Matrices

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De La Salle University

March 13, 2020

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Definition

A *matrix* is a rectangular array of numbers.

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Note: $n \times n$ matrix is a *square matrix*

Convention: Boldface uppercase letters are used to represent matrices.

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

2×3 matrix $\quad 3 \times 2$ matrix $\quad 2 \times 2$ matrix

Matrix Operations

Addition Let $\mathbf{A}$ and $\mathbf{B}$ be $m \times n$ matrices.

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$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} + \begin{bmatrix} 2 & 4 & 6 \\ 1 & 3 & 5 \end{bmatrix} = \begin{bmatrix} 3 & 6 & 9 \\ 5 & 8 & 11 \end{bmatrix}$$

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$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \begin{bmatrix} 2 & 4 \\ 3 & 6 \\ 4 & 8 \end{bmatrix} = \begin{bmatrix} 20 & 1(4)+2(6)+3(8) \\ 4(2)+5(3)+6(4) & 4(4)+5(6)+6(8) \end{bmatrix}$$

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$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \begin{bmatrix} 2 & 4 \\ 3 & 6 \\ 4 & 8 \end{bmatrix} = \begin{bmatrix} 20 & 40 \\ 47 & 4(4) + 5(6) + 6(8) \end{bmatrix}$$

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$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \begin{bmatrix} 2 & 4 \\ 3 & 6 \\ 4 & 8 \end{bmatrix} = \begin{bmatrix} 20 & 40 \\ 47 & 94 \end{bmatrix}$$

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Exercise 1

Given that $r = 3$ and $s = -2$, and the following matrices:

$$\mathbf{A} = \begin{bmatrix} 2 & 1 \\ -1 & 0 \\ 3 & 4 \end{bmatrix} \qquad \mathbf{B} = \begin{bmatrix} 4 & 1 & 2 \\ 6 & -1 & 5 \\ 1 & 3 & 2 \end{bmatrix}$$

$$\mathbf{C} = \begin{bmatrix} 2 & 4 \\ 6 & -1 \end{bmatrix} \qquad \mathbf{D} = \begin{bmatrix} 4 & -6 \\ 1 & 3 \\ 2 & -1 \end{bmatrix}$$

Compute the following (if possible):

1. $\mathbf{A} + \mathbf{D}$
2. $r(s\mathbf{C})$
3. $\mathbf{BA} + \mathbf{D}$
4. $r(\mathbf{A} + \mathbf{D})$
5. $\mathbf{DC}$
6. $\mathbf{CA}$
7. $\mathbf{A} + s\mathbf{D}$
8. $\mathbf{BA}$

Exercise 2

Find w, x, y, and z:

$$\begin{bmatrix} x+y & 2x-3y \\ z-w & z+2w \end{bmatrix} = \begin{bmatrix} 4 & -7 \\ -6 & 6 \end{bmatrix}$$

References


[Rosen, 2007] Kenneth Rosen.
Discrete Mathematics and Its Applications 7^{th} edition, 2007