1. Suppose $A$ is a square matrix, and $A^2 = A$.
   What are the possible values for $\det(A)$? Explain.

2. Find all values of $a$ that make
   \[
   \begin{pmatrix}
   a & a & 0 \\
   a^2 & 2 & a \\
   0 & a & a
   \end{pmatrix}
   \]
   singular.