Square Matrix Summary

$\mathbf{A}$ is an $n \times n$ matrix.

Non-singular	Singular
$\mathbf{A}$ has an inverse matrix	$\mathbf{A}$ has no inverse matrix
$\mathbf{A}_R = \mathbf{I}$	$\mathbf{A}_R$ has at least one row of zeros
$\operatorname{rank} \mathbf{A} = n$ (full rank)	$\operatorname{rank} \mathbf{A} < n$
$\operatorname{image} \mathbf{A} = \mathbb{R}^n$	$\operatorname{image} \mathbf{A}$ is smaller than $\mathbb{R}^n$
$\operatorname{nullity} \mathbf{A} = 0$	$\operatorname{nullity} \mathbf{A} > 0$
$\operatorname{kernel} \mathbf{A} = \{\mathbf{0}\}$	$\operatorname{kernel} \mathbf{A}$ is more than $\{\mathbf{0}\}$
$\mathbf{Ax} = \mathbf{0}$ has $\mathbf{x} = \mathbf{0}$ as its only solution	$\mathbf{Ax} = \mathbf{0}$ has nonzero solutions
$\mathbf{Ax} = \mathbf{b}$ has $\mathbf{x} = \mathbf{A}^{-1}\mathbf{b}$ as its only solution	$\mathbf{Ax} = \mathbf{b}$ has either no solutions or infinitely many solutions
The rows of $\mathbf{A}$ form a basis for $\mathbb{R}^n$	The rows of $\mathbf{A}$ are linearly dependent, and fail to span $\mathbb{R}^n$
The columns of $\mathbf{A}$ form a basis for $\mathbb{R}^n$	The columns of $\mathbf{A}$ are linearly dependent, and fail to span $\mathbb{R}^n$
$\det \mathbf{A} \neq 0$	$\det \mathbf{A} = 0$
All eigenvalues of $\mathbf{A}$ are non-zero	0 is an eigenvalue of $\mathbf{A}$