MATHS

BOOKS - VIKRAM PUBLICATION (ANDHRA PUBLICATION)

MATRICES

Textual Exercises Exercise 3 A

1. Write the following as a single matrix.

(i) $\begin{bmatrix}2 & 1 & 3\end{bmatrix} + \begin{bmatrix}0 & 0 & 0\end{bmatrix}$

(ii) $\begin{bmatrix}0 \\ 1 \\ -1\end{bmatrix} + \begin{bmatrix}-1 \\ 1 \\ 0\end{bmatrix}$

(iii) $\begin{bmatrix}3 & 9 & 0 \\ 1 & 8 & -2\end{bmatrix} + \begin{bmatrix}4 & 0 & 2 \\ 7 & 1 & 4\end{bmatrix}$

(iv) $\begin{bmatrix}-1 & 2 \\ 1 & -2 \\ 3 & -1\end{bmatrix} + \begin{bmatrix}0 & 1 \\ -1 & 0 \\ -2 & 1\end{bmatrix}$

2. If $A = \begin{bmatrix} -1 & 3 \\ 4 & 2 \end{bmatrix}, B = \begin{bmatrix} 2 & 1 \\ 3 & -5 \end{bmatrix}, X = \begin{bmatrix} x_1 & x_2 \\ x_3 & x_4 \end{bmatrix}$ and $A + B = x$ then find the values of x_1, x_2, x_3 and x_4.

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3. If $A = \begin{bmatrix} -1 & -2 & 3 \\ 1 & 2 & 4 \\ 2 & -1 & 3 \end{bmatrix}, B = \begin{bmatrix} 1 & -2 & 5 \\ 0 & -2 & 2 \\ 1 & 2 & -3 \end{bmatrix}$ and $C = \begin{bmatrix} -2 & 1 & 2 \\ 1 & 1 & 2 \\ 2 & 0 & 1 \end{bmatrix}$ then $A + B + C =$

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4. IF $A = \begin{bmatrix} 3 & 2 & -1 \\ 2 & -2 & 0 \\ 1 & 3 & 1 \end{bmatrix} B = \begin{bmatrix} -3 & -1 & 0 \\ 2 & 1 & 3 \\ 4 & -1 & 2 \end{bmatrix}$ and X=A+B then find X.

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5. If $\begin{bmatrix} x-3 & 2y-8 \\ z+2 & 6 \end{bmatrix} = \begin{bmatrix} 5 & 2 \\ -2 & a-4 \end{bmatrix}$ then find x,y,z & a.

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6. If $\begin{bmatrix} x-1 & 2 & 5-y \\ 0 & z-1 & 7 \\ 1 & 0 & a-5 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 4 & 7 \end{bmatrix}$ then find the values of x,y,z and a.

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7. Find the trace of $\begin{bmatrix} 1 & 3 & -5 \\ 2 & -1 & 5 \\ 1 & 0 & 1 \end{bmatrix}$

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8. If $A = \begin{bmatrix} 0 & 1 & 2 \\ 2 & -1 & 5 \\ 4 & 5 & -6 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 2 & 3 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$. Find B-A and 4A-5B

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9. IF $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 2 & 1 \\ 1 & 2 & 3 \end{bmatrix}$, find 3B-2A

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Textual Exercises Exercise 3 B

1. If $A = \begin{bmatrix} 1 & -2 & 3 \\ -4 & 2 & 5 \end{bmatrix}, B = \begin{bmatrix} 2 & 3 \\ 4 & 5 \\ 2 & 1 \end{bmatrix}$ then

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

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3. If $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, find A^2.

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4. IF $A = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$ and $C = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ and 1 is the unit matrix of order 2. then show that AB=-BA=-C

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5. If $A = \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 2 & 0 \\ 1 & 0 & 4 \end{bmatrix}$, then find AB. Find BA if it exists.

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6. if $A = \begin{bmatrix} 2 & 4 \\ -1 & k \end{bmatrix}$, and $A^2 = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ find the value of k.

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7. If $A = \begin{vmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{vmatrix}$, then find A^4

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8. IF $A = \begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix}$ then find A^3.

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9. If $A = \begin{bmatrix} 1 & -2 & 1 \\ 0 & 1 & -1 \\ 3 & -1 & 1 \end{bmatrix}$ then show that $A^3 - 3A^2 - A - 3I = O$, where I is unit matrix of order 3

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10. If $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and $E = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ then show that $(aI + bE)^3 = a^3I + 3a^2bE$ where I is identify matrix of order 2.

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11. If $diagA = [a_1, a_2, a_3]$, then for any integer $n \geq 1$ show that $A^n = diag\left[a_1^n, a_2^n, a_3^n\right]$

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12. $\theta - \varphi = \frac{\pi}{2}$ then show that $\begin{bmatrix}\cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta\end{bmatrix}\begin{bmatrix}\cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi\end{bmatrix} = O$

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13. IF $A = \begin{bmatrix}3 & -4 \\ 1 & -1\end{bmatrix}$ then show that $A^n = \begin{bmatrix}1+2n & -4n \\ n & 1-2n\end{bmatrix}$, for any integer $n \geq 1$.

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14. Given example of two square matrices A and B of the same order for which AB=O, but $BA \neq O$.

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15. A trust fund has to invest Rs 30,000 in two different types of bonds. The first bond pays 5% interest per year, and the second bond pays 7% interest per year. Using matrix multiplication, determine how to divide Rs.30,000 among the two types of bonds, if the trust fund must obtain an annual total interest of (a) Rs.1800(b) Rs.2000.

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Textual Exercises Exercise 3 C

1. If $A = \begin{bmatrix} 2 & 0 & 1 \\ -1 & 1 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 1 & 0 \\ 0 & 1 & -2 \end{bmatrix}$, then find (AB).

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2. IF $A = \begin{bmatrix} -2 & 1 \\ 5 & 0 \\ -1 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 3 & 1 \\ 4 & 0 & 2 \end{bmatrix}$ then find 2A+B' and 3B'-A.

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3. If $A = \begin{bmatrix} 2 & -4 \\ -5 & 3 \end{bmatrix}$, then find A+A' and AA'.

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4. IF $A = \begin{bmatrix} -1 & 2 & 3 \\ 2 & 5 & 6 \\ 3 & x & 7 \end{bmatrix}$ is symmetric, find the value of x

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5. IF $\begin{bmatrix} 0 & 2 & 1 \\ -2 & 0 & -2 \\ -1 & x & 0 \end{bmatrix}$ is a skew symmetric matrix then find the value of x.

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6. Is $A = \begin{bmatrix} 0 & 1 & 4 \\ -1 & 0 & 7 \\ -4 & -7 & 0 \end{bmatrix}$ symmetric or skew symmetric?

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7. If $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, then show that AA'= A'A.

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8. If $A = \begin{bmatrix} 1 & 5 & 3 \\ 2 & 4 & 0 \\ 3 & -1 & -5 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -1 & 0 \\ 0 & -2 & 5 \\ 1 & 2 & 0 \end{bmatrix}$ then find $3A - 4B$.

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9. IF $A = \begin{bmatrix} 7 & -2 \\ -1 & 2 \\ 5 & 3 \end{bmatrix}$. $B = \begin{bmatrix} -2 & -1 \\ 4 & 2 \\ -1 & 0 \end{bmatrix}$ then find AB' and BA'

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10. For any square matrix A, show that AA' is symmetric.

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Textual Exercises Exercise 3 D

1. Find the determinant value of the following matrices.

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

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2. Find the determinant value of the following matrices.

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

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3. Find the determinant value of the following matrices.

$$\begin{bmatrix} i & 0 \\ 0 & -i \end{bmatrix}$$

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4. $\begin{vmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{vmatrix} =$

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5. $\begin{vmatrix} 1 & 4 & 2 \\ 2 & -1 & 4 \\ -3 & 7 & -6 \end{vmatrix} =$

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6. Find the determination of the following matrices.

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

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7. Find the determinant value of the following matrices.

$$\begin{bmatrix} 1 & 2 & -3 \\ 4 & -1 & 7 \\ 2 & 4 & -6 \end{bmatrix}$$

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8. $\begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix} =$

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9. $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} =$

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10. Find the determinant of the matrix $\begin{bmatrix} 1^2 & 2^2 & 3^2 \\ 2^2 & 3^2 & 4^2 \\ 3^2 & 4^2 & 5^2 \end{bmatrix}$

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11. IF $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 3 & 4 \\ 5 & -6 & x \end{bmatrix}$ and det A=45 then find x.

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12. Show that $\begin{vmatrix} bc & b+c & 1 \\ ca & c+a & 1 \\ ab & a+b & 1 \end{vmatrix} = (a-b)(b-c)(c-a)$

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13.

$\left|(b+c, c+a, a+b), (a+b, b+c, c+a), (a, b, c)\right] = a^3 + b^3 + c^3 - 3abc$

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14. Prove that $\begin{vmatrix} y+z & x & x \\ y & z+x & y \\ z & z & x+y \end{vmatrix} = 4xyz$

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15. $\begin{vmatrix} a & a^2 & 1+a^3 \\ b & b^2 & 1+b^3 \\ c & c^2 & 1+c^3 \end{vmatrix} = 0, \begin{vmatrix} a & a^2 & 1 \\ b & b^2 & 1 \\ c & c^2 & 1 \end{vmatrix} \neq 0$అయితే abc=-1 అని చూపండి.

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16. Without expanding the determinant, prove that:

(i) $\begin{vmatrix} \alpha & \alpha^2 & \beta\gamma \\ \beta & \beta^2 & \gamma\alpha \\ \gamma & \gamma^2 & \alpha\beta \end{vmatrix} = \begin{vmatrix} 1 & \alpha^2 & \alpha^3 \\ 1 & \beta^2 & \beta^3 \\ 1 & \gamma^2 & \gamma^3 \end{vmatrix}$

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17. Without expanding the determinant, prove that:

$$\begin{vmatrix} \alpha\xi & \beta\psi & \gamma\zeta \\ \xi^2 & \psi^2 & \zeta^2 \\ 1 & 1 & 1 \end{vmatrix} = \begin{vmatrix} \alpha & \beta & \gamma \\ \xi & \psi & \zeta \\ \psi\zeta & \zeta\xi & \psi\zeta \end{vmatrix}$$

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18. Without expanding the determinant, prove that:

$$\begin{vmatrix} 1 & \beta\gamma & \beta+\gamma \\ 1 & \gamma\alpha & \gamma+\alpha \\ 1 & \alpha\beta & \alpha+\beta \end{vmatrix} = \begin{vmatrix} 1 & \alpha & \alpha^2 \\ 1 & \beta & \beta^2 \\ 1 & \gamma & \gamma^2 \end{vmatrix}$$

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19. If

$$\Delta_1 = \begin{vmatrix} a_1^2 + b_1 + c_1 & a_1 a_2 |b_2| c_2 & a_1 a_3 + b_3 + c_3 \\ b_1 b_2 + c_1 & b_2^2 + c_2 & b_2 b_3 + c_3 \\ c_1 c_3 & c_2 c_3 & c_3^2 \end{vmatrix} \text{ and } \Delta_2 = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$$

, then find the value of $\frac{\Delta_1}{\Delta_2}$.

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20. $\Delta_1 = \begin{vmatrix} 1 & \cos\alpha & \cos\beta \\ \cos\alpha & 1 & \cos\gamma \\ \cos\beta & \cos\gamma & 1 \end{vmatrix}, \Delta_2 = \begin{vmatrix} 0 & \cos\alpha & \cos\beta \\ \cos\alpha & 0 & \cos\gamma \\ \cos\beta & \cos\gamma & 0 \end{vmatrix}, \Delta_1 = \Delta_2$ అయితే $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$ అని చూపండి.

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21. Show that $\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3$

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22. Show that

$$\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}^2 = \begin{vmatrix} 2bc-a^2 & c^2 & b^2 \\ c^2 & 2ac-b^2 & a^2 \\ b^2 & a^2 & 2ab-c^2 \end{vmatrix} = \left(a^3+b^3+c^3-3abc\right)^2$$

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23. Show that $\begin{vmatrix} a^2+2a & 2a+1 & 1 \\ 2a+1 & a+2 & 1 \\ 3 & 3 & 1 \end{vmatrix} = (a-1)^3$

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24. Show that $\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ a^2 & b^3 & c^3 \end{vmatrix} = abc(a-b)(b-c)(c-a)$

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25. Show that $A = \begin{vmatrix} -2a & a+b & c+a \\ a+b & -2b & b+c \\ c+a & c+b & -2c \end{vmatrix} = 4(a+b)(b+c)(c+a)$

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26. Show that $\begin{vmatrix} a-b & b-c & c-a \\ b-c & c-a & a-b \\ c-a & a-b & b-c \end{vmatrix} = 0$

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27. Show that $\begin{vmatrix} 1 & a & a^2 - bc \\ 1 & b & b^2 - ca \\ 1 & c & c^2 - ab \end{vmatrix} = 0$

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28. Show that $\begin{vmatrix} x & a & a \\ a & x & a \\ a & a & x \end{vmatrix} = (x + 2a)(x - a)^2$

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Textual Exercises Exercise 3 E

1. Find the Adjoint and Inverse of the matrix $A = \begin{bmatrix} 2 & -3 \\ 4 & 6 \end{bmatrix}$

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2. Find the Adjoint and Inverse of the matrix $\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$

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3. Find the adjoint and inverse of the matrix $A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}$

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4. Find the adjoint and inverse of the matrix $\begin{bmatrix} 2 & 1 & 2 \\ 1 & 0 & 1 \\ 2 & 2 & 1 \end{bmatrix}$

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5. Find the adjoint and inverse of the following matrices.

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

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6. Find the adjoint and inverse of the following matrices.

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

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7. Find the adjoint and inverse of the following matrices.

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

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8. If $A = \begin{bmatrix} a+ib & c+id \\ -c+id & a-ib \end{bmatrix}, a^2+b^2+c^2+d^2=1$, then find inverse of A.

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9. If $A = \begin{bmatrix} 1 & -2 & 3 \\ 0 & -1 & 4 \\ -2 & 2 & 1 \end{bmatrix}$, then find $(A)^{-1}$.

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10. IF $A = \begin{bmatrix} -1 & -2 & -2 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$ then show that adj $A = 3A^T$. Also find A^{-1}.

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11. IF $abc \neq 0$, find the inverse of $\begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$

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12. If $S = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$, $A = \frac{1}{2}\begin{bmatrix} b+c & c-a & b-a \\ c-b & c+a & a-b \\ b-c & a-c & a+b \end{bmatrix}$, then $SAS^{-1} =$

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13. IF $3A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ -2 & 2 & -1 \end{bmatrix}$ then show that $A^{-1} = A'$.

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14. IF $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ then show that $A^{-1} = A^3$.

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15. If AB = I or BA= I, then prove that A is invertible and $B = A^{-1}$.

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Textual Exercises Exercise 3 F

1. Find the rank of $\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$

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2. Find the rank of $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

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3. Find the rank of $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$

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4. Find the rank of $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$

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

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6. Find the rank of $\begin{bmatrix} 1 & 2 & 6 \\ 2 & 4 & 3 \end{bmatrix}$

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7. Find the rank of the following matrices

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

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

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9. Find the rank of $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$

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10. Find the rank of $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$

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11. Find the rank of $A = \begin{bmatrix} 1 & 2 & 0 & -1 \\ 3 & 4 & 1 & 2 \\ -2 & 3 & 2 & 5 \end{bmatrix}$ using elementary transformations.

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12. Find the rank of the following matrices

$$\begin{bmatrix} 0 & 1 & 1 & -2 \\ 4 & 0 & 2 & 5 \\ 2 & 1 & 3 & 1 \end{bmatrix}$$

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Textual Exercises Exercise 3 G

1. Examine the consistency of the following systems of equations $x+y+z=4, 2x+5y-2z=3, x+7y-7z=5,$ and if consistent find the complete solutions.

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2. Apply the test of rank to examine whether the equations $x+y+z=6, x-y+z=2, 2x-y+3z=9$ is consistent or inconsistent and if consistent find the complete solution.

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3. Examine whether the following system of equations are consistent or inconsistent and if consistent, find the complete solution, $x+y+z=1, 2x+y+z=2, x+2y+2z=1.$

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4. Solve the following system of equations.

(a) By using Cramer's rule and Matrix inversion method, when the coefficient matrix is non - singular.

(b) By using Gauss-Jordan method, also determine whether the system has unique solution, or infinite number of solutions or solution and find the solution if exist.

$x + y + z = 9$

$2x + 5y + 7z = 52$

$2x + y - z = 0$

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5. Examine the consistency of the following systems of equations $x + y + z = 6, x + 2y + 3z = 10, x + 2y + 4z = 1$ and if consistent find the complete solutions.

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6. Examine the consistency of the following systems of equations $x - 3y - 8z = 10, 3x + y - 4z = 0, 2x + 5y + 6z = 13,$ and if consistent find the complete solutions.

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7. Examine the consistency of the following systems of equations $2x + 3y + z = 9, x + 2y + 3z = 6, 3x + y + 2z = 8$ and if consistent find the complete solutions.

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8. Examine the consistency of the following systems of equations $x + y + 4z = 6, 3x + 2y - 2z = 9, 5x + y + 2z = 13$ and if consistent find the complete solutions.

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1. Solve the following system of equations.

(a) By using Cramer's rule and Matrix inversion method, when the coefficient matrix is non - singular.

(b) By using Gauss-Jordan method, also determine whether the system has unique solution, or infinite number of solutions or solution and find the solution if exist.

$5x - 6y + 4z = 15$

$7x + 4y - 3z = 19$

$2x + y + 6z = 46$

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2. Solve the following systems of equations.

i) by using Cramer's rule and matrix inversion method, when the coefficient matrix is non-singular.

ii) ' by using Gauss-Jordan method. Also determine whether the system has a unique solution or infinite number of solutions or no solution and find the solutions if exist.

$x + y + z = 1$

$2x + 2y + 3z = 6$

$x + 4y + 9z = 3$

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3. Solve the equations $x + y + 3z = 5, 4x + 2y - z = 0, -x + 3y + z = 5$ by matrix inversion method.

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4. Solve the following system of equations.

(a) By using Cramer's rule and Matrix inversion method, when the coefficient matrix is non - singular.

(b) By using Gauss-Jordan method, also determine whether the system has unique solution, or infinite number of solutions or solution and find the solution if exist.

$2x + 6y + 11 = 0$

$6x + 20y - 6z + 3 = 0$

$6y - 18z + 1 = 0$

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5. Solve the following system of equations by using Cramer's rule.

$2x - y + 3z = 9, x + y + z = 6, x - y + z = 2.$

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6. Solve the following system of equations by using Cramer,s ruel .

$3x + 4y + 5z = 18, 2x - y + 8z = 13, 5x - 2y + 7z = 20$

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7. Solve the system of equations by Matrix inverse method, $2x - y + 3z = 8, \; - x + 2y + z = 4, 3x + y - 4z = 0$

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8. Solve the following system of equations.

(a) By using Cramer's rule and Matrix inversion method, when the coefficient matrix is non - singular.

(b) By using Gauss-Jordan method, also determine whether the system has unique solution, or infinite number of solutions or solution and find the solution if exist.

$x + y + z = 9$

$2x + 5y + 7z = 52$

$2x + y - z = 0$

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Textual Exercises Exercise 3 I

1. Solve the following systems of homogeneous equations.

$2x + 3y - z = 0$

$x - y - 2z = 0$

$3x + y + 3z = 0$

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2. Solve the following systems of homogeneous equations.

$3x + y - 2z = 0$

$x + y + z = 0$

$x - 2y + z = 0$

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3. Solve the following systems of homogeneous equations.

$x + y - 2z = 0$

$2x + y - 3z = 0$

$5x + 4y - 9z = 0$

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4. Solve the system of homogenous equations $x+y-z=0, x-2y+z=0, 3x+6y-5z=0.$

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Solved Problems

1. If $A=\begin{bmatrix}2 & 3 & -1\\ 7 & 8 & 5\end{bmatrix}$ and $B=\begin{bmatrix}1 & 0 & 1\\ 2 & -4 & -1\end{bmatrix}$ then find A+B.

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2. If $\begin{bmatrix}x-1 & 2 & y-5\\ z & 0 & 2\\ 1 & -1 & 1+a\end{bmatrix}=\begin{bmatrix}1-x & 2 & -y\\ 2 & 0 & 2\\ 1 & -1 & 1\end{bmatrix}$ then find the values of x,y,z and a.

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3. Find the trace of A, if $A = \begin{bmatrix} 1 & 2 & -1/2 \\ 0 & -1 & 2 \\ -1/2 & 2 & 1 \end{bmatrix}$

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4. If $A = \begin{bmatrix} 4 & -5 \\ -2 & 3 \end{bmatrix}$ then find $-5A$.

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5. Find the additive inverse of A where $A = \begin{bmatrix} i & 0 & 1 \\ 0 & -i & 2 \\ -1 & 1 & 5 \end{bmatrix}$

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6. If $A = \begin{bmatrix} 2 & 3 & 1 \\ 6 & -1 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & -1 \\ 0 & -1 & 3 \end{bmatrix}$ then find the matrix X, such that $A + B - X = 0$. What is the order of the matrix X ?

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7. IF $A = \begin{bmatrix} 0 & 1 & 2 \\ 2 & 3 & 4 \\ 4 & 5 & 6 \end{bmatrix}, B = \begin{bmatrix} 1 & -2 & 0 \\ 0 & 1 & -1 \\ -1 & 0 & 3 \end{bmatrix}$ then find A-B and 4B-3A.

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8. if $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$ and 2X+A=B then find X

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9. Two factories I and II produce three varieties of pens namely, Gel, Ball and Ink pens. The sale in namely, Gel, Ball and Ink pens by both the factories in the month of September and October in a year are given by the following matries A and B.

September sales (in Rupees)

$$A = \begin{array}{c} \text{Gel} \quad \text{Ball} \quad \text{Ink} \\ \begin{bmatrix} 1000 & 2000 & 3000 \\ 5000 & 3000 & 1000 \end{bmatrix} \begin{array}{l} Factory\ I \\ Factory\ II \end{array} \end{array}$$

October sales (in Rupees)

$$B = \begin{array}{c} \text{Gel} \quad \text{Ball} \quad \text{Ink} \\ \begin{bmatrix} 500 & 1000 & 600 \\ 2000 & 1000 & 1000 \end{bmatrix} \begin{array}{l} Factory\ I \\ Factory\ II \end{array} \end{array}$$

(i) Find the combined sales in September and October for each factory in each variety.

(ii) Find the decrease in sales from September to October.

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10. Construct a 3×2 matrix whose elements are defined by $a_{ij} = \frac{1}{2}|i - 3j|$

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11. If $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 2 & 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 1 & -2 \\ -1 & 0 \\ 2 & -1 \end{bmatrix}$ then find AB and BA.

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12. If $A = \begin{bmatrix} 1 & -2 & 3 \\ 2 & 3 & -1 \\ -3 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 2 \\ 1 & 2 & 0 \end{bmatrix}$ then examine whether A and B commute with respect to multiplication of matrices.

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13. if $A = [(I, 0)(0, -i)]$ then show that $A^2 = -1\left(i^2 = -1\right)$.

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14. If $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ then show that for all the positive integers n,

$A^n = \begin{bmatrix} \cos n\theta & \sin n\theta \\ -\sin n\theta & \cos n\theta \end{bmatrix}$.

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15. IF $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ then show that $A^2 - 4A - 5I = O$.

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16. IF $A = \begin{bmatrix} -2 & 1 & 0 \\ 3 & 4 & -5 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 4 & 3 \\ -1 & 5 \end{bmatrix}$ then find A+B'.

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17. IF $A = \begin{bmatrix} -1 & 2 \\ 0 & 1 \end{bmatrix}$ then find AA'. Do A and A' commute with respect to mulitplication of matrices?

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18. If $\begin{bmatrix} 0 & 4 & -2 \\ -4 & 0 & 8 \\ 2 & -8 & x \end{bmatrix}$ is a skew symmetric matrix then find the value of x.

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19. For any $n \times n$ matrix A, prove that A can be uniquely expressed as a sum of a symmetric matrix and a skew symmetric matrix.

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20. Show that $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (a-b)(b-c)(c-a)$

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21. Show that $\begin{vmatrix} b+c & c+a & a+b \\ c+a & a+b & b+c \\ a+b & b+c & c+a \end{vmatrix} = 2\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$

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22. Show that $\begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix}$ =(a-b)(b-c)(c-a)(ab+bc+ca)

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23. find determinant of $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix} =$

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24. Show that $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$

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25. Show that the determinant of skew - symmetric matrix of order three is always zero.

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26. Fiind the valueof x if:

$$\begin{vmatrix} x-2 & 2x-3 & 3x-4 \\ x-4 & 2x-9 & 3x-16 \\ x-8 & 2x-27 & 3x-64 \end{vmatrix} = 0$$

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27. Find the Adjoint and Inverse of the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & -5 \end{bmatrix}$

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28. Find the adjoint and the inverse of the matrix $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$

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29. Show that the matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 3 & 2 & 3 \\ 1 & 1 & 2 \end{bmatrix}$ is non-singular and find A^{-1}.

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30. Find the rank of $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 2 & 1 \end{bmatrix}$ using elementary transformations.

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31. Find the rank of $A = \begin{bmatrix} 1 & 2 & 0 & -1 \\ 3 & 4 & 1 & 2 \\ -2 & 3 & 2 & 5 \end{bmatrix}$ using elementary transformations.

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32. Apply the test of rank to examine whether the following equations are consistent.

$2x - y + 3z = 8, \ - x + 2y + z = 4, 3x + y - 4z = 0$ and, if consistent, find the complete solution.

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33. Solve the following system of equations by using Cramer,s ruel .

$3x + 4y + 5z = 18, 2x - y + 8z = 13, 5x - 2y + 7z = 20$

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34. Solve the equations $3x + 4y + 5z = 18, 2x + y + 8z = 13, 5x - 2y + 7z = 20$ by matrix inversion method.

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35. Solve the following system of equations by using Cramer,s ruel .

$3x + 4y + 5z = 18, 2x - y + 8z = 13, 5x - 2y + 7z = 20$

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36. Solve the system of equations $2x + 4y - z = 0, x + 2y + 2z = 5, 3x + 6y - 7z = 2$ by Gauss Jordan Method.

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37. Solve the following- system of equations, $2x + 5y + 6z = 0, x - 3y + 8z = 0, 3x + y - 4z = 0$

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38. The number of nontrivial solutions of the system: $x - y + z = 0, x + 2y = 0, 2x + y + 3z = 0$ is

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39. Theorem: Matrix multiplication is associative, i.e., if conformability is assured for the matrices A, B and.C, then (AB)C = A(BC).

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40. Theorem : Matrix multiplication, is distri-butive over matrix addition i.e.. If con-formability is assured for the matrices A, B .and C, then.

i) A(B + C) = AB + AC

ii) (B + C)A = BA + CA

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41. If A is any matrix, then: $\left(A^T\right)^T = A$

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42. If A-and B are two matrices of same type, then $(A+B)^T = A^T + B^T$

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43. If A and B are two matrices for which conformability for multiplication is assured, then prove$(AB)^T = B^T A^T$

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44. If A is an invertible matrix and A is also invertible then prove $\left(A^T\right)^{-1} = \left(A^{-1}\right)$

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45. A certain book shop has 10 dozen chemistry books, 8 dozen physics books, 10 dozen economics books. Their selling prices are Rs. 80, Rs. 60, Rs. 40 each respectively. Using matrix algebra, find the total value of the books in the shop.

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