Linear transformation

"takes an input an create an output out of it"

input vector $\rightsquigarrow$ output vector
moving over (function)

* Squishing space $\rightsquigarrow$ you can transform each dot in space to another dot
↓
arbitrary transformation

* linear $\rightsquigarrow$ 1) all lines must remain line without curve

  2) origin must fix in place

"Grid lines remain parallel and evenly spaced"

* Rotation around origin is one kind of linear transformation

* record two basis vector

the transformation of vector is produced by a coefficient of transformation of its basis vector

transformed $\vec{v}$ = a (transformed $\hat{i}$) + b (" $\hat{j}$)

* deduce where a transformed vector is landed only by knowing transformation of $\hat{i}$ & $\hat{j}$.

* rotate all space 90° clockwise:

$\hat{i} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ $\hat{j} = \begin{bmatrix} -1 \\ 0 \end{bmatrix}$

if we want what happens to a vector after 90° clockwise rotation we only need to only multiply it by these matrixes:

$$\begin{bmatrix} 1 & -1 \\ 0 & 0 \end{bmatrix}$$

* Shear transformation

$$\begin{array}{cc} \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \\ \hat{i} \quad \hat{j} \end{array}$$

* if transformation of $\hat{i}$ and transformation of $\hat{j}$ are linearly dependent columns

→ one is a scale version of the other

linear transformation squishes all 2d space on to the lines vector where those two vector sits

* move around space using linear transformation

* three dimensional linear transformation

we have three standard basis ($\hat{i}$, $\hat{j}$, $\hat{k}$)

transformation (2d to 2d) (3d to 3d) till now

* transformation between dimension (2d to 3d) → what makes them linear is that to parallel the grid lines and origin stays fixed

in this case matrix transformation is 3x2

$$\begin{array}{cc} \left[\begin{array}{cc} \quad & \quad \\ \quad & \quad \\ \quad & \quad \end{array}\right] \\ \hat{i} \quad \hat{j} \end{array} \Big\} \rightarrow \text{transformation of basis in 3d space}$$

we can have different type of transformation (2d to one dimensional) (3d to 2d) & ___.