Matrix

In mathematics, a matrix is an arrangement of numbers, symbols, or expressions arranged in rows and columns so as to form a square shape

Definition

$$\begin{Bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{Bmatrix}$$

2 x 3 matrix (2 rows, 3 columns)

Transpose

Transpose of a matrix is the operator located in the matrix along its main diagonal. This operator swaps every row and column in the matrix

$$\begin{Bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{Bmatrix}^T = \begin{Bmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{Bmatrix}$$

`2 x 3 -> 3 x 2`

Addition / Subtraction

$$\begin{Bmatrix} 1 & 3 & 2 \\ 2 & 4 & 7 \end{Bmatrix} + \begin{Bmatrix} 0 & 1 & 5 \\ 3 & -2 & 8 \end{Bmatrix} = \begin{Bmatrix} 1 & 4 & 7 \\ 5 & 2 & 15 \end{Bmatrix}$$

Multiplication

Rule

- Matrix multiplication can only be performed if number of first matrix columns equal to number of second matrix rows
- Multiplication result is the (number of first matrix row) x (number of second matrix column)

$$\begin{Bmatrix} 1 & 3 & 2 \\ 2 & 4 & 7 \end{Bmatrix} \times \begin{Bmatrix} 0 & 3 \\ 1 & -2 \\ 5 & 8 \end{Bmatrix} = \begin{Bmatrix} 13 & 13 \\ 39 & 54 \end{Bmatrix}$$

Explanation

1. `13 = (0 x 1) + (1 x 3) + (5 x 2)`
2. `39 = (0 x 2) + (1 x 4) + (5 x 7)`
3. `13 =(3 x 1) + (-2 x 3) + (8 x 2)`
4. `54 = (3 x 2) + (-2 x 4) + (8 x 7)`

Trace

In linear algebra, the trace of a matrix is defined as the sum of each element on the main diagonal of the matrix

$$trace(\begin{Bmatrix} 1 & 3 & 2 \\ 2 & 4 & 7 \\ 1 & 3 & 8 \end{Bmatrix}) = 13$$

trace = `1 + 4 + 8 = 13`

$$trace(\begin{Bmatrix} 1 & 3 & 2 \\ 2 & 4 & 7 \end{Bmatrix}) = 5$$

trace = `1 + 4 = 5`

Determinant

In linear algebra, the determinant is a value that can be calculated from the elements of a matrix. The determinant of matrix A is written with the sign det, det A, or |A|. The determinant can be thought of as a scaling factor of the transformation described by the matrix

Formula

- 2D Matrix

  $$A = \begin{Bmatrix} a & b \\ c & d \end{Bmatrix}$$

  $$|A| = ab - dc$$

- 3D Matrix

  $$A = \begin{Bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{Bmatrix}$$

  $$|A| = a(ei - fh) - b(di - fg) + c(dh - eg)$$

Reference

https://youtu.be/p48uw2vFWQs

https://play.google.com/store/apps/details?id=com.aswdc_linearalgebra

https://www.wikipedia.org