

task2

1. Given the matrices:

$$A = \begin{bmatrix} -1 & 23 & 10 \\ 0 & -2 & -11 \end{bmatrix}, \quad B = \begin{bmatrix} -6 & 2 & 10 \\ 3 & -3 & 4 \\ -5 & -11 & 9 \\ 1 & -1 & 9 \end{bmatrix}, \quad C = [-3 \quad 2 \quad 9 \quad -5 \quad 7]$$
$$D = \begin{bmatrix} -2 & 6 \\ -5 & 2 \end{bmatrix}, \quad E = [3], \quad F = \begin{bmatrix} 3 \\ 5 \\ -11 \\ 7 \end{bmatrix}, \quad G = \begin{bmatrix} -6 & -4 & 23 \\ -4 & -3 & 4 \\ 23 & 4 & 1 \end{bmatrix}$$

- a) What is the dimension of each matrix?
- b) Which matrices are square?
- c) Which matrices are symmetric?
- d) Which matrix has the entry at row 3 and column 2 equal to -11?
- e) Which matrices has the entry at row 1 and column 3 equal to 10?
- f) Which are column matrices?
- g) Which are row matrices?
- h) Find AT,CT,ET,GT. (T -> Transpose)

a) $\begin{bmatrix} -1 & 23 & 10 \\ 0 & -2 & -11 \end{bmatrix} \rightarrow (2 \times 3)$

- Matrix (B) $\rightarrow (4 \times 3)$

- Matrix (C) $\rightarrow (1 \times 5)$

- Matrix (D) $\rightarrow (2 \times 2)$

- Matrix (E) $\rightarrow (1 \times 1)$

- Matrix (F) $\rightarrow (4 \times 1)$

- Matrix (G) $\rightarrow (3 \times 3)$

b) Matrices \rightarrow (D), (E), (G)

c) - (E) is Symmetric, (G) is Symmetric

d) ~~$\begin{bmatrix} -2 & -5 \end{bmatrix}$~~ \times $\begin{bmatrix} 6 & -4 & 23 \\ -4 & -3 & 4 \\ 23 & 4 & 1 \end{bmatrix}$

D) Matrix (B) $\begin{bmatrix} -6 & 2 & 10 \\ 3 & -3 & 4 \\ -5 & 11 & 9 \\ 1 & -1 & 9 \end{bmatrix}$

E) Matrix (A)

F) Matrix (F)

G) Matrix (C)

h) $A^T = \begin{bmatrix} -1 & 0 \\ 23 & -2 \\ 10 & -11 \end{bmatrix}$, $C^T = \begin{bmatrix} -3 \\ 2 \\ 9 \\ -5 \\ 7 \end{bmatrix}$

$E^T = [3]$, $G^T = \begin{bmatrix} -6 & -4 & 23 \\ -4 & -3 & 4 \\ 23 & 4 & 1 \end{bmatrix}$

2. A, B, C, D and E are matrices given by:

$$A = \begin{bmatrix} -1 & 1 & -2 \\ 0 & -2 & 1 \end{bmatrix}, \quad B = \begin{bmatrix} -1 & 2 & 0 \\ 0 & -3 & 4 \\ -1 & -2 & 3 \end{bmatrix}, \quad C = [-3 \quad 2 \quad 9 \quad -5 \quad 7]$$

$$D = \begin{bmatrix} -2 & 6 \\ -5 & 2 \end{bmatrix}, \quad E = \begin{bmatrix} 3 \\ 5 \\ -11 \end{bmatrix}, \quad F = \begin{bmatrix} -1 & 0 & 2 \\ -2 & -3 & 4 \\ 1 & 4 & -3 \end{bmatrix}$$

Find if possible:

- a) AB
- b) BC
- c) AD
- d) EF
- e) FE

2] a) AB

$$\begin{bmatrix} 1+0+2 & -2-3+4 & 0+4-6 \\ 0+0+(-1) & 0+6-2 & 0-8+3 \end{bmatrix} = \begin{bmatrix} 3 & -1 & -2 \\ -1 & 4 & -5 \end{bmatrix}$$

b) $(3 \times 3) \cdot (1 \times 5)$ "not possible"

c) $(2 \times 3) \cdot (2 \times 2)$ "not possible"

d) $(3 \times 1) \cdot (3 \times 3)$ "not possible"

e) FE

$$\begin{bmatrix} -3+0-22 \\ -6-15-44 \\ 3+20+33 \end{bmatrix} = \begin{bmatrix} -25 \\ -65 \\ 56 \end{bmatrix}$$

3. Find the determinant of the matrix M :

$$M = \begin{pmatrix} 15 & 10 \\ 3 & 2 \end{pmatrix} \quad M = \begin{pmatrix} 2 & 3 & 1 \\ -1 & 2 & 3 \\ 3 & 2 & -1 \end{pmatrix}$$

$$3 + 20 + 33 = 56$$

$$3. a - \det(M) = ad - bc \quad M = \begin{bmatrix} 15 & 10 \\ 3 & 2 \end{bmatrix}$$

$$= 30 - 30 = \boxed{0}$$

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

$$-4 + 27 + -2 = \underline{21} \quad \text{"downward diagonal"}$$

$$6 + 12 + 3 = 21 \quad \text{"upward"}$$

$$\det(M) = 21 - 21 = \boxed{0}$$

4. Find the inverse matrix A^{-1} to the matrix A :

$$A = \begin{pmatrix} -3 & -2 \\ 3 & 3 \end{pmatrix} \quad A = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$$

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4-a) $A = \begin{bmatrix} -3 & -2 \\ 3 & 3 \end{bmatrix}$ $\text{MAT}(A) = -9 + 6 = \boxed{-3}$

$A^{-1} = \frac{1}{-3} \begin{bmatrix} 3 & 2 \\ -3 & -3 \end{bmatrix} = \begin{bmatrix} -1 & -2/3 \\ 1 & 1 \end{bmatrix}$

b) $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$, $A^{-1} = \begin{bmatrix} 0 & -1 & 1 \\ -1 & 0 & 1 \\ 1 & 1 & -1 \end{bmatrix}$

5. What does it mean if three equations are linearly independent?

- a. Two of the equations can be combined to come up with the third equation.
- b. There is no way to combine any two equations to come up with the third equation.
- c. The graphical representations of the equations are lines that do not intersect.
- d. The graphical representations of the equations are lines that do intersect.

5. (b), (c)