Do each of the following problems

1. Exercise 7, Chapter 7, Page 73 of Lax.
2. Exercise 16, Chapter 7, Page 75 of Lax.
3. Exercise 1, Chapter 8, Page 77 of Lax.
4. Exercise 3, Chapter 8, Page 79 of Lax.
5. Let $M$ be a real $n \times n$ selfadjoint matrix. Let $a$ be an eigenvalue of $M$, and set
   \[ E = \{ z \in \mathbb{C}^n : Mz = az \} \]
   so $E$ is the eigenspace in $\mathbb{C}^n$ for eigenvalue $a$. Prove that there is an orthonormal basis for $E$ consisting of real eigenvectors. That is, verify that Lax is correct in his claim in lines 4 and 5 of his proof of Theorem 4’, Page 82.
6. Let
   \[ M = \begin{pmatrix} 3 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 3 \end{pmatrix} \]
   and let $q(x) = (x, Mx)$. Find an orthogonal matrix $N$ which diagonalizes the quadratic form $q$.
7. Exercise 4, Chapter 8, Page 91 of Lax.
8. Exercise 9, Chapter 8, Page 92 of Lax.

Extra credit problems (Optional).

1. Exercise 5, Chapter 8, Page 91 of Lax.
2. Exercise 6, Chapter 8, Page 91 of Lax.