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1). An $n \times m$ matrix A is called nonsingular or invertible if there exists an $n \times n$ matrix B such that $AB = BA = I$. If A does not have an inverse, A is called singular. A matrix B such that $AB = BA = I$ is called an inverse of A .

2). A singular matrix if its determinant is zero.

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} ad - bc = 0 \quad \begin{bmatrix} 1 & 2 \\ 1 & 2 \end{bmatrix} (1 \times 2 - 1 \times 2) = 0$$

A nonsingular matrix if its determinant is not zero

$$\begin{bmatrix} 1 & 2 \\ 2 & 2 \end{bmatrix} (3 \times 2 - 1 \times 2) = 4 \quad \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix} (3 \times 2 - 1 \times 2) = 4$$

$$\begin{bmatrix} 8 & 2 \\ 4 & 3 \end{bmatrix} (8 \times 3 - 2 \times 4) = 16$$