Proof: If A is invertible, then by IMT, A is row equivalent to I_n

i.e., $I = e_p(e_{p-1}(\cdots e_1(A)))$ for some sequence of elementary row ops.

If E_1 to E_p are the corresponding elementary matrices, then

$I = (E_p \cdots E_1)A$, Each E_i being invertible,

$\Rightarrow A = (E_p \cdots E_1)^{-1} I = E_1^{-1} \cdots E_p^{-1}$

Hence A is a product of elementary ops.

Furthermore, $A^{-1} = (E_1^{-1} \cdots E_p^{-1})^{-1} = (E_p \cdots E_1) = (E_p \cdots E_1)I = e_p(e_{p-1}(\cdots e_1(I)))$

In other words, the same sequence of row ops that reduce A to I also reduce I to A^{-1}.