Matrices part 1

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Q 1 Rank:

Rank is the size of a matrix and represented as - row x column
e.g.

$A = \begin{bmatrix} 2 & 3 \\ 3 & 5 \\ 2 & 4 \\ 1 & 6 \end{bmatrix}$ Rank $A = 4 \times 2$ (4 = Rows, 2 = Cols)

Q2 elements of a matrix

$A = \begin{bmatrix} 2 & 3 \\ 8 & 5 \\ 2 & 4 \\ 1 & 6 \end{bmatrix}$ $a_{12} = 3$

Row 1, col 2 — element in Row 1, Col 2 of Matrix A

$E = \begin{bmatrix} 1 & 4 & 6 & 3 \\ 0 & 5 & 9 & 5 \\ 7 & -1 & 6 & -5 \\ 12 & 6 & 8 & 4 \\ -2 & 3 & 4 & 0 \end{bmatrix}$ $a_{44} = 4$ (Row 4, col 4)

Q3 addition and subtraction of matrices

1) $\begin{bmatrix} 2 & 3 \\ -4 & 3 \end{bmatrix} + \begin{bmatrix} 1 & 2 \\ 5 & 4 \end{bmatrix} = \begin{bmatrix} 2+1 & 3+2 \\ -4+5 & 3+4 \end{bmatrix} = \begin{bmatrix} 3 & 5 \\ 1 & 7 \end{bmatrix}$

Matrices must have the same rank

add corresponding elements

$\begin{bmatrix} 5 & -1 \\ 6 & 2 \end{bmatrix} - \begin{bmatrix} 4 & -1 \\ 7 & -2 \end{bmatrix} = \begin{bmatrix} 5-4 & -1-(-1) \\ 6-7 & 2-(-2) \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ -1 & 4 \end{bmatrix}$

subtract corresponding elements

Q4 multiplication video on Khan Academy.

$\begin{bmatrix} 2 & 1 & -1 \\ 0 & 2 & 1 \\ 3 & -4 & -2 \end{bmatrix} \begin{bmatrix} 0 & 2 & -2 \\ 1 & -1 & 0 \\ 4 & -3 & -2 \end{bmatrix} = \begin{bmatrix} 2\times0+1\times1+-1\times4 & 2\times2+1\times-1+-1\times-3 & 2\times-2+1\times0+-1\times-2 \\ 0\times0+2\times1+1\times4 & 0\times2+2\times-1+1\times-3 & 0\times-2+2\times0+1\times-2 \\ 3\times0+-4\times1+-2\times4 & 3\times2+-4\times-1+-2\times-3 & 3\times-2+-4\times0+-2\times-2 \end{bmatrix}$

3×3 3×3

Check that Matrices can be multiplied

i.e. number of cols in A = number of rows in B

part 4) BF $\Rightarrow \begin{bmatrix} 0 & 2 & -2 \\ 1 & -1 & 0 \end{bmatrix} \begin{bmatrix} 3 \\ -2 \end{bmatrix} = \begin{bmatrix} 0\times3+2\times-2+-2\times1 \\ \cdots \end{bmatrix} = \begin{bmatrix} 0-4-2 \end{bmatrix}$

part 4) $BF \Rightarrow \begin{bmatrix} 0 & 2 & -2 \\ 1 & -1 & 0 \\ 4 & -3 & -2 \end{bmatrix}\begin{bmatrix} 3 \\ -2 \\ 1 \end{bmatrix} = \begin{bmatrix} 0\times3+2\times-2+-2\times1 \\ 1\times3+-1\times-2+0\times1 \\ 4\times3+-3\times-2+-2\times1 \end{bmatrix} = \begin{bmatrix} 0-4-2 \\ 3+2+0 \\ 12+6-2 \end{bmatrix}$

$3\times3 \quad 3\times1 \quad 3\times1$

$= \begin{bmatrix} -6 \\ 5 \\ 16 \end{bmatrix}$ ✓ 3×1

part 6) $I \Rightarrow$ Identity matrix for a 3×3 $I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ $\quad 3\times1=3$

$AI = A$

part 9) $\frac{B}{2} \Rightarrow \frac{1}{2} \times B \Rightarrow \frac{1}{2}\begin{bmatrix} 0 & 2 & -2 \\ 1 & -1 & 0 \\ 4 & -3 & -2 \end{bmatrix} = \begin{bmatrix} 0 & \frac{2}{2} & \frac{-2}{2} \\ \frac{1}{2} & \frac{-1}{2} & 0 \\ \frac{4}{2} & \frac{-3}{2} & \frac{-2}{2} \end{bmatrix}$

A scalar

$= \begin{bmatrix} 0 & 1 & -1 \\ \frac{1}{2} & -\frac{1}{2} & 0 \\ 2 & -\frac{3}{2} & -1 \end{bmatrix}$ ✓