MATHS

BOOKS - SURA MATHS (TAMIL ENGLISH)

APPLICATION OF MATRICES AND DETERMINANTS

Exercise 1 1

1. Find the adjoint of the following :

$$\begin{bmatrix}-3 & 4 \\ 6 & 2\end{bmatrix}$$

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2. Find the adjoint of the following :

$$\begin{bmatrix} 2 & 3 & 1 \\ 3 & 4 & 1 \\ 3 & 7 & 2 \end{bmatrix}$$

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3. Find the adjoint of the following :

$$\frac{1}{3}\begin{bmatrix} 2 & 2 & 1 \\ -2 & 1 & 2 \\ 1 & -2 & 2 \end{bmatrix}$$

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4. Find the inverse (if it exists) of the following

$$\begin{bmatrix} -2 & 4 \\ 1 & -3 \end{bmatrix}$$

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5. Find the inverse (if it exists) of the following

$$\begin{bmatrix} 5 & 1 & 1 \\ 1 & 5 & 1 \\ 1 & 1 & 5 \end{bmatrix}$$

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6. Find the inverse (if it exists) of the following

$$\begin{bmatrix} 2 & 3 & 1 \\ 3 & 4 & 1 \\ 3 & 7 & 2 \end{bmatrix}$$

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7. If F $(\alpha) = \begin{bmatrix} \cos\alpha & 0 & \sin\alpha \\ 0 & 1 & 0 \\ -\sin\alpha & 0 & \cos\alpha \end{bmatrix}$

Show that = F $(\alpha)^{-1} = F(-\alpha)$

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8. If A = $\begin{bmatrix} 5 & 3 \\ -1 & -2 \end{bmatrix}$, show that $A^2 - 3A - 7I_2 = 0_2$.

Hence find A^{-1}.

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9. If A=$\frac{1}{9}\begin{bmatrix} -8 & 1 & 4 \\ 4 & 4 & 7 \\ 1 & -8 & 4 \end{bmatrix}$, prove that $A^{-1} = A^T$.

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10. If A=$\begin{bmatrix} 8 & -4 \\ -5 & 3 \end{bmatrix}$, verify that A(adj A)= (adj A) A= $|A|I_2$.

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11. If A = $\begin{bmatrix} 3 & 2 \\ 7 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & -3 \\ 5 & 2 \end{bmatrix}$ verify that $(AB)^{-1} = B^{-1}A^{-1}$.

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12. If adj (A) = $\begin{bmatrix} 2 & -4 & 2 \\ -3 & 12 & -7 \\ -2 & 0 & 2 \end{bmatrix}$, find A.

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13. If adj (A) = $\begin{bmatrix} 0 & -2 & 0 \\ 6 & 2 & -6 \\ -3 & 0 & 6 \end{bmatrix}$ find A^{-1}.

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14. Find adj (adj(A)) if adj A = $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & 0 \\ -1 & 0 & 1 \end{bmatrix}$.

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15.

$A = \begin{bmatrix} 1 & \tan x \\ -\tan x & 1 \end{bmatrix}$ show that $A^T A^{-1} = \begin{bmatrix} \cos 2x & -\sin 2x \\ \sin 2x & \cos 2x \end{bmatrix}$.

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16. Find the matrix A for which $A\begin{bmatrix} 5 & 3 \\ -1 & -2 \end{bmatrix} = \begin{bmatrix} 14 & 7 \\ 7 & 7 \end{bmatrix}$.

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17. Given A = $A = \begin{bmatrix} 1 & -1 \\ 2 & 0 \end{bmatrix}, B = \begin{bmatrix} 3 & -2 \\ 1 & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix}$,

find a matrix X such that AXB = C.

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18. If $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$, show that $A^{-1} = \frac{1}{2}\left(A^2 - 3I\right)$

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19. Decrypt the received encoded message $[2 \quad -3][20 \quad 4]$ with the encryption matrix $\begin{bmatrix} -1 & -1 \\ 2 & 1 \end{bmatrix}$ and the decryption matrix as its inverse where the system of codes are described by the numbers 1-26 to the letters A-Z respectively, and the number 0 to a blank space.

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Exercise 1 2

1. Find the rank of the following matrices by minor method :

$$\begin{bmatrix} 2 & -4 \\ -1 & 2 \end{bmatrix}$$

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2. Find the rank of the following matrices by minor method :

$$\begin{bmatrix} -1 & 3 \\ 4 & -7 \\ 3 & -4 \end{bmatrix}$$

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3. Find the rank of the following matrices by minor method :

$$\begin{bmatrix} 1 & -2 & -1 & 0 \\ 3 & -6 & -3 & 1 \end{bmatrix}$$

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4. Find the rank of the following matrices by minor method :

$$\begin{bmatrix} 1 & -2 & 3 \\ 2 & 4 & -6 \\ 5 & 1 & -1 \end{bmatrix}$$

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5. Find the rank of the following matrices by minor method :

$$\begin{bmatrix} 0 & 1 & 2 & 1 \\ 0 & 2 & 4 & 3 \\ 8 & 1 & 0 & 2 \end{bmatrix}$$

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6. Find the rank of the following matrices by row reduction method

:

$$\begin{bmatrix} 1 & 1 & 1 & 3 \\ 2 & -1 & 3 & 4 \\ 5 & -1 & 7 & 11 \end{bmatrix}$$

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7. Find the rank of the following matrices by row reduction method

:

$$\begin{bmatrix} 1 & 2 & -1 \\ 3 & -1 & 2 \\ 1 & -2 & 3 \\ 1 & -1 & 1 \end{bmatrix}$$

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8. Find the rank of the following matrices by row reduction method :

$$\begin{bmatrix} 3 & -8 & 5 & 2 \\ 2 & -5 & 1 & 4 \\ -1 & 2 & 3 & -2 \end{bmatrix}$$

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9. Find the inverse of each of the following by Gauss - Jordan method :

$$\begin{bmatrix} 2 & -1 \\ 5 & -2 \end{bmatrix}$$

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10. Find the inverse of each of the following by Gauss - Jordan method :

$$\begin{bmatrix} 1 & -1 & 0 \\ 1 & 0 & -1 \\ 6 & -2 & -3 \end{bmatrix}$$

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11. Find the inverse of each of the following by Gauss - Jordan method :

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 3 \\ 1 & 0 & 8 \end{bmatrix}$$

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Exercise 1 3

1. Solve the following system of linear equations by matrix inversion method.

$2x+5y = -2, x+2y=-3$

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2. Solve the following system of linear equations by matrix inversion method.

$2x-y=8, 3x+2y=-2$

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3. Solve the following system of linear equations by matrix inversion method.

$2x+3y-z=9, x+y+z=9, 3x-y-z=-1$

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4. Solve the following system of linear equations by matrix inversion method.

x+y+z-=2 = 0, 6x-4y+5z-31=0,5x+2y+2z=13.

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5. If A= $\begin{bmatrix} -5 & 1 & 3 \\ 7 & 1 & -5 \\ 1 & -1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 & 2 \\ 3 & 2 & 1 \\ 2 & 1 & 3 \end{bmatrix}$, find the products AB and BA and hence solve the system of equations x+y+2z= 1,3x+2y+z=7, 2x+y+3z=2.

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6. A man is appointed in a job with a monthly salary of certain amount and a fixed amount of annual increment. If his salary was

Rs 19,800 per month at the end of the first month after 3 years of service and Rs 23,400 per month at the end of the first month after 9 years of service find his starting salary and his annual increment. (Use matrix inversion method to solve the problem.)

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7. Four men and 4 women can finish a piece of work jointly in 3 days while 2 men and 5 women can finish the same work jointly in 4 days. Find the time taken by one man alone and that of one woman alone to finish the same work by using matrix inversion method.

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8. The prices of three commodities A,B and C are Rs x, y and z per unit respectively. A person P purchases 4 units of B and sells two units of A and 5 units of C. Person Q purchases 2 units of C and sells 3 units of A and one unit of B. Person R purchases one unit of A and sells 3 unit of B and one unit of C. In the process, PQ and R earn Rs 15,000, Rs 1,000 and Rs 4,000 respectively. Find the prices per unit of A,B and C. (Use matrix inversion method to solve the problem.)

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Exercise 1 4

1. Solve the following systems of linear equation by Cramer's rule:

$5x-2y+16=0, x+3y-7=0$

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2. Solve the following systems of linear equation by Cramer's rule:

$$\frac{3}{x}+2y=12, \frac{2}{x}+3y=13$$

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3. Solve the following systems of linear equation by Cramer's rule:

3x+3y-z=11, 2x-y+2z=9, 4x+3y+2z=25

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4. Solve the following systems of linear equation by Cramer's rule:

$$\frac{3}{x}-\frac{4}{y}-\frac{2}{z}-1=0, \frac{1}{x}+\frac{2}{y}+\frac{1}{z}-2=0, \frac{2}{x}-\frac{5}{y}-\frac{4}{z}+1=0$$

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5. In a competitive examination, one mark is awarded for every correct answer while $\frac{1}{4}$ mark is deducted for every wrong answer. A student answered 100 questions and got 80 marks. How many questions did he answer correctly ? (Use Cramer's rule to solve the problem).

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6. A chemist has one solution which is 50% acid and another solution which is 25 % acid. How much each should be mixed to make 10 litres of a 40 % acid solution ? (Use Cramer's rule to solve the problem).

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7. A fish tank can be filled in 10 minutes using both pumps A and B simultaneously. However, pump B can pump water in or out at the same rate. If pump B is inadvertently run in reverse, then the tank will be filled in 30 minutes. How long would it take each pump to fill the tank by itself ? (Use Cramer's rule to solve the problem).

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8. A family of 3 people went out for dinner in a restaurant. The cost of two dosai, three idlies and two vadais is Rs 150. The cost of the two dosai, two idlies and four vadais is Rs 200. The cost of five dosai, four idlies and two vadais is Rs 250. The family has Rs 350 in hand and they ate 3 dosai and six idlies and six vadais. Will they be able to manage to pay the bill within the amount they had?

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Exercise 1 5

1. Solve the following systems of linear equations by Gaussian elimination method.

2x-2y+3z=2,x+2y-z=3,3x-y+2z=1.

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2. Solve the following systems of linear equations by Gaussian elimination method.

2x+4y+6z=22,3x+8y+5z=27,-x+y+2z=2

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3. If ax^2+bx+c is divided by x+3,x-5, and x-1, the remainders are 21, 61 and 9 respectively. Find a,b, and c. (Use Gaussian elimination method.)

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4. An amount of Rs 65,000 is invested in three bonds at the rates of 6 % , 8% and 10% per annum respectively. The total annual income is Rs 4,800. The income from the third bond is Rs 600 more than that from the second bond. Determine the price of each bond. (Use Gaussian elimination method.)

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Exercise 1 6

1. Test for consistency and if possible solve the following system of equations by rank method.

$x-y+2z=2, 2x+y+4z=7, 4x-y+z=4$

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2. Test for consistency and if possible solve the following system of equations by rank method.

$3x+y+z=2, x-3y+2z=1, 7x-y+4z=5.$

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3. Test for consistency and if possible solve the following system of equations by rank method.

$2x+2y+z=5, x-y+z=1, 3x+y+2z=4$

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4. Test for consistency and if possible solve the following system of equations by rank method.

2x-y+z=2,6x-3y+3z=6,4x-2y+2z=4.

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5. Find the value of k for which the equations kx-2y+z=1, x-2ky+z=-2,x-2y+kz=1 have

(i) no solution

(ii) unique solution

(iii) infinitely many solution

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6. In vestigate the values of λ and μ the system of linear equations 2x+3y+5z=9,7x+3y-5z=8, 2x+3y+λz=μ, have

(i) no solution

(ii) a unique solution

(iii) an infinite number of solutions.

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Exercise 1 7

1. Solve the following system of homogeneous equations.

3x+2y+7z=0,4x-3y-2z=0, 5x+9y+23z=0

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2. Solve the following system of homogeneous equations.

2x+3y-z=0,x-y-2z=0,3x+y+3z=0.

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3. Determine the values of λ for which the following system of equations x+y+3z=0,4x+3y+λz=0, 2x+y+2z=0 has

(i) a unique solution

(ii) a non-trivial solution.

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4. By using Gaussian elimination method, balance the chemical reaction equation:

$C_2H_6 + O_2 \rightarrow H_2O + CO_2$.

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Exercise 1 8

1. If $|adj(adjA)| = |A|^9$ square matrix A is

A. 3

B. 4

C. 2

D. 5

Answer: D

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2. If A is a 3×3 non -singular matrix such that $\mathrm{AA}^T = A^T A \text{and} B = A^{-1}A^T, \text{then} BB^T$ =

A. A

B. B

C. I_3

D. B^T

Answer: C

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3. A= $\begin{bmatrix} 3 & 5 \\ 1 & 2 \end{bmatrix}$, B=adj A and C =3A, then $\frac{|adjB|}{|C|}$=

A. $\frac{1}{3}$

B. $\frac{1}{9}$

C. $\frac{1}{4}$

D. 1

Answer: A

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4. If A $\begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix} = \begin{bmatrix} 6 & 0 \\ 0 & 6 \end{bmatrix}$, then A=

A. $\begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 2 \\ -1 & 4 \end{bmatrix}$

C. $\begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 4 & -1 \\ 2 & 1 \end{bmatrix}$

Answer: A::B::D

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5. If A = $\begin{bmatrix} 7 & 3 \\ 4 & 2 \end{bmatrix}$, then $9I_2 - A =$

A. A^{-1}

B. $\frac{A^{-1}}{2}$

C. $3A^{-1}$

D. $2A^{-1}$

Answer: A::B

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6. If A = $\begin{bmatrix} 2 & 0 \\ 1 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 4 \\ 2 & 0 \end{bmatrix}$ then |adj(AB)|=

A. -40

B. -80

C. -60

D. -20

Answer:

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7. If P = $\begin{vmatrix} 1 & x & 0 \\ 1 & 3 & 0 \\ 2 & 4 & -2 \end{vmatrix}$ is the adjoint of 3×3 matrix A and |A|=4, then x is

A. 15

B. 12

C. 14

D. 11

Answer: A

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8. If A = $\begin{bmatrix} 3 & 1 & -1 \\ 2 & -2 & 0 \\ 1 & 2 & -1 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$ then the value of a_{23} is

A. 0

B. -2

C. -3

D. -1

Answer: A

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9. If A, B and C are invertible matrices of some order, then which one of the following is not true?

A. adj A = $|A|A^{-1}$

B. adj (AB) = (adj A) (adj B)

C. det A^{-1} = $(\det A)^{-1}$

D. $(ABC)^{-1} = C^{-1}B^{-1}A^{-1}$

Answer: A::B::D

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10. If $(AB)^{-1} = \begin{bmatrix} 12 & -17 \\ -19 & 27 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1 & -1 \\ -2 & 3 \end{bmatrix}$ then B^{-1}=

A. $\begin{bmatrix} 2 & -5 \\ -3 & 8 \end{bmatrix}$

B. $\begin{bmatrix} 8 & 5 \\ 3 & 2 \end{bmatrix}$

C. $\begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 8 & -5 \\ -3 & 2 \end{bmatrix}$

Answer: B::C

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11. If $A^T . A^{-1}$ is symmetric, then A^2=

A. A^{-1}

B. $(A^T)^2$

C. A^T

D. $(A^{-1})^2$

Answer: A::B

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12. If A is a non-singular matrix such that $A^{-1} = \begin{bmatrix} 5 & 3 \\ -2 & -1 \end{bmatrix}$, then $(A^T)^{-1}$=

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

B. $\begin{bmatrix} 5 & 3 \\ -2 & -1 \end{bmatrix}$

C. $\begin{bmatrix} -1 & -3 \\ 2 & 5 \end{bmatrix}$

D. $\begin{bmatrix} 5 & -2 \\ 3 & -1 \end{bmatrix}$

Answer: A::B::C

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13. A = $\begin{bmatrix} \frac{3}{5} & \frac{4}{5} \\ x & \frac{3}{5} \end{bmatrix}$ and $A^T = A^{-1}$, then the value of x is

A. $\frac{-4}{5}$

B. $\frac{-3}{5}$

C. $\frac{3}{5}$

D. $\frac{4}{5}$

Answer: D

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14. If A = $\begin{bmatrix} 1 & \tan\frac{\theta}{2} \\ -\tan\frac{\theta}{2} & 1 \end{bmatrix}$ and AB = I_2, then B=

A. $\left(\cos^2\frac{\theta}{2}\right)A$

B. $\left(\cos^2\frac{\theta}{2}\right)A^T$

C. $\left(\cos^2\theta\right)I$

D. $\left(\sin^2\frac{\theta}{2}\right)A$

Answer: A::B::C

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15. $A=\begin{bmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{bmatrix}$ and A (adj A) = $\begin{bmatrix}k & 0\\ 0 & k\end{bmatrix}$, then =k

A. 0

B. $\sin\theta$

C. $\cos\theta$

D. 1

Answer: A

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16. If $A = \begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$ be such that $\lambda A^{-1} = A$, then λ is

A. 17

B. 14

C. 19

D. 21

Answer: A

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17. If adj A = $\begin{bmatrix} 2 & 3 \\ 4 & -1 \end{bmatrix}$ and adj B = $\begin{bmatrix} 1 & -2 \\ -3 & 1 \end{bmatrix}$ then adj (AB) is

A. $\begin{bmatrix} -7 & -1 \\ 7 & -9 \end{bmatrix}$

B. $\begin{bmatrix} -6 & 5 \\ -2 & -10 \end{bmatrix}$

C. $\begin{bmatrix} -7 & 7 \\ -1 & -9 \end{bmatrix}$

D. $\begin{bmatrix} -6 & -2 \\ 5 & -10 \end{bmatrix}$

Answer: A::B

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18. The rank of the matrix $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 6 & 8 \\ -1 & -2 & -3 & -4 \end{bmatrix}$ is

A. 1

B. 2

C. 4

D. 3

Answer: A

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19. If

$$x^a y^b = e^m, x^c y^d = e^n, \Delta_1 = \begin{bmatrix} m & b \\ n & d \end{bmatrix} \Delta_2 = \begin{bmatrix} a & m \\ c & n \end{bmatrix}, \Delta_3 = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

then the value of x and y are respectively.

A. $e^{(\Delta_2 / \Delta_1)}, e^{(\Delta_3 / \Delta_1)}$

B. $\log(\Delta_1 / \Delta_3), \log(\Delta_2 / \Delta_3)$

C. $\log(\Delta_2 / \Delta_1), \log(\Delta_3 / \Delta_1)$

D. $e^{(\Delta_1 / \Delta_3)}, e^{(\Delta_2 / \Delta_3)}$

Answer: A::B::C::D

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20. Which of the following is/are correct ?

(i) Adjoint of a symmetric matrix is also a symmetric matrix.

(ii) Adjoint of a diagonal matrix is also a diagonal matrix.

(iii) If A is a square matrix of order n and λ is a scalar, then adj ($\lambda A) = \lambda^n$ adj(A)

(iv) A (adj A) = (adj A) A = $|A|I$

A. Only (i)

B. (ii) and (iii)

C. (iii) and (iv)

D. (i), (ii) and (iv)

Answer: A::D

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21. If ρ (A) = ρ ([A|B]), then the system AX = B of linear equations is

A. consistent and has a unique solution

B. consistent

C. consistent and has infinitely many solution

D. inconsistent

Answer: C

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22. If $0 \leq \theta \leq \pi$ and the system of equations x+(sin $\theta)y-(\cos\theta)z=0, (\cos\theta)x-y+z=0, (\sin\theta)x+y-z=0$ has a non -trivial solution then θ is

A. $\frac{2\pi}{3}$

B. $\frac{3\pi}{4}$

C. $\frac{5\pi}{6}$

D. $\frac{\pi}{4}$

Answer: D

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23. The augmented matrix of a system of linear equations is $\begin{bmatrix} 1 & 2 & 7 & 3 \\ 0 & 1 & 4 & 6 \\ 0 & 0 & \lambda - 7 & \mu + 5 \end{bmatrix}$. The system has infinitely many solutions if

A. $\lambda = 7, \mu \neq -5$

B. $\lambda = -7, \mu = -5$

C. $\lambda \neq 7, \mu \neq -5$

D. $\lambda = 7, \mu = -5$

Answer: A::B::D

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24. Let A $= \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix} \text{and} 4B = \begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & x \\ -1 & 1 & 3 \end{bmatrix}$.

If B is the inverse of A, then the value of x is

A. 2

B. 4

C. 3

D. 1

Answer: A

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25. If A = $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, then adj (adj A) is

A. $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$

B. $\begin{bmatrix} 6 & -6 & 8 \\ 4 & -6 & 8 \\ 0 & -2 & 2 \end{bmatrix}$

C. $\begin{bmatrix} -3 & 3 & -4 \\ -2 & 3 & -4 \\ 0 & 1 & -1 \end{bmatrix}$

D. $\begin{bmatrix} 3 & -3 & 4 \\ 0 & -1 & 1 \\ 2 & -3 & 4 \end{bmatrix}$

Answer: A::B::C::D

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Additional Questions 1 Mark

1. The system of linear equations x +y+z =6, x+2y+3z= 14 and 2x+5y+ $\lambda z = \mu(\lambda, \mu \in \mathrm{RR})$ is consistent with unique solution if

A. $\lambda = 8$

B. $\lambda = 8, \mu \neq 36$

C. $\lambda \neq 8$

D. none

Answer: A::B::D

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2. If the system of equations x= cy +bz, y=az +cx and z=bx+ay has a non - trivial solution then

A. $a^2 + b^2 + c^2$=1

B. abc $\neq$ 1

C. a+b+c=0

D. $a^2 + b^2 + c^2 + 2abc = 1$

Answer: A::B::C

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3. Let A be a 3×3 matrix and B its adjoint matrix If |B|= 64, then |A| =

A. ± 2

B. ± 4

C. ± 8

D. ± 12

Answer:

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4. If A^T is the transpose of a square matrix A, then

A. $|A| \neq |A^T|$

B. $|A| = |A^T|$

C. $|A| + |A^T|$=0

D. $|A| = |A^T|$ only

Answer: A

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5. The number of solutions of the system of equations 2x+y=4, x-2y=2, 3x+5y=6 is

A. 0

B. 1

C. 2

D. infinitely many

Answer: A

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6. If A is a square matrix that |A|= 2, than for any positive integer n ,

$|A^n| =$

A. 0

B. 2n

C. 2^n

D. n^2

Answer: B

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7. The system of linear equations x+y+z =2, 2x+y-z=3, 3x+2y+kz= has a unique solution if

A. $k \neq 0$

B. $-1 < k < 1$

C. $-2 < k < 2$

D. k=0

Answer:

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8. If A is a square matrix of order n, then |adj A|=

A. $|A|^{n-1}$

B. $|A|^{n-2}$

C. $|A|^{n}$

D. none

Answer: A

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9. If the system of equations x +2y-3x=2, (k+3) z=3, (2k+1) y+z=2 is inconsistent then k is

A. $-3, \ -\frac{1}{2}$

B. $-\frac{1}{2}$

C. 1

D. 2

Answer: A::B::C

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10. If A = $\begin{pmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{pmatrix}$ and A (adj A) = $\lambda \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ then λ is

A. sinx cos x

B. 1

C. 2

D. none

Answer: B

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11. If A is a matrix of order $m \times n$, then ρ (A) is

A. m

B. n

C. $\leq$ min (m,n)

D. $\geq$ min (m,n)

Answer:

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12. The system of equations x +2y+3z=1, x-y+4z=0, 2x+y+7z=1 has

A. One solution

B. Two solution

C. No solution

D. Infinitely many solution

Answer: A

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13. If ρ (A) = ρ ([A/B]) = number of unknowns, then the system is

A. consistent and has infinitely many solutions

B. consistent

C. inconsistent

D. consistent and has unique solution.

Answer: A::C::D

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14. Which of the following is not an elementary transformation ?

A. $R_i \leftrightarrow R_j$

B. $R_i \rightarrow 2R_i + R_j$

C. $C_j \rightarrow C_j + C_i$

D. $R_i \rightarrow R_i + C_j$

Answer: C

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15. If ρ (A) =r then which of the following is correct?

A. all the minors of order in which do not vanish

B. A' has at least one minor of order r which does not vanish and all higher order minors vanish

C. A' has at least one (r+1) order minor which vanish

D. all (r+1) and higher order minors should not vanish

Answer: A::B::C::D

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Additional Questions Ii Fill In The Blanks

1. Every homogeneous system ....

A. Is always consistent

B. Has only trivial solution

C. Has infinitely many solution

D. Need not be consistent

Answer: A::C

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2. If $\rho(A) \neq \rho([A \mid B])$, then the system is ....

A. consistent and has infinitely many solutions

B. consistent and has a unique solution

C. consistent

D. inconsistent

Answer: C

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3. In the non-homogeneous system of equations with 3 unknowns if $\rho(A) = \rho([A \mid B])$=2, then the system has ....

A. unique solution

B. one parameter family of solution

C. two parameter family of solutions

D. in consistent

Answer: A

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4. Cramer's rule is applicable only when ....

A. $\Delta \neq 0$

B. $\Delta = 0$

C. $\Delta = 0, \Delta_x = 0$

D. $\Delta_x = \Delta_y = \Delta_z = 0$

Answer: A::D

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5. In a homogeneous system if $\rho(A) = \rho([A \mid 0]) <$ the number of unknowns then the system has..........

A. trivial solution

B. only non- trivial solution

C. no solution

D. trivial solutions and infinitely many non- trivial solutions

Answer: A::D

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6. In the system of equations with 3 unknowns, if $\Delta = 0$ and one of $\Delta_x, \Delta_y, \text{of}\Delta_z$ is non zero then the system is ....

A. Consistent

B. inconsistent

C. consistent with one parameter family of solutions

D. consistent with two parameter family of solutions

Answer: C

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7. In the system of liner equations with 3 unknowns if $\rho(A) = \rho([A \mid B]) = 1$, the system has ....

A. unique solution

B. inconsistent

C. consistent with 2 parameter family of solution

D. consistent with one parameter family of solution.

Answer: A::B::C

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8. If A = [2 0 1] then the rank of AA^T is ....

A. 1

B. 2

C. 3

D. 0

Answer: A

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9. If A is a non-singular matrix then $\left|A^{-1}\right|$=

A. $\left|\frac{1}{A^2}\right|$

B. $\frac{1}{|A|^2}$

C. $\left|\frac{1}{2}\right|$

D. $\frac{1}{|A|}$

Answer: d

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10. In a square matrix the minor M_{ij} and the co-factor A_{ij} of and element a_{ij} are related by

A. $A_{ij} = -M_{ij}$

B. $A_{ij} = M_{ij}$

C. $A_{ij} = (-1)^{i+j} M_{ij}$

D. $A_{ij} = (-1)^{i-j} M_{ij}$

Answer: A

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Additional Questions Iv Choose The Odd Man Out

1. The rank of any 3×4 matrix is

A. May be 1

B. May be 2

C. May be 3

D. May be 4

Answer: A::B::D

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2. If A is symmetric then

A. A^T =A

B. adj A is symmetric

C. adj $\left(A^T\right) = (adjA)^T$

D. A is orthogonal

Answer: A

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3. If A is a non-singular matrix of odd order them

A. Order of A is 2 m +1

B. Order of A is 2m+2

C. |adj A| is positive

D. Order of A is 2m+2

Answer:

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4. If A is a orthogonal matrix, then

A. $AA^T = A^T A = I$

B. A is non- singular

C. |A| =0

D. $A^{-1} = A^T$

Answer: A

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5. A matrix which is obtained from an identity matrix by applying only one elementary transformation is

A. Identity matrix

B. Elementary matrix

C. Square matrix

D. Equivalent of identify matrix

Answer: A::D

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Additional Questions V Choose The Incorrect Answer

1. In an echelon form which of the following is incorrect ?

A. Every row of A which has all its entries 0 occurs below every row which has a non-zero entry.

B. The first non-zero entry in each non-zero row is 1

C. The number of zeros before the first non-zero element in a row is less than the number of such zeros in the next row

D. Two row can have same number of zeros before the first non-zero entry

Answer: b

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2. Which of the following elementary transformation is not correct ?

A. $R_i \to R_i + 2R_j$

B. $C_i \to C_i - C_j$

C. $R_i \to 7R_i + \frac{5}{3}R_j$

D. $C_i \to C_i - R_j$

Answer: C

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3. It A is an invertible matrix, then which of the following is not true.

A. $\left(A^2\right)^{-1} = \left(A^{-1}\right)^2$

B. $\left|A^{-1}\right| = |A|^{-1}$

C. $\left(A^T\right)^{-1} = \left(A^{-1}\right)^T$

D. $|A| \neq 0$

Answer: A::B

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4. The matrix $\begin{bmatrix} 5 & 10 & 3 \\ -2 & -4 & 6 \\ -1 & -2 & x \end{bmatrix}$ is a singular matrix if the value of x is

A. 3

B. non-existent

C. All values of x

D. none of the above

Answer: C

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5. The number of solutions of the system of equations $2x+y-z=7, x-3y+2z=1, x+3y-3z=5$ is

A. 0

B. 3

C. No solution

D. inconsistent

Answer: C

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Additional Questions 2 Marks

1. For any 2×2 matrix if A (adj A)= $\begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$ then find |A|.

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2. For the matrix A, if $A^3 = I$, then find A^{-1}.

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3. If A is a square matrix such that $A^3 = I$, then prove that A is non-singular

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4. Show that the system of equations is inconsistent. $2x+5y=7, 6x+15y=13$.

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5. Find the rank of the matrix $\begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$

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6. Find the rank of matrix A = $\begin{bmatrix} 4 & 5 & -6 & 1 \\ 7 & -3 & 0 & 8 \end{bmatrix}$.

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7. Show that the equations $3x+y+9z=0$, $3x+2y+12z=0$ and $2x+y+7z=0$ have non-trival solutions also.

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8. Find k if the equations $x+2y+2z=0$, $x-3y-3z=0$, $2x+y+kz=0$ have only the trivial solution.

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9. Solve $2x-y=3, 5x+y=4$ using matrices.

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10. Solve $6x-7y=16$, $9x-5y=35$ using (Cramer's rule).

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Additional Questions 3 Marks

1. Solve 2x+3y=10, x+6y=4 using Cramer's rule.

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2. For what value of t will the system tx+3y-z=1, x+2y+z=2, -tx+y+2z=-1 fail to have unique solution ?

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3. Solve 3x+ay=4,2x+ay=2,a $\neq$ 0 by Cramer's rule.

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4. Verify $(AB)^{-1} = B^{-1}A^{-1}$ for A = $\begin{bmatrix} 2 & 1 \\ 5 & 3 \end{bmatrix}$ and B= $\begin{bmatrix} 4 & 5 \\ 3 & 4 \end{bmatrix}$.

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5. Under what conditions will the rank of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & h-2 & 2 \\ 0 & 0 & h+2 \\ 0 & 0 & 3 \end{bmatrix}$ be less than 3 ?

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6. Find the rank of the matrix math $\begin{bmatrix} 4 & 4 & 0 & 3 \\ -2 & 3 & -1 & 5 \\ 1 & 4 & 8 & 7 \end{bmatrix}$

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7. Verify that $(A^{-1})^{T} = (A^{T})^{-1}$ for A = $\begin{bmatrix} -2 & -3 \\ 5 & -6 \end{bmatrix}$.

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8. Solve 2x-3y=7, 4x-6y=14 by Gaussian Jordan method.

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9. Solve x+y+3z=4, 2x+2y+6z=7, 2x+y+z=10.

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10. If the rank of the matrix $\begin{bmatrix} \lambda & -1 & 0 \\ 0 & \lambda & -1 \\ -1 & 0 & \lambda \end{bmatrix}$ is 2, then find λ.

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Additional Questions 5 Marks

1. Using determinants find the quadratic defined by f(x)=ax^2+bx+c, if f(1)=0, f(2)=-2 and f(3) = - 6.

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2. Solve :

$$\frac{2}{x}+\frac{3}{y}+\frac{10}{z}=4,\ \frac{4}{x}-\frac{6}{y}+\frac{5}{z}=1,\ \frac{6}{x}+\frac{9}{y}-\frac{20}{z}=2$$

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3. The sum of three numbers is 20. If we multiply the third number by 2 and add the first number to the result we get 23. By adding second and third numbers to 3 times the first number we get 46. Find the numbers using Cramer's rule.

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4. For what value of λ, the system of equations x+y+z=1, x+2y+4z=λ, x+4y+10z=λ^2 is consistent

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5. Show that the equations -2x+y+z=a,x-2y+z=b,x+y-2z=c are consistent only if a+b+c=0.

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