Verify that $\begin{pmatrix} a_1 & 0 \\ 0 & a_2 \end{pmatrix}\begin{pmatrix} b_1 & 0 \\ 0 & b_2 \end{pmatrix} = \begin{pmatrix} a_1 b_1 & 0 \\ 0 & a_2 b_2 \end{pmatrix}$. Prove in general that the product of two diagonal matrices is a diagonal matrix, with elements given by the product of the diagonal elements.

$\begin{pmatrix} a_1 \cdot b_1 + 0 \cdot 0 & a_1 \cdot 0 + 0 \cdot b_2 \\ 0 \cdot b_1 + a_2 \cdot 0 & 0 \cdot 0 + a_2 \cdot b_2 \end{pmatrix}$

$\begin{pmatrix} a_1 b_1 & 0 \\ 0 & a_2 b_2 \end{pmatrix}$ ✓