Determinants

A general way to compute it is,
If If A is an $n \times n$ matrix where $n = 1$,

$$\det(A) = a_{1,1}$$

If A is an $n \times n$ matrix where $n > 1$,

$$\det(A) = a_{1,1} \det\left(A_{1,1}\right) - a_{1,2} \det\left(A_{1,2}\right) + \cdots + (-1)^{n+1} a_{1,n} \det\left(A_{1,n}\right)$$

$a_{i,j}$ means the element at the i^{th} row and the j^{th} column.
$A_{i,j}$ means the Matrix if you drop (get rid of) the i^{th} row and the j^{th} column.

Deriving it for a 2×2
Say we have $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$

$$\begin{aligned}
&\det(A) = (a_{1,1})(\det\left(A_{1,1}\right)) - (a_{1,2})(\det\left(A_{1,2}\right)) \\
&\det(A) = (a)\,(d) - (b)\,(c) \\
&\det(A) = ad - bc
\end{aligned}$$