

Vectors and Vector Spaces

a student's academic performance

75/100 - Chemistry (75%)

87/100 - Physics (87%)

91/100 - Maths (91%)

performance = $\begin{bmatrix} C & P & M \\ 75\% & 87\% & 91\% \end{bmatrix}$

$$\begin{bmatrix} 75 \\ 87 \\ 91 \end{bmatrix}$$

$$[75, 87, 91]$$

$$p = \begin{bmatrix} 75 \\ 87 \\ 91 \end{bmatrix}$$

student 1

$$p_{s1} = \begin{bmatrix} 75 \\ 87 \\ 91 \end{bmatrix}$$

Vector representation
(3 elements, aspects,
properties,
dimensions)

$$n = 10, (p_{s1}, p_{s2}, p_{s3}, \dots, p_{s10})$$

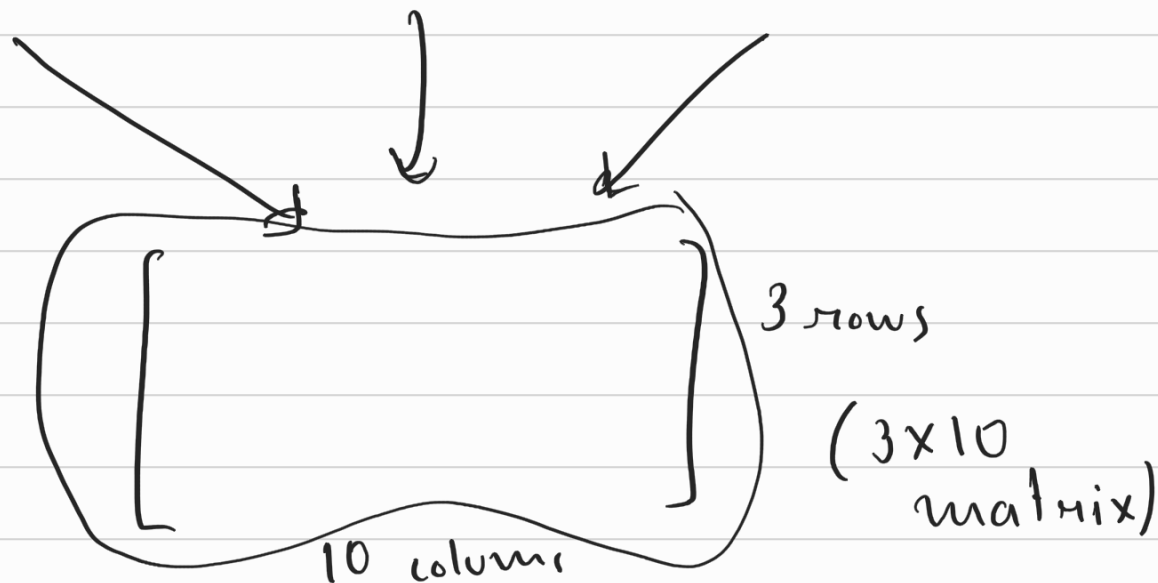
$$P^c = \begin{bmatrix} 75 & 80 & \dots & 91 \\ 87 & 85 & \dots & 90 \\ 91 & 89 & \dots & 92 \\ \vdots & \vdots & \ddots & \vdots \\ s1 & s2 & \dots & s10 \end{bmatrix}$$

3 values

10 columns

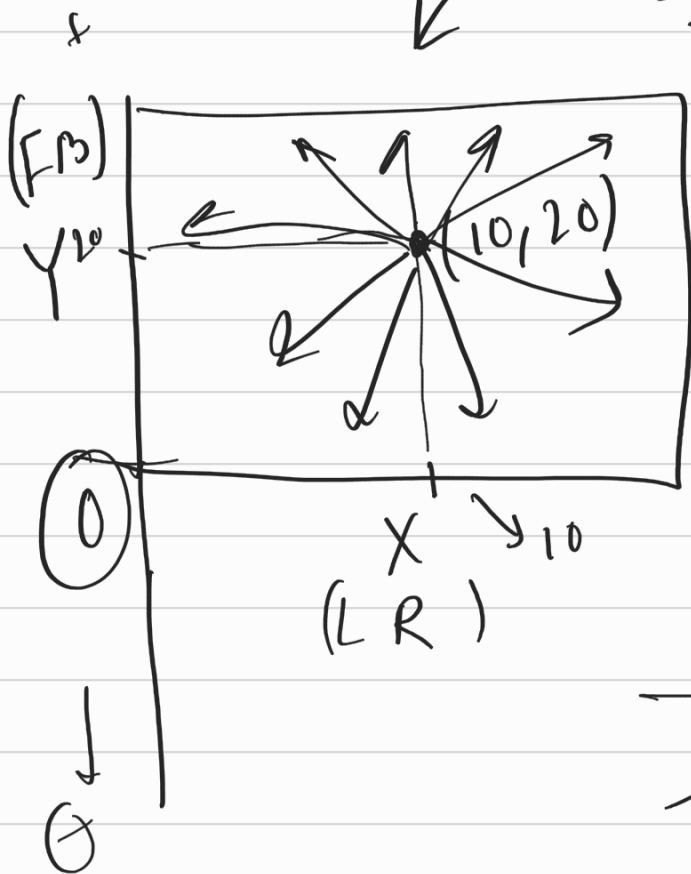
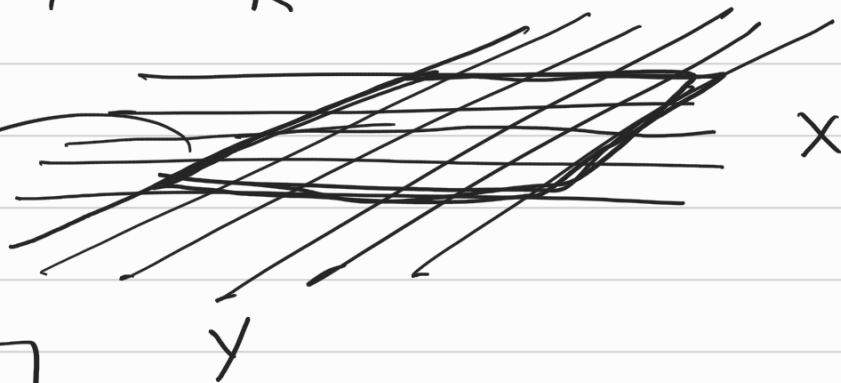
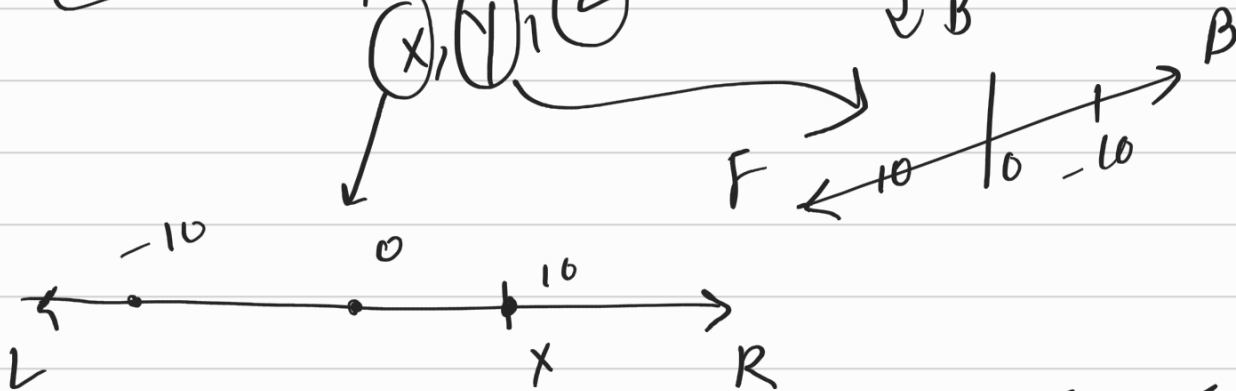
MATRIX

$$\begin{matrix} p_{s1}, & p_{s2}, & p_{s3} & \dots & p_{s10} \\ \downarrow & \downarrow & \downarrow & & \downarrow \\ \begin{bmatrix} 75 \\ 87 \\ 91 \end{bmatrix} & \begin{bmatrix} 80 \\ 85 \\ 89 \end{bmatrix} & \begin{bmatrix} \vdots \\ \vdots \\ \vdots \end{bmatrix} & \dots & \begin{bmatrix} 91 \\ 90 \\ 92 \end{bmatrix} \end{matrix}$$

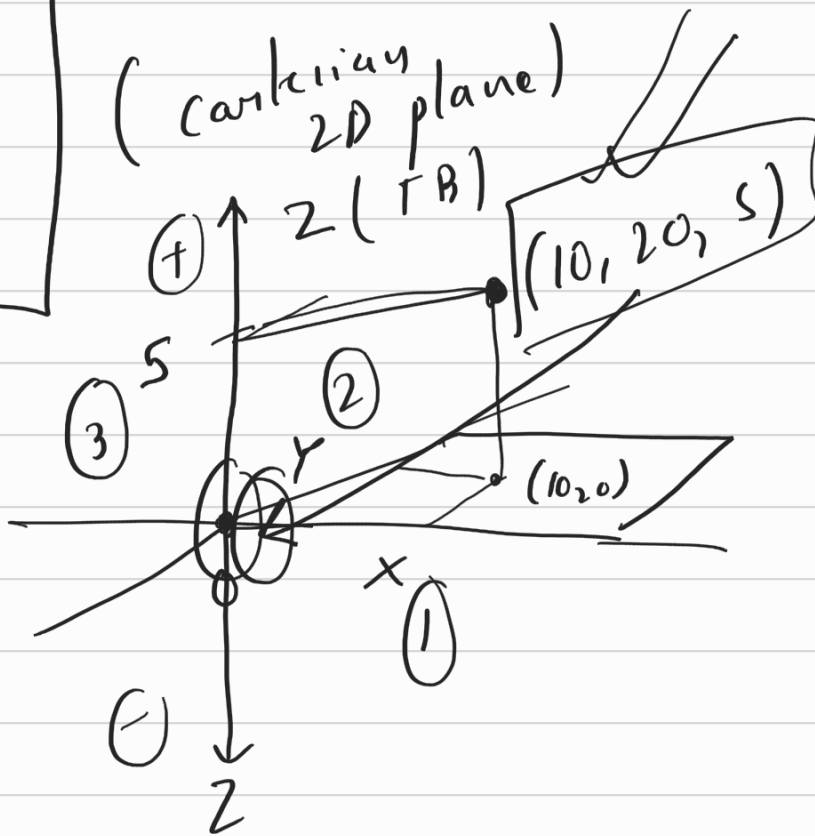


SPACE

3 pieces of information T



(cartesian 2D plane)



Vectors

$$\begin{bmatrix} \\ \\ \end{bmatrix}$$

Matrices

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

$$\textcircled{3} \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} + \textcircled{3} \begin{bmatrix} 2 \\ 4 \\ 6 \end{bmatrix} = \begin{bmatrix} 1+2=3 \\ 2+4=6 \\ 3+6=9 \end{bmatrix} = \textcircled{3} \begin{bmatrix} 3 \\ 6 \\ 9 \end{bmatrix}$$

$v_1 \qquad v_2 \qquad v_3$

$$\begin{bmatrix} 10 \\ 9 \\ 8 \end{bmatrix} - \begin{bmatrix} 7 \\ 6 \\ 5 \end{bmatrix} = \begin{bmatrix} 10-7=3 \\ 9-6=3 \\ 8-5=3 \end{bmatrix} = \begin{bmatrix} 3 \\ 3 \\ 3 \end{bmatrix}$$

$$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \times \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix} \textcircled{(3 \times 1)}$$

v_1

v_2

$$(3 \times \textcircled{1})$$

v_1 being
CONFORMABLE
with v_2

$$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \times \begin{bmatrix} 4 & 5 & 6 \end{bmatrix} \textcircled{(1 \times 3)}$$

$$(3 \times \textcircled{1})$$

$$\textcircled{(1 \times 3)}$$

3×3
matrix

$$\begin{bmatrix} 4 & 5 & 6 \\ 8 & 10 & 12 \\ 12 & 15 & 18 \end{bmatrix} \textcircled{v}$$

$$\left(\frac{1}{5}\right) \times \begin{bmatrix} 10 \\ 15 \\ 20 \end{bmatrix} = \begin{bmatrix} \frac{1}{5} \times 10 = 2 \\ 3 \\ 4 \end{bmatrix}$$