

Step-1

We have to verify that why does no 3 by 3 matrix have a null space that equals its column space.

We know that the dimension of null space + dimension of column space = dimension of the vector space.

Therefore $\dim \text{null space of } A + \dim \text{column space of } A = 3$

Step-2

But from the given condition, $\dim \text{null space } A = \dim \text{column space of } A$

$\Rightarrow 2 (\dim \text{null space of } A) = 3$, and we know that for this matrix the dimension should be equal to 3 or less than 3.

But this equation is impossible for $\dim \text{null space of } A = 1$ or 2 or 3.

Therefore there is no 3 by 3 matrix which have a null space that equals its column space.