(1) Prove that the field of Laurent series is isomorphic to the fraction field of the field of power series (i.e. show that $k((t)) = Q(k[[t]])$).

(2) Construct a field with 4 elements by adjoining to $F_2$ the root of an irreducible quadratic polynomial. Find the multiplication table for your field.

(3) Let $F$ be a field of characteristic other than 2. Let $D_1, D_2$ be elements of $F$, neither of which is a square in $F$. Prove that $F(\sqrt{D_1}, \sqrt{D_2})$ is of degree 4 over $F$ if $D_1D_2$ is not a square in $F$ and is of degree 2 otherwise.

(4) Show that $Q(\sqrt{2})$ is not isomorphic to $Q(\sqrt{3})$.

(5) Give an example of a field $F$ and a non-zero map of fields $\phi : F \to F$ which is not an isomorphism. Are there any examples when $F$ is an algebraic extension of $Q$?

(6) Suppose that $\alpha$ is algebraic over $F$ and that $[F(\alpha) : F] = p$ a prime. Show that for all $1 \leq k < p$, we have $F(\alpha^k) = F(\alpha)$.