# 8.5: Functions of Matrices

Alex L.

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**Definition:** (Powers of a Matrix) The **powers** of a square matrix $A$ are:

$$A^n = AAAAA...A$$

or $A$ multiplied with itself $n$ times.

Notice that this function is only well defined if $A$ is a square matrix.

Now, lets construct functions of matrices of the form $S = \sum_n a_n A^n$.

For example, we can define an exponential of a matrix $e^A = \sum_{n=0}^{\infty} \frac{A^n}{n!}$

We can use this method to define other functions like $\sin A$ and $\cos A$ as well.