The Invertible Matrix Theorem

Let $A$ be a square $n \times n$ matrix. Then the following statements are equivalent.

a. $A$ is an invertible matrix
b. $A$ is row equivalent to the $n \times n$ identity matrix
c. $A$ has $n$ pivot positions
e. The columns of $A$ form a linearly independent set
h. The columns of $A$ span $\mathbb{R}^n$

m. The columns of $A$ form a basis of $\mathbb{R}^n$

n. $\text{Col } A = \mathbb{R}^n$
o. $\dim \text{Col } A = n$
p. $\text{rank } A = n$
q. $\text{Nul } A = \{0\}$
r. $\dim \text{Nul } A = 0$
s. The number 0 is not an eigenvalue of $A$
t. $\det A \neq 0$