Simple discussion about powers of matrices.

Let A be a square matrix, and n a positive integer.

① we define $A^n = AA\cdots A$ (n times)

② we define $A^{-n} = (A^{-1})^n = A^{-1}A^{-1}\cdots A^{-1}$

(n times, A^{-1} denotes the inverse of A)

③ we define $A^0 = I$. It can be used to solve systems of linear differential equations.

To be specific, let A be $m\times m$ real or complex matrix. The exponential of A, denoted by e^A or $\exp(A)$, is the $m\times m$ matrix given by the power series:

$$e^A = \sum_{k=0}^{\infty} \frac{1}{k!} A^k$$

Where A^0 is defined to be the identity matrix I with the same dimensions of A.