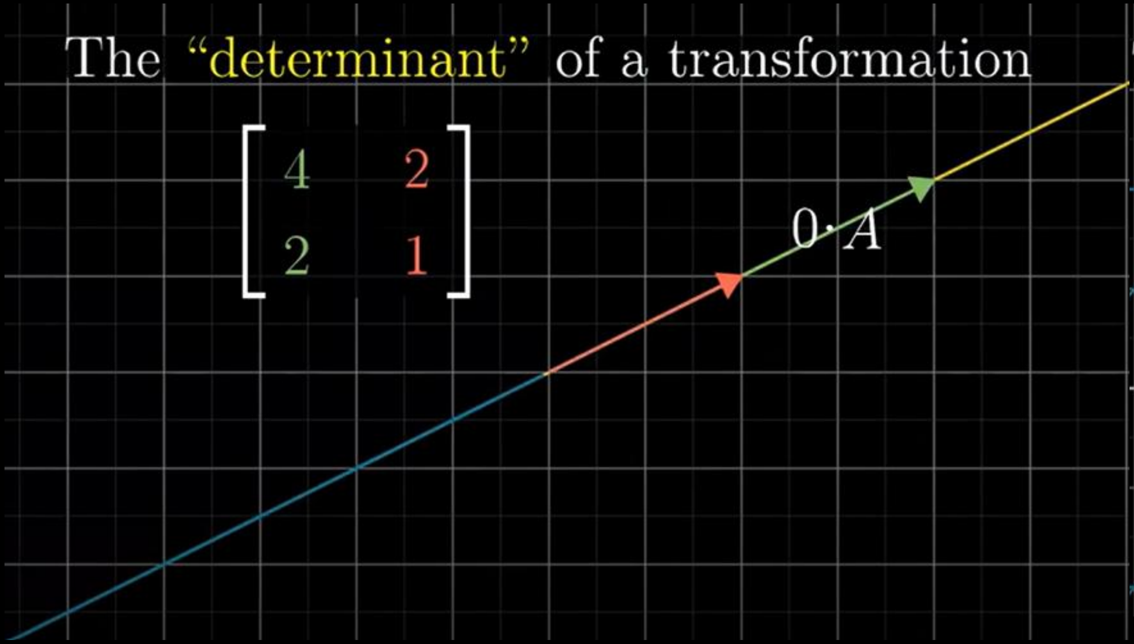
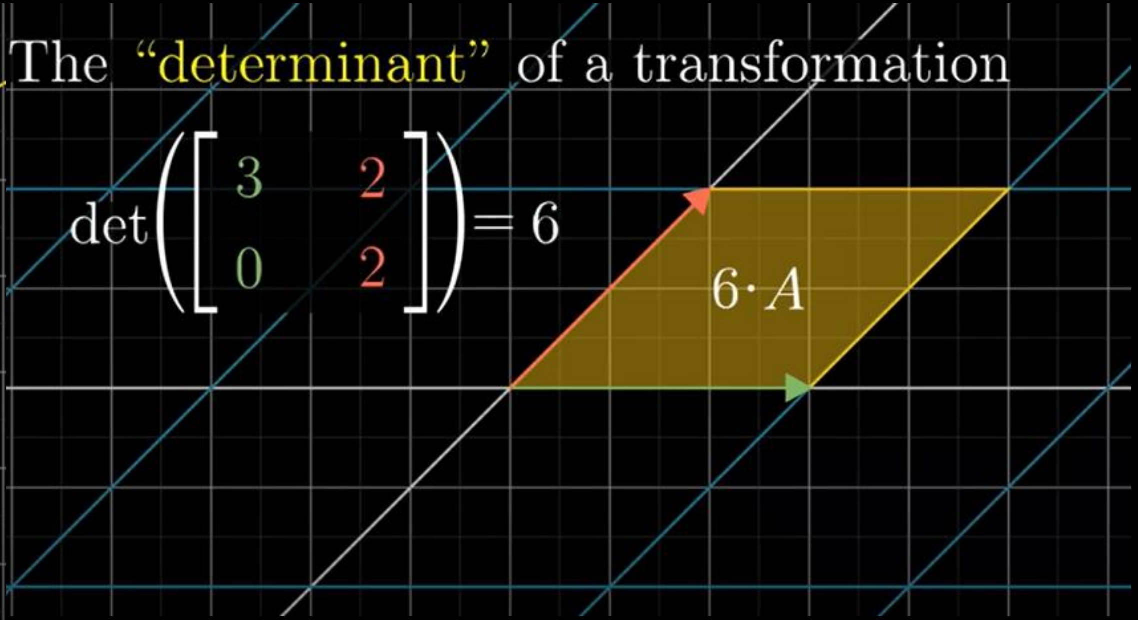
Week 4
MATH1012 Practical

Determinants:

Determinant: (Signed) Change in Area/Volume for a matrix under a transformation.

Linearly Dependence: Det A = 0





Column Space

For a given transformation:

Column Space: The Range of a Transformation (Where your vectors end up after a transformation). i.e. The span of a transformation.

$$A = \begin{bmatrix} 1 & 2 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 5 \\ 0 \end{bmatrix}$$

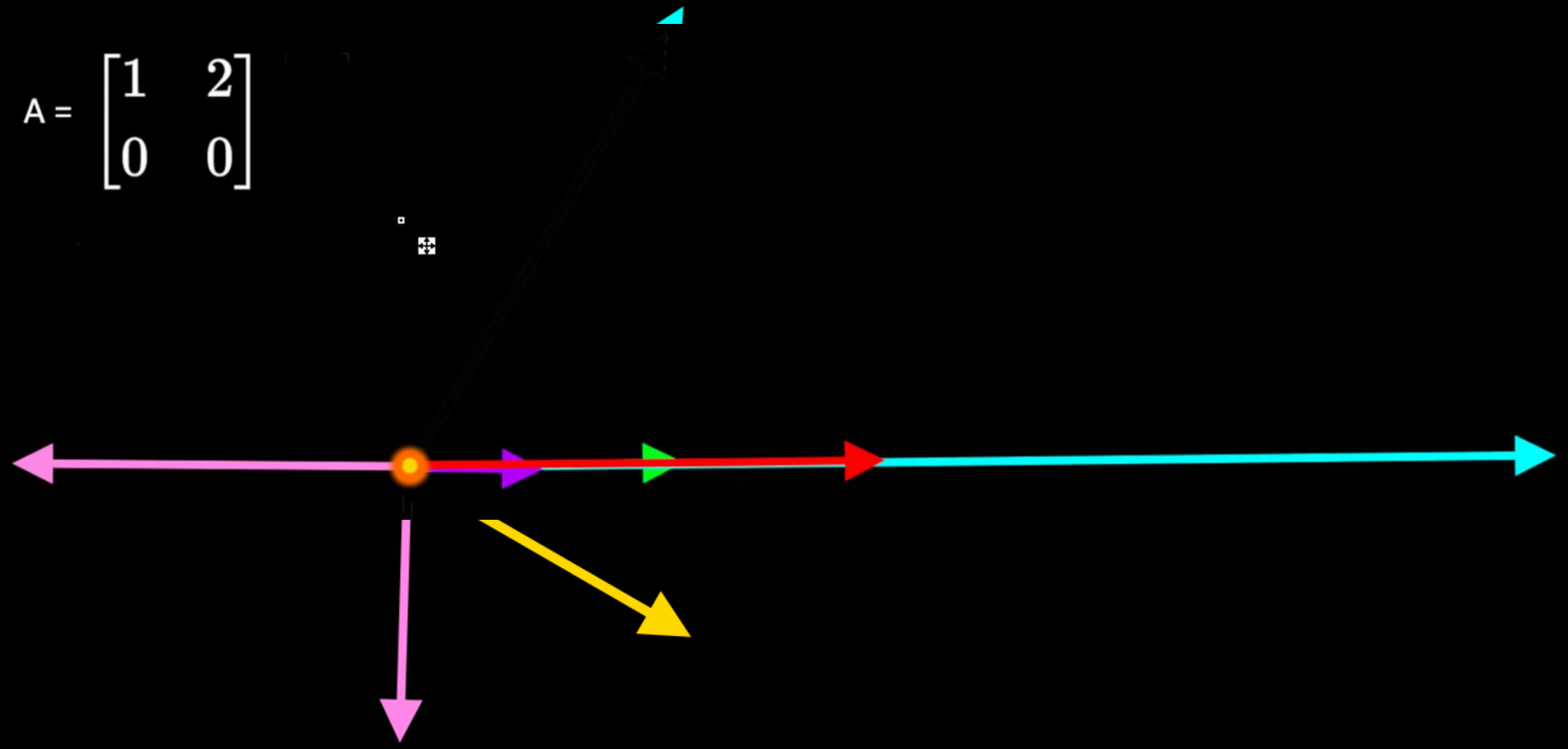
$$s \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

Row Space – A^T of the Column Space

Nullspace

All of the vectors in the domain where: Ax = 0

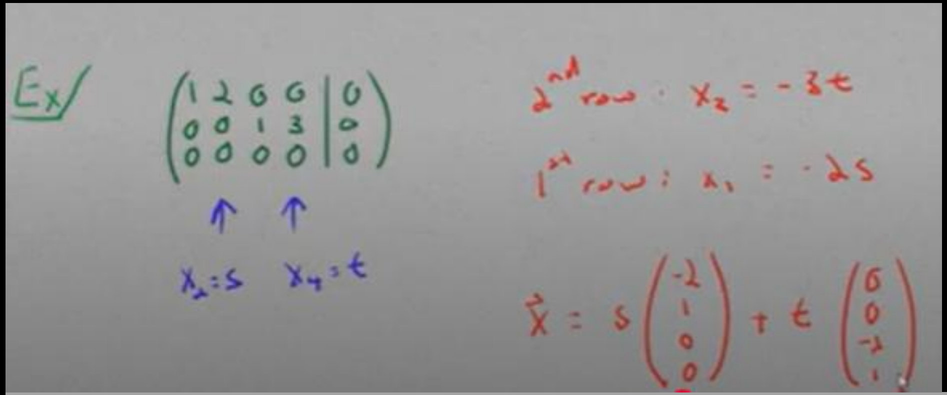
A = $\begin{bmatrix} 1 & 2 \\ 0 & 0 \end{bmatrix}$



Nullspace & Column Space (Computation):

Nullspace is: The Parametric/Vector Solution of Ax = 0

Column Space are the original vectors which corresponds to the leading 1's after finding REF.



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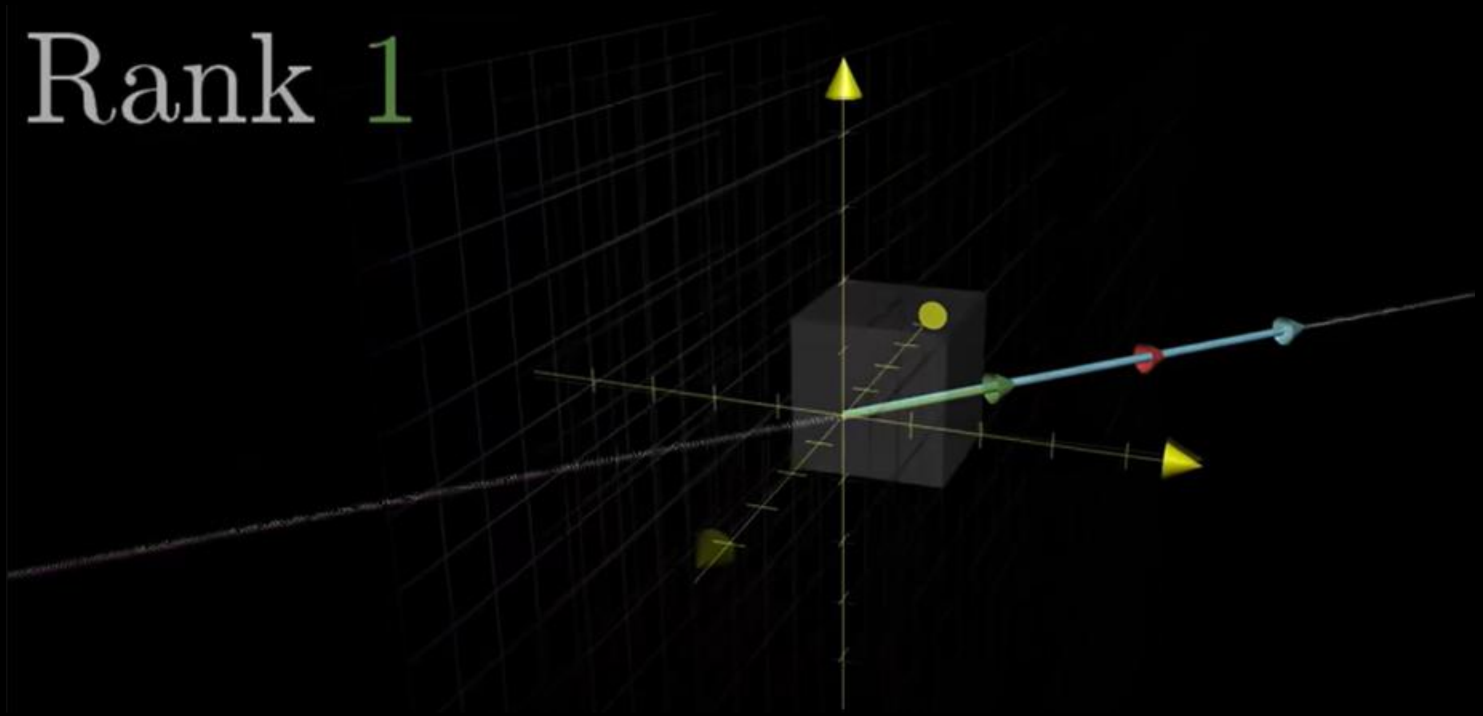
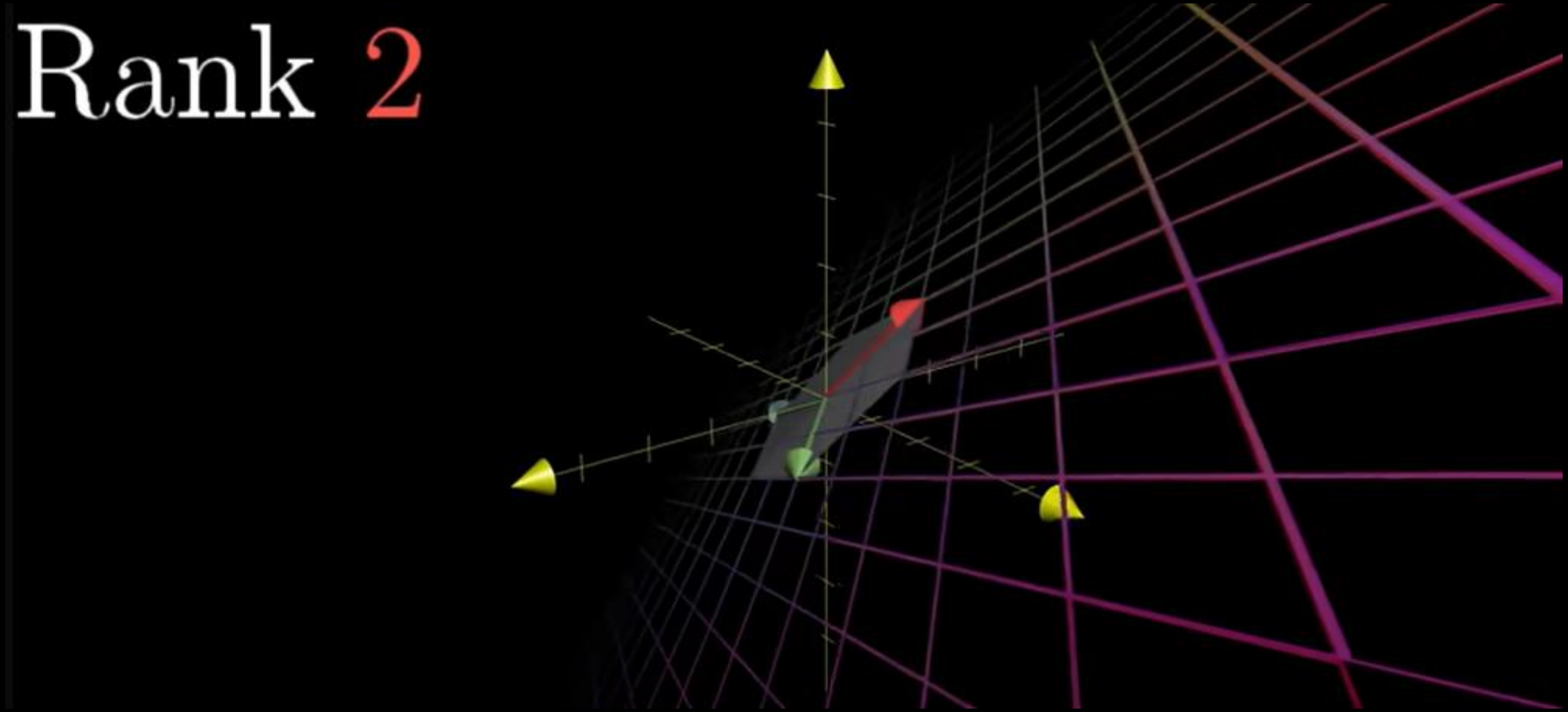
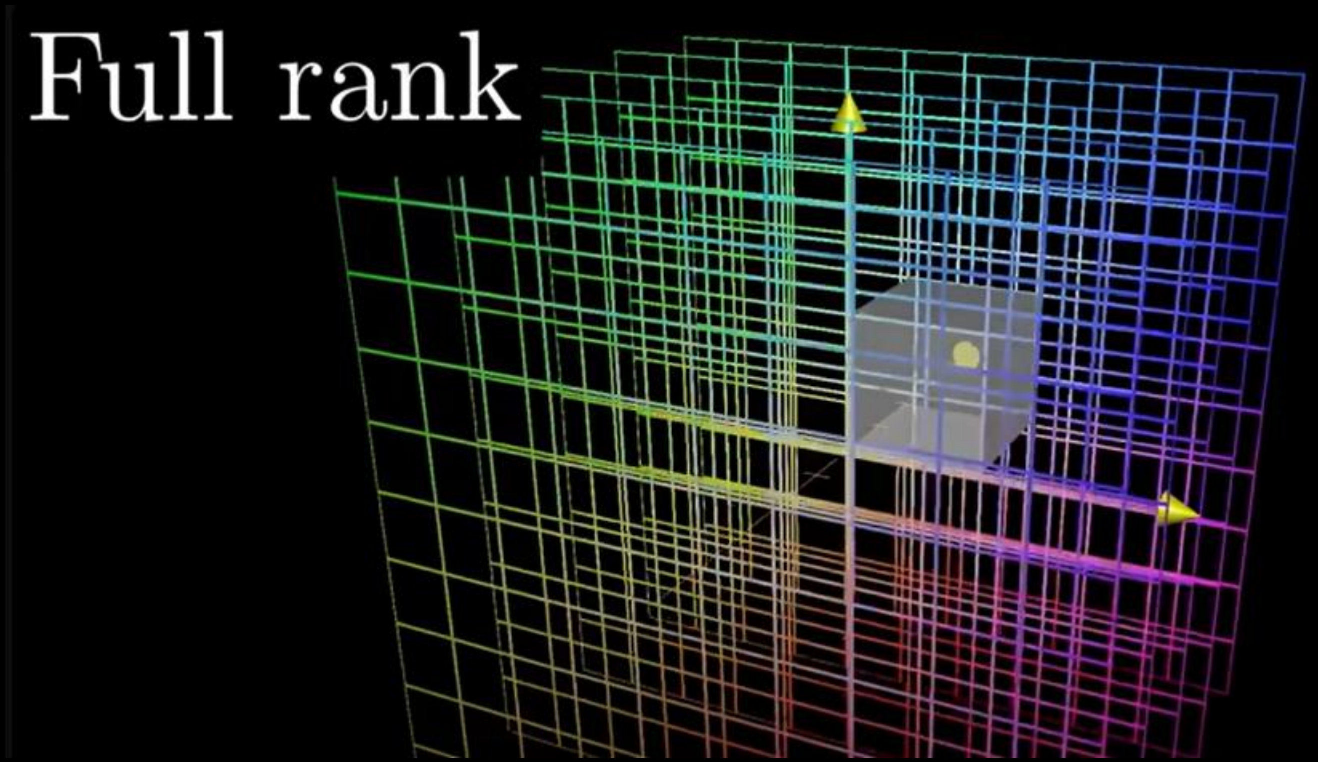
Rank



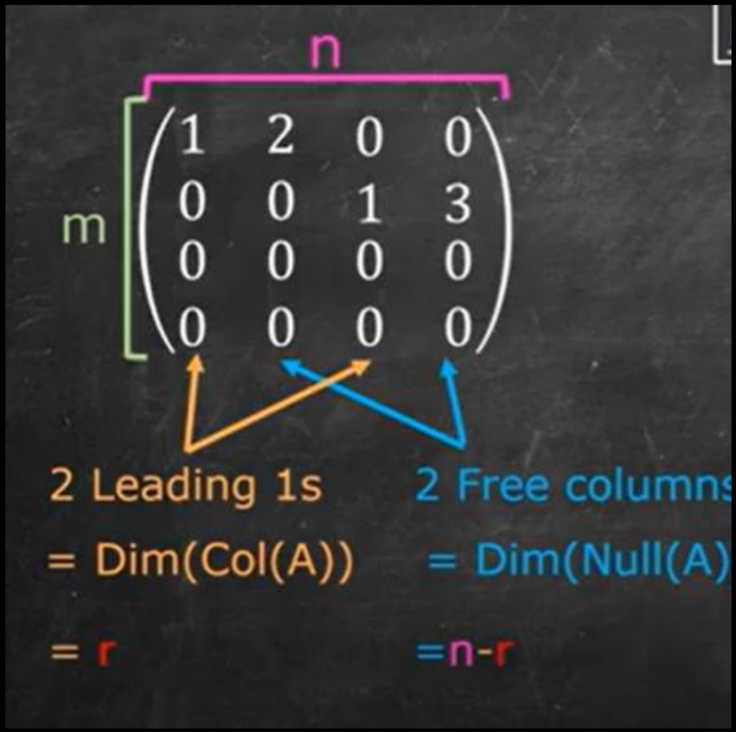

Rank 2


Full rank

Rank – Nullity Theorem

Dimension Theorem:
For mxn matrix A,
Dim(Col(A)) +Dim(Null(A)) = n

Rank(A)+Dim(Null(A)=n



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Summary:

Nullspace: All of the vectors in the domain where; $Ax = 0$

Column Space: The Range of a Transformation (Where your vectors end up after a transformation). i.e. The span of a transformation.

Computation:

Nullspace is: The Parametric/Vector Solution of $Ax = 0$

Column Space are the original vectors which corresponds to the leading 1's after finding REF.

Rank-Nullity Theorem:

Rank(A)+Dim(Null(A)=n (with n. as no. of columns)

Sources

Images:

3Blue1Brown/Grant Sanderson – Slides 2,6,7,8
Trefor Bazett – Slides 5,9

Column Space

For a given transformation:

Column Space: The Range of a Transformation (Where your vectors end up after a transformation). i.e. The span of a transformation.