Read Hoffman and Kunze, Chapter 3, Section 7, and Chapter 4, Sections 1-3.

1. From Hoffman and Kunze, Chapter 3, do these problems:
   Pages 115-116, #1, 7.

2. From Hoffman and Kunze, Chapter 4, do these problems:
   Pages 122-123, #1(a), 4-6. Pages 126-127, #5, 6. [Hint for #6: what is $L(1)$? $L(x)$?]

3. Let $X, Y$ be subspaces of a finite dimensional vector space $V$ and assume that $V = X \oplus Y$.
   Show that $V^* = \text{Ann}(X) \oplus \text{Ann}(Y)$. [Hint: Choose bases for $X$ and $Y$.]

4. a) Show that if $T : V \to W$ is a surjective linear transformation of finite dimensional vector spaces with kernel $N$, then $\dim(V/N) = \dim(V) - \dim(N)$. [Hint: Consider $\dim(W)$.]
   b) Illustrate this with the example $V = \mathbb{R}^3$, $W = \mathbb{R}$, $T(x, y, z) = x + y + z$.

5. Let $T : V \to W$ and $S : W \to Z$ be linear transformations of finite dimensional vector spaces.
   a) Show that $(S \circ T)^t = T^t \circ S^t$, and deduce that if $S \circ T = 0$ then $T^t \circ S^t = 0$. [You can do this either using the linear transformations or the corresponding matrices.]
   b) Show that if $T$ is surjective then $T^t$ is injective. [Hint: What is the kernel of $T^t$?]
   c) Show that if $T$ is injective then $T^t$ is surjective. [Hint: Pick a basis $B$ of $V$, and show that $T(B)$ extends to a basis of $W$.]