

Matrices = Matrix

$[a]$ \parallel r \parallel

~~a~~ , b , r elements

$$A = [a] \text{ row, } \rightarrow \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

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$$C = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \quad C_{3 \times 3}$$

$$D = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix} \quad D_{3 \times 2}$$

$$F = [1 \ 2 \ 3 \ 4 \ 5] \quad F_{1 \times 5}$$

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Sq. matrix = rows = columns.

Transpose = interchange rows & columns

$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \quad A^T = \begin{bmatrix} a & c \\ b & d \end{bmatrix}$$

$$B = \begin{bmatrix} 1 & a & 2 & b \end{bmatrix} \quad B^T = \begin{bmatrix} 1 \\ a \\ 2 \\ b \end{bmatrix}$$

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Add/Subtract \Rightarrow Scalar

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \quad B = \begin{bmatrix} -4 & 7 \\ 11 & 2 \end{bmatrix} \quad C = \begin{bmatrix} 1 & 2 \\ 4 & 9 \\ 0 & 1 \end{bmatrix}$$

$$1. A^T = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$$

$$2. A + B = \begin{bmatrix} 1+(-4) & 2+7 \\ 3+11 & 4+2 \end{bmatrix} = \begin{bmatrix} -3 & 9 \\ 14 & 6 \end{bmatrix}$$

$$3. 5C = 5 \begin{bmatrix} 1 & 2 \\ 4 & 9 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 5(1) & 5(2) \\ 5(4) & 5(9) \\ 5(0) & 5(1) \end{bmatrix} = \begin{bmatrix} 5 & 10 \\ 20 & 45 \\ 0 & 5 \end{bmatrix}$$

↑
Scalar

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$$A = \begin{bmatrix} 4 & -1 \\ 2 & 7 \end{bmatrix} \quad B = \begin{bmatrix} 6 & -3 \\ 4 & -2 \end{bmatrix}$$

1. $A - B = A + (-1)B$

$$\begin{bmatrix} 4 & -1 \\ 2 & 7 \end{bmatrix} + (-1) \begin{bmatrix} 6 & -3 \\ 4 & -2 \end{bmatrix}$$

$$\begin{bmatrix} 4 & -1 \\ 2 & 7 \end{bmatrix} + \begin{bmatrix} -6 & +3 \\ -4 & +2 \end{bmatrix} = \begin{bmatrix} -2 & 2 \\ -2 & 9 \end{bmatrix}$$

2. $4B + 2A$

$$4 \begin{bmatrix} 6 & -3 \\ 4 & -2 \end{bmatrix} + 2 \begin{bmatrix} 4 & -1 \\ 2 & 7 \end{bmatrix} = \begin{bmatrix} 24 & -12 \\ 16 & -8 \end{bmatrix} + \begin{bmatrix} 8 & -2 \\ 4 & 14 \end{bmatrix}$$

$$\begin{bmatrix} 32 & -14 \\ 20 & 6 \end{bmatrix}$$

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$$2 \begin{bmatrix} 4 & 7 \\ -5 & 2 \end{bmatrix} + 3 \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} 16 & -20 \\ 12 & -41 \end{bmatrix}$$

$$\begin{bmatrix} 8 & 14 \\ -10 & 4 \end{bmatrix} + \begin{bmatrix} 3a & 3b \\ 3c & 3d \end{bmatrix} = \begin{bmatrix} 16 & -20 \\ 12 & -41 \end{bmatrix}$$

$$8 + 3a = 16 \quad -10 + 3c = 12$$

$$3a = 8 \quad 3c = +22$$

$$a = 8/3 \quad c = +22/3$$

$$14 + 3b = -20 \quad 4 + 3d = -41$$

$$3b = -34 \quad 3d = -45$$

$$b = -34/3 \quad d = -15$$

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Matrix Multiplication

$[3] \cdot [2] = [6]$

$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}_{2 \times 2}$
 $B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}_{2 \times 2}$

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

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

elements of a new \times corresponding elements of a column, then add the result

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

$\begin{bmatrix} 5+14 & 6+16 \\ 15+28 & 18+32 \end{bmatrix} = \begin{bmatrix} 19 & 22 \\ 43 & 50 \end{bmatrix}$

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$\begin{bmatrix} 1 & 2 & 3 & 4 \end{bmatrix}_{1 \times 4} \begin{bmatrix} 5 \\ 6 \\ 7 \\ 8 \end{bmatrix}_{4 \times 1} = \begin{bmatrix} 1(5)+2(6)+3(7)+4(8) \end{bmatrix}$

$= \begin{bmatrix} 5+12+21+32 \end{bmatrix}$

$= \begin{bmatrix} 70 \end{bmatrix}$

$A = \begin{bmatrix} 2 & 3 \\ 5 & 7 \\ -1 & 4 \end{bmatrix}_{3 \times 2}$
 $B = \begin{bmatrix} 1 & 0 & 6 \\ -3 & 2 & 5 \end{bmatrix}_{2 \times 3}$

1. $A \cdot B$ 2. $B \cdot A$
 $3 \times 2 \cdot 2 \times 3$ $2 \times 3 \cdot 3 \times 2$
 3×3 2×2

$\begin{bmatrix} 2(1)+3(-3) & 2(0)+3(2) & 2(6)+3(5) \\ 5(1)+7(-3) & 5(0)+7(2) & 5(6)+7(5) \\ -1(1)+4(-3) & -1(0)+4(2) & -1(6)+4(5) \end{bmatrix}$

$\begin{bmatrix} 2-9 & 0+6 & 12+15 \\ 5-21 & 0+14 & 30+35 \\ -1-12 & 0+8 & -6+20 \end{bmatrix}$

$\begin{bmatrix} -7 & 6 & 27 \\ -16 & 14 & 65 \\ -13 & 8 & 14 \end{bmatrix}$

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9 identity elements

$2 \neq 0 = 2$

$3 \times 1 = 3$

$A_{2 \times 2}$

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

↑
zero matrix

$B_{5 \times 3}$

$A_{2 \times 2}$ $B_{3 \times 3}$ $C_{4 \times 4}$

$\begin{bmatrix} 5 & -3 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} =$

$5(1) + -3(0)$ $5(0) + -3(1)$
 $4(1) + 2(0)$ $4(0) + 2(1)$
 $5 + 0$ $0 - 3$
 $4 + 0$ $0 + 2$

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