Introduction to Matrices →

— Solving Simultaneous Equation Problems.

Matrices ⇒ objects that rotate and stretch stretch vectors

, But also objects that lets us solve RE eg with apples and Bananas previously

Eg lets visit again apple/Bananas problem.

a ⇒ apples
b ⇒ Banana
} walked into shop to buy

(Day 1) $2a + 3b = 8$

(Day 2) $10a + b = 13$

Silly above, But in business above,

Price discovery happens all time
(Complicated contracts, pros)

But how can be written in another way.

Using Matrices:

$$\begin{bmatrix} 2 & 3 \\ 10 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 8 \\ 13 \end{bmatrix}$$

Matrix

∴ multiply row element with column (Element)

$$\begin{pmatrix} 2a + 3b \\ 10a + 1b \end{pmatrix} = \begin{pmatrix} 8 \\ 13 \end{pmatrix}$$ (Back to orginal)

But they look like vectors → and we dealt with vectors before.

Matrix operates one vector to give result vector

⇒ DO what vector (transform) / do we use to give the guy on right side (result)

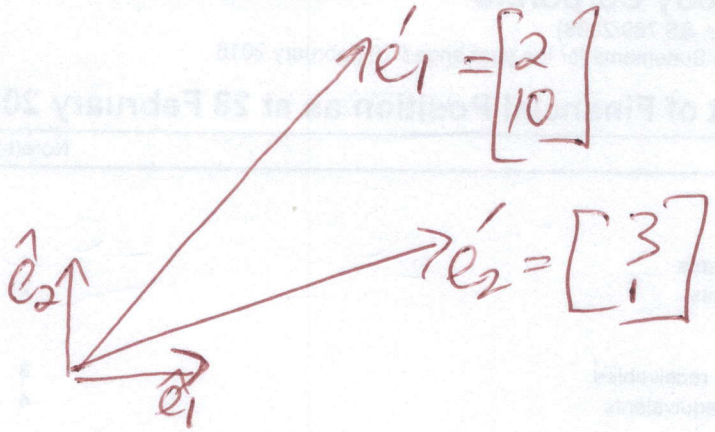
∴ Lets multiply matrix with, unit basis vector (x y axis)

$$\begin{bmatrix} 2 & 3 \\ 10 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 2 \\ 10 \end{bmatrix}$$

$2 \times 1 + 3 \cdot 0$ =

$10 \times 1 + 1 \cdot 0$

Geometrically it does the following:



⇒ takes unit vector $\hat{e}_2$, and transforms it to another place $\hat{e}_1'$

⇒ and do it with other basis vector (0,1)

$$\begin{bmatrix} 2 & 3 \\ 10 & 1 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$$ where

⇒ that means now, the other basis vector $\hat{e}_2$, gets transformed to $\hat{e}_2'$

⇒ so matrix does it ~~transform~~ moves the basis vectors in someway, transforms them, changes the space.

So matrix $\begin{bmatrix} 2 & 3 \\ 10 & 1 \end{bmatrix}$ is a functor that operates on input vectors and gives other output vectors

⇒ And set of simultaneous equations is saying "what vector do I need in order to get a transformed product at position $\begin{bmatrix} 8 \\ 13 \end{bmatrix}$ in order to get output $\begin{bmatrix} 8 \\ 13 \end{bmatrix}$

We can now see what we mean by linear algebra:

→ take input values (a and b) and multiply it with constants (So everything is linear)

→ and its algebra that its notation describing mathematical objects in manipulation those notations

LA, is a mathematical system of manipulating vectors ~~spaces~~ in space described by vectors

There is a deep connection between

(1) Simultaneous equations (called matrices)
(2) Vectors (Covered previously)

Key: to solving Sim. equation problems is appreciating how vectors are transformed by matrices, which is the Kernel of LA.