$\boxed{3}$ Fact: Tridiagonal hermitian matrix with nonzero diagonals has distinct eigenvalues.
Now, it is done if we show A^TA is of such a form.
Let $a_1, \cdots, a_m$ be the main diagonals of A $(a_i \neq 0, b_i \neq 0)$
$b_1, \cdots, b_{m-1}$ be the super ".

Then, the main diagonals of A^TA: $(A^TA)_{kk} = \begin{cases} a_1^2, a_m^2 \\ a_k^2 + b_{k-1}^2 (2 \leq k \leq m) \end{cases}$ ■

super " $(A^TA)_{k,k+1} = b_k^2 \quad (1 \leq k \leq m-1)$

sub " $(A^TA)_{k+1,k} = a_k^2 \quad (1 \leq k \leq m-1)$

$\boxed{4}$ See smallestsingval.mlx.