CHAPTER 3

DAY 6 – ADDITION, DIFFERENCE OF MATRICES, MULTIPLICATION OF MATRIX BY A SCALAR

Addition of Matrices

Let A and B two matrices of same order. Then, by addition of the matrices A and B, we mean the addition of corresponding elements of A and B.

- Only matrices of same order can be added.
- E.g. : let $A = [1\ 3\ \ -6\ 7\ ]$, $B = [4\ \ -2\ 5\ 3\ ]$.

  Then, $A + B = [1\ 3\ \ -6\ 7\ ] + [4\ \ -2\ 5\ 3\ ] = [5\ 1\ \ -1\ 11\ ]$

- **Properties**

  - **Commutative Law -** Let A and B two matrices of same order. Then
  $$A + B = B + A$$
  - **Associative Law -** Let A, B and C be three matrices of same order. Then
  $$A + (B + C) = (A + B) + C$$
  - **Existence of additive identity** – Let A be any $m\times n$ matrix and O be the $m\times n$ zero matrix. Then $A + O = O + A = A$. That is, O is the additive identity of matrix addition.
  - **Existence of additive Inverse** - Let A be any $m\times n$ matrix. Then, there exists another matrix $-A$ of the same order such that $A + (-A) = (-A) + A = O$. That is, $-A$ is the additive inverse of matrix addition.

Difference of Matrices

Let A and B two matrices of same order. Then, the difference of the matrices A and B, is defined as $A - B = A + (-B)$

- Only matrices of same order can be subtracted.
- E.g. : let $A = [1\ 3\ \ -6\ 7\ ]$, $B = [4\ \ -2\ 5\ 3\ ]$.

  Then, $A - B = [1\ 3\ \ -6\ 7\ ] - [4\ \ -2\ 5\ 3\ ] = [-3\ 5\ \ -11\ 4\ ]$

Multiplication of matrix by a scalar

Let $A = [a_{ij}]$ be any matrix and k be any scalar. Then, the multiplication of matrix by a scalar is defined as $kA = k\left[a_{ij}\right] = \left[ka_{ij}\right]$.

- E.g. Let $A = [1\ 3\ \ -6\ 7\ ],\ \ k = 2.$
  Then, $kA = 2[1\ 3\ \ -6\ 7\ ]\ =\ [2\ 6\ \ -12\ 14\ ]$

Properties

Let A and B be two matrices of same order and k and l be any two scalars. Then,

- $k(A + B) = kA + kB.$
- $(k + l)A = kA + lA.$

<u>Questions</u>

1. Let $A = [2\ 4\ 3\ 2\ ],\ \ B = [1\ 3\ \ -2\ 5\ ]$ and $C = [-\ 2\ 5\ 3\ 4\ ]$. Find each of the following
   a. $A + B$
   b. $A - B$
   c. $3A - C$
   d. $2B + 3C$
   e. Show that $A + (B + C) = (A + B) + C$

2. Simplify
   $\cos cos\ x\ [\cos cos\ x\ \ \ \sin sin\ x\ \ \ -\sin sin\ x\ \ \ \cos cos\ x\ \ ] + \sin sin\ x\ [\sin sin\ x\ \ \ -\cos cos\ x\ \ \ \cos cos\ x\ \ \ \mathrm{si}$

3. Find $x,\ y$ if $2[1\ 3\ 0\ x\ ] + [y\ 0\ 1\ 2\ ] = [5\ 6\ 1\ 8\ ]$

4. Find the values of $x,\ y,\ z$ and t such that $2[x\ y\ z\ t\ ] + 3[1\ \ -1\ 0\ 2\ ] = 3[3\ 5\ 4\ 6\ ]$

5. If $x[2\ 3\ ] + y[-\ 1\ 1\ ] = [5\ 10\ ]$, find the values of$x, y$.

6. Find values matrices X and Y if
   a. $X + Y = [7\ 0\ 2\ 5\ ]$ and $X - Y = [3\ 0\ 0\ 3\ ]$
   b. $2X + 3Y = [2\ 3\ 4\ 0\ ]$ and $3X + 2Y = [2\ \ -2\ \ -1\ 5\ ]$
   c. $Y = [3\ 2\ 1\ 4\ ]$ and $2X + Y = [1\ 0\ \ -3\ 2\ ]$

More questions from this section can be practiced!