

0.1 Commutation

We define a function, the commutator, between two objects a and b as:

$$[a, b] = ab - ba$$

For numbers, $ab - ba = 0$, however for matrices this is not generally true.

0.2 Commutators and eigenvectors

Consider two matrices which share an eigenvector v .

$$Av = \lambda_A v$$

$$Bv = \lambda_B v$$

Now consider:

$$ABv = A\lambda_B v$$

$$ABv = \lambda_A \lambda_B v$$

$$BAv = \lambda_A \lambda_B v$$

If the matrices share all the same eigenvectors, then the matrices commute, and $AB = BA$.