

# Recitation 3

Alex Dong

CDS, NYU

Fall 2020

# Rank Nullity Theorem

## Theorem (Rank-nullity theorem)

*Let  $L : \mathbb{R}^m \rightarrow \mathbb{R}^n$  be a linear transformation. Then*

$$\text{rank}(L) + \dim(\text{Ker}(L)) = m.$$

One of the most important theorems in linear algebra.

You should be able to state and prove this theorem (with no notes).

# Symmetric Matrices: That's cute!

Symmetric Matrices are not just "cute"...

They are actually DEEPLY LINKED to many topics in linear algebra.

Orthogonal Projections (Next lecture) are symmetric matrices.

Spectral theorem - "eigenvectors and eigenvalues of symmetric matrices are really special".

PCA: Covariance matrix is symmetric  
Concavity: Hessian Matrix (matrix of double derivatives) is symmetric

But, we will see most of this later.

For now, just trust me :)