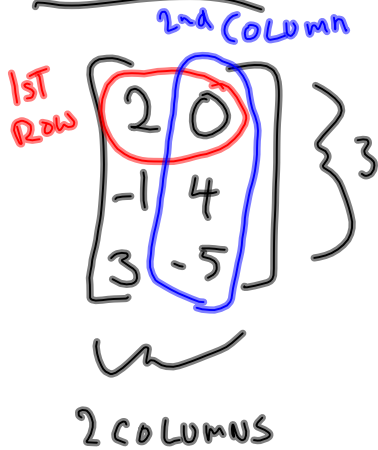




MATRICES A MATRIX IS AN (2-DIMENSIONAL) ARRAY OF NUMBERS (REAL) ORGANIZED INTO ROWS AND COLUMNS.

EXAMPLE



THE SIZE OF A MATRIX IS THE NUMBER OF ROWS CROSSED WITH THE # OF COLUMNS.

HERE THE SIZE IS 3x2.

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

WE REFER TO ENTRIES BY  
THEIR ROW AND COLUMN (RESP.)  
HERE THE (3,1) ENTRY IS 3.  
THE (2,2) ENTRY IS 4, ETC.

THOUGHT

A MATRIX IS AN ORGANIZED DATUM,  
THAT IS "INFORMATION  
WITHOUT CONTEXT".  
WE WILL SEE SOME CONTEXTS NEXT TIME.

↑  
SINGULAR FORM OF DATA.

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# ADDITION OF MATRICES

TWO MATRICES MAY BE ADDED TOGETHER IF THEY HAVE THE SAME SIZE.

## EXAMPLES

$$\begin{bmatrix} 0 \\ 2 \\ 3 \\ 5 \\ 7 \end{bmatrix} + \begin{bmatrix} 10 \\ 9 \\ 8 \\ 7 \\ 6 \end{bmatrix} \text{ IS DEFINED.}$$

Both 5x1

$$\begin{matrix} 3 \times 2 \\ \downarrow \\ \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix} \end{matrix} + \begin{matrix} 2 \times 3 \\ \downarrow \\ \begin{bmatrix} 1 & 3 & 9 \\ 2 & 6 & 18 \end{bmatrix} \end{matrix}$$

IS NOT DEFINED

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MATRIX ADDITION (CONT.)

WHEN ADDING TWO MATRICES THE  $(i,j)$  ENTRY OF THE SUM IS THE SUM OF THE  $(i,j)$  ENTRIES OF THE SUMMANDS.

EXAMPLE

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

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# MATRIX MULTIPLICATION (CONT.)

THE  $(i,j)$  ENTRY OF THE PRODUCT IS THE SUM OF THE PRODUCTS OF  $(i,k)$  ENTRIES FROM THE LEFT WITH  $(k,j)$  ENTRIES FROM THE RIGHT.

## EXAMPLE

$$\begin{array}{ccc}
 \begin{bmatrix} 1 & 0 & -1 \\ 2 & -3 & 0 \end{bmatrix} & \begin{bmatrix} -2 \\ 0 \\ 2 \end{bmatrix} & = \begin{bmatrix} 1 \cdot (-2) + 0 \cdot 0 + (-1) \cdot 2 \\ 2 \cdot (-2) + (-3) \cdot 0 + 0 \cdot 2 \end{bmatrix} = \begin{bmatrix} -4 \\ -4 \end{bmatrix} \\
 2 \times 3 & 3 \times 1 & 2 \times 1 \\
 \text{(SIZES)} & & 
 \end{array}$$

$(1,1) \cdot (1,1) + (1,2) \cdot (2,1) + (1,3) \cdot (3,1)$

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## TRANSPOSE OF A MATRIX

THE TRANSPOSE OF AN  $n \times m$  MATRIX IS AN  $m \times n$  MATRIX FOR WHICH THE  $(i,j)$  ENTRY IS THE  $(j,i)$  ENTRY OF THE ORIGINAL

$$\begin{matrix} (3,1) \\ \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ -1 & 0 \\ 0 & -1 \end{bmatrix}^T \\ (4,2) \end{matrix} = \begin{matrix} (1,3) \\ \begin{bmatrix} 1 & 0 & -1 & 0 \\ 0 & 1 & 0 & -1 \end{bmatrix} \\ (2,4) \end{matrix}$$

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