Examples
For any $m \times n$ matrix $A$, multiplying by the appropriately sized identity matrix (i.e., $I_m$ or $I_n$) results in $A$. More formally:

$$AI_n = I_mA = A$$

**Example**

Is matrix multiplication commutative (i.e., does $AB = BA$ for any pair of matrices)?
Matrix Multiplication Algorithm
Matrix multiplication chain

What order should we multiply our matrices in?

Calculate the number of multiplications of each approach and pick the one with the lesser complexity:

We can reduce the cost of calculating matrix multiplication by picking a different order of operations.
Powers of a matrix

Let $A$ be a square $n \times n$ matrix.

We define $A^2 = A \cdot A$. 
Transpose of a matrix

Given a matrix $A$, its transpose is obtained by rewriting rows of $A$ as columns.

The transpose of $A$ is denoted by $A^t$.

For a square matrix, the main diagonal remains the same. The elements not on the diagonal are moved to the other side of the diagonal.

If $A = A^t$, then $A$ is a symmetric matrix.
Determinant of a matrix

Determinants are defined for square matrices.

The determinant of a square matrix of order \( n \times n \) is a function that assigns a scalar value to each possible \( n \times n \) matrix.

If \( A = (a_{ij})_{n \times n} \), then \(|A|\) or \( \text{det}(A) \) denotes the determinant of \( A \).
Laplace Expansion

Each element of $A$, has a minor $M_{ij}$. This is the determinant of the submatrix obtained by removing row $i$ and column $j$ of $A$.

$C_{ij}$ denotes the cofactor of $a_{ij}$. Specifically, $C_{ij} = (-1)^{i+j} M_{ij}$.