1. (a) What is the degree of $\mathbb{Q} \left( \sqrt{2} + 3i \right)$ as an extension of $\mathbb{Q}$?
(b) Find the minimal monic polynomial of $\sqrt{2} + 3i$ in $\mathbb{Q}[X]$.

2. Let $K$ be a field and let $R$ be a commutative ring containing $K$ that is also a finite-dimensional $K$-vector space. Suppose $R$ is an integral domain. Prove that $R$ is a field.

3. Let $L \supset K$ be a finite extension of fields, with $[L : K] = p$ an odd prime number.
   (a) List all the subfields $K' \subset L$ containing $K$.
   (b) Suppose $L = K(\alpha)$ for some $\alpha \in L$. Let $K' = K(\alpha^2) \subset L$. What are the possible degrees of $L$ over $K'$?

4. Rotman’s book, Exercises 72 (iii), 73, and 77, p. 58.