & 0 & c \\ b & -c & 0 \end{bmatrix} is$

(a) -2abc (b) abc (c) 0 (d) $a^2 + b^2 + c^2$

19) If x_1, x_2, x_3 as well as y_1, y_2, y_3 are in geometric progression with the same common ratio, then the points (x_1, y_1), (x_2, y_2), (x_3, y_3) are

(a) vertices of an equilateral triangle (b) vertices of a right angled triangle (c) vertices of a right angled isosceles triangle

(d) collinear

20) If A = $\begin{vmatrix} -1 & 2 & 4 \\ 3 & 1 & 0 \\ -2 & 4 & 2 \end{vmatrix}$ and B = $\begin{vmatrix} -2 & 4 & 2 \\ 6 & 2 & 0 \\ -2 & 4 & 8 \end{vmatrix}$, then B is given by

(a) B = 4A (b) B = -4A (c) B = -A (d) B = 6A

21) If $\lfloor . \rfloor$ denotes the greatest integer less than or equal to the real number under consideration and $-1 \leq x < 0$, $0 \leq y < 1$, $1 \leq z < 2$, then the value of the determinant $\begin{vmatrix} \lfloor x \rfloor + 1 & \lfloor y \rfloor & \lfloor z \rfloor \\ \lfloor x \rfloor & \lfloor y \rfloor + 1 & \lfloor z \rfloor \\ \lfloor x \rfloor & \lfloor y \rfloor & \lfloor z \rfloor + 1 \end{vmatrix}$ is

(a) $\lfloor z \rfloor$ (b) $\lfloor y \rfloor$ (c) $\lfloor x \rfloor$ (d) $\lfloor x \rfloor + 1$

22) If A is skew-symmetric of order n and C is a column matrix of order n $\times$ 1, then $C^T AC$ is

(a) an identity matrix of order n (b) an identity matrix of order 1 (c) a zero matrix of order 1

(d) an identity matrix of order 2

23) The matrix A satisfying the equation $\begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix} A = \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix}$ is

(a) $\begin{bmatrix} 1 & 4 \\ -1 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & -4 \\ 1 & 0 \end{bmatrix}$ (c) $\begin{bmatrix} 1 & 4 \\ 0 & -1 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & -4 \\ 1 & 1 \end{bmatrix}$

24) If $A + I = \begin{bmatrix} 3 & -2 \\ 4 & 1 \end{bmatrix}$, then (A + I)(A - I) is equal to

(a) $\begin{bmatrix} -5 & -4 \\ 8 & -9 \end{bmatrix}$ (b) $\begin{bmatrix} -5 & 4 \\ -8 & 9 \end{bmatrix}$ (c) $\begin{bmatrix} 5 & 4 \\ 8 & 9 \end{bmatrix}$ (d) $\begin{bmatrix} -5 & -4 \\ -8 & -9 \end{bmatrix}$

25) Let A and B be two symmetric matrices of same order. Then which one of the following statement is not true?

(a) A + B is a symmetric matrix (b) AB is a symmetric matrix (c) $AB = (BA)^T$ (d) $A^T B = AB^T$

II. Answer all question 5 x 2 = 10

26) Simplify : $sec\theta \begin{bmatrix} sec\theta & tan\theta \\ tan\theta & sec\theta \end{bmatrix} - tan\theta \begin{bmatrix} tan\theta & sec\theta \\ sec\theta & tan\theta \end{bmatrix}$

27) If a, b, c and x are positive real numbers, then show that $\begin{vmatrix} (a^x + a^{-x})^2 & (a^x - a^{-x})^2 & 1 \\ (b^x + b^{-x})^2 & (b^x - b^{-x})^2 & 1 \\ (c^x + c^{-x})^2 & (c^x - c^{-x})^2 & 1 \end{vmatrix}$ is zero.

28) Find the sum A + B + C if A, B, C are given by

$A = \begin{bmatrix} \sin^2\theta & 1 \\ \cot^2\theta & 0 \end{bmatrix}, B = \begin{bmatrix} \cos^2\theta & 0 \\ -\operatorname{cosec}^2\theta & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$

29) Suppose that a matrix has 12 elements. What are the possible orders it can have? What if it has 7 elements?

30) Evaluate $\begin{vmatrix} 2014 & 2017 & 0 \\ 2020 & 2023 & 1 \\ 2023 & 2026 & 0 \end{vmatrix}$

III. ANSWER ALL QUESTION 5 x 3 = 15

31) If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$ and $A^3 - 6A^2 + 7A + KI = O$, find the value of k.

32) Find x, y, a, and b if $\begin{bmatrix} 3x + 4y & 6 & x - 2y \\ a + b & 2a - b & -3 \end{bmatrix} = \begin{bmatrix} 2 & 6 & 4 \\ 5 & -5 & -3 \end{bmatrix}$

33) If $A = \begin{bmatrix} 0 & c & b \\ c & 0 & a \\ b & a & 0 \end{bmatrix}$, compute A^2

34) If A and B are symmetric matrices of same order, prove that AB - BA is a skew-symmetric matrix.

35) Find the value of x if $\begin{vmatrix} x-1 & x & x-2 \\ 0 & x-2 & x-3 \\ 0 & 0 & x-3 \end{vmatrix} = 0$

III. ANSWER ALL QUESTION 2 x 5 = 10

36) a) Show that $\begin{vmatrix} a^2 + x^2 & ab & ac \\ ab & b^2 + x^2 & bc \\ ac & bc & c^2 + x^2 \end{vmatrix}$ is divisible by x^4.

(OR)

b) If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ x & 2 & y \end{bmatrix}$ is a matrix such that $AA^T = 9I$, find the values of x and y.

(OR)

c) Show that $\begin{vmatrix} x + 2a & y + 2b & z + 2c \\ x & y & z \\ a & b & c \end{vmatrix} = 0$.

37) a)

If A = $\begin{bmatrix} \frac{1}{2} & \alpha \\ 0 & \frac{1}{2} \end{bmatrix}$,prove that $\sum_{k=1}^{n} det(A^k) = \frac{1}{3}(1 - \frac{1}{4^n})$.

(OR)

b)

Prove that $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc\left(1 + \frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right).$

(OR)

c)

Show that $\begin{vmatrix} 1 & 1 & 1 \\ x & y & z \\ x^2 & y^2 & z^2 \end{vmatrix}$ = (x - y)(y - z)(z - x).

ALL THE BEST

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