Row space, null space and rank:

$A = m \times n$

$NULL(A)$ = subspace of all $n \times 1$ matrices.

$col(A)$ = subspace of all $(m \times 1)$ matrices.

$Row(A) = col(A^T) \Rightarrow$ subspace of all $n \times 1$ matrices

$Left\ null(A) = NULL(A^T) \Rightarrow$ subspace of $m \times 1$ matrices.

$Ax = 0 \rightarrow$ Vectors in row space are orthogonal to vectors in the null space.

* rref $\rightarrow$ reduced Echelon form.

$rref(A)$

$\dim(NULL(A)) = \#$ no pivot columns

$\dim(row(A)) = \#$ of pivot columns

$\rightarrow$ The sum of these 2 is going to be the total of columns of the matrix.

$NULL(A)$ & $Row(A)$ are orthogonal complements.

dim(col(A)) = # of pivot columns.

dim(Row(A)) = dim(col(A))

$$\Downarrow$$

dim(Row(A)) = dim(col(A)) = rank = # linear independent columns of the matrix