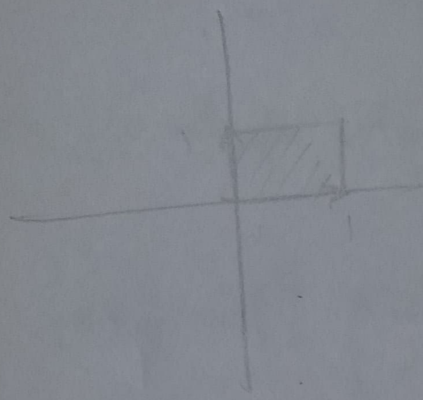
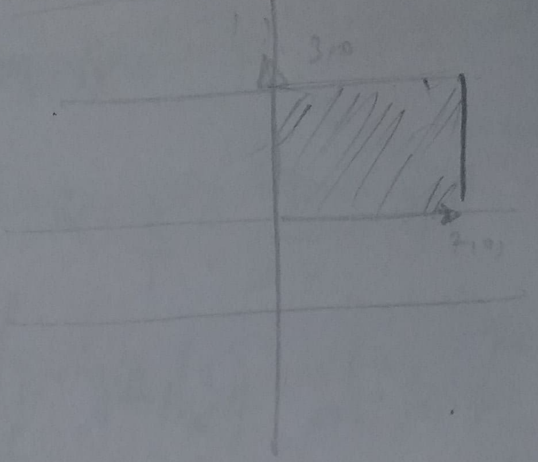
Determinant





If there was a certain amount of area A what would happen to that area, by how many times would that be squished or scaled?

That is answered by determinant.

For eg in above transformation

Area formed by $\begin{pmatrix}1\\0\end{pmatrix} + \begin{pmatrix}0\\1\end{pmatrix} = 1$ sq

after transforming $\begin{bmatrix}1\\0\end{bmatrix} \rightarrow \begin{bmatrix}2\\0\end{bmatrix}$

$\begin{pmatrix}0\\1\end{pmatrix} \rightarrow \begin{bmatrix}0\\3\end{bmatrix}$

New area $= 6$.

determinant $= 6/1 = 6$

generally in a 2-D space it would be

Area of ||gm / Area of sq

Here ▭ → a special ||gm

and in 3D

Volume of ||ppd / Volume of cube

Determinant can also have -ve values based on New 2nd basis ($\hat{j}$) is on the left of New 1st basis ($\hat{i}$) or not.

Basically to get the idea of orientation.

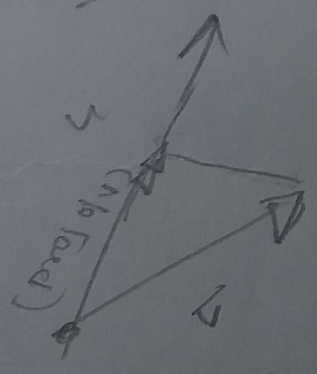
Dot products

$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} \cdot \begin{bmatrix} d \\ e \\ f \end{bmatrix} = a \cdot d + b \cdot e + c \cdot f$$

a scalar

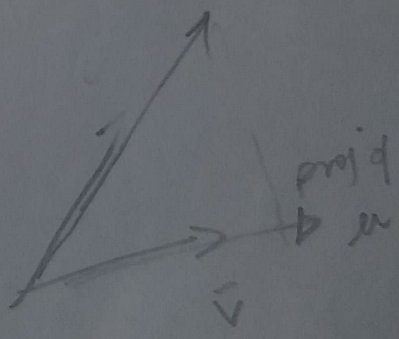
u v

Mathematically



len (project v on u) × len(u)

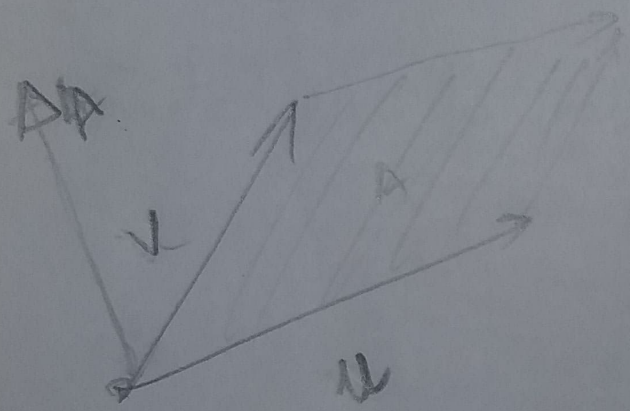
OR



len(proj of u on v) × len(v).

Reasons: well explained in 3b1b series

Cross product is



a vector perpendicular to u and v, such that u, v, cross product form Right hand rule and magnitude of that cross product is the area of parallelogram formed by $\vec{u}, \vec{v}$; (as shown).