

Section 7.2: Matrix (Plural $\rightarrow$ Matrices)

$m \times n$ matrix is a rectangular array with m rows and n columns of real numbers.

example:

$$\begin{bmatrix} 1 & -2 & 3 \\ 2 & 0 & 4 \end{bmatrix}$$

order
 2×3

$$\begin{bmatrix} 1 & -4 \\ 0 & -1 \\ 2 & 2 \\ 3 & 2 \end{bmatrix}$$

4×2

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

$3 \times 3 \rightarrow$ Square matrix

- 2 matrices are equal if they have ^{same} order and their corresponding elements are equal.
- matrices of different orders cannot be added or subtracted.

ex 11:

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$$A = \begin{bmatrix} 2 & 3 \\ -1 & 5 \end{bmatrix}$$

a_{11} (pointing to 2), a_{12} (pointing to 3), a_{21} (pointing to -1), a_{22} (pointing to 5)

$$B = \begin{bmatrix} 1 & -3 \\ -2 & -4 \end{bmatrix}$$

b_{11} (pointing to 1)

- $A+B$
- $A-B$
- $3A$
- $2A-3B$

a) $\begin{bmatrix} 3 & 0 \\ -3 & 1 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 6 \\ 1 & 9 \end{bmatrix}$

$$c) \begin{bmatrix} 6 & 9 \\ -3 & 15 \end{bmatrix} \quad d) \begin{bmatrix} 1 & 15 \\ 4 & 22 \end{bmatrix}$$

$$2A \begin{bmatrix} 4 & 6 \\ -2 & 10 \end{bmatrix} \quad -3B \begin{bmatrix} -3 & 9 \\ 6 & 12 \end{bmatrix}$$

Product

Not always possible: the number of columns of A should equal the number of rows of B for the product $A \times B$ to exist.

example: $A = \begin{bmatrix} 2 & 1 & -3 \\ 0 & 1 & 2 \end{bmatrix}$ $B = \begin{bmatrix} 1 & -4 \\ 0 & 2 \end{bmatrix}$

2x3

3x2

$A \times B$? $\checkmark$ yes

~~2x3~~
~~3x2~~

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

2x3

$$B = \begin{bmatrix} 3 & -4 \\ 2 & 1 \end{bmatrix}$$

2x2 square matrix

$A \times B$

~~2x3~~

~~2x2~~

product not defined

$B \times A$

~~2x2~~

~~2x3~~

yes.

$$a) A = \begin{bmatrix} 2 & -3 \\ 0 & 2 \end{bmatrix}$$

2x3

$$B = \begin{bmatrix} 1 & -4 \\ 0 & 2 \\ 0 & 2 \end{bmatrix}$$

3x2

$$\begin{array}{r} A \times B \\ 2 \times 3 \\ 3 \times 2 \\ \hline 2 \times 2 \end{array} \text{ yes.}$$

- $2 + 0 - 3 = -1$
- $-8 + 2 + 0 = -6$
- $0 + 0 + 2 = 2$
- $0 + 2 + 0 = 2$

$$\begin{bmatrix} -1 & -6 \\ 2 & 2 \end{bmatrix}$$

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$$A = \begin{bmatrix} -1 & 2 \\ 3 & 4 \end{bmatrix}$$

2x2

$$B = \begin{bmatrix} -3 & 5 \end{bmatrix}$$

1x2

a) $A \times B$

b) $B \times A$

$$a) \begin{array}{r} 2 \times 2 \\ 1 \times 2 \\ \hline \end{array} \text{ No}$$

$$b) \begin{array}{r} 1 \times 2 \\ 2 \times 2 \\ \hline \end{array} \text{ possible } B \times A$$

1x2 matrix.

$$B = \begin{bmatrix} -3 & 5 \end{bmatrix}$$

$$A = \begin{bmatrix} -1 & 2 \\ 3 & 4 \end{bmatrix}$$

- $3 + 15 = 18$
- $-6 + 20 = 14$

$$\begin{bmatrix} 18 & 14 \end{bmatrix}$$