1. Read Section 2.2, pages 44 to 46 of the textbook.

2. Exercise (2), page 46 of the textbook. Prove that the topology generated by a subbase is the intersection of all the topologies that contain it.

3. Exercise 4, page 46 of the textbook. Consider the plane \( \mathbb{R}^2 \), and define an open half-plane to be a set of the form
   \[
   \{(x, y) \in \mathbb{R}^2 : ax + by < c\}
   \]
   for some choice of constants \( a, b, c \).
   
   (a) If \( a, b, c \in \mathbb{R} \), show that \( \{(x, y) \in \mathbb{R}^2 : ax + by > c\} \) is an open half-plane.
   
   (b) Show that the collection of all open half-planes is a subbase for the usual topology of \( \mathbb{R}^2 \).

4. Read Section 2.3, pages 48 to 51 of the textbook.

5. Exercise 3, page 52 of textbook; modified. Suppose \((X, \mathcal{F})\) and \((W, \mathcal{U})\) are topological spaces and \( \{A_i : i \in I\} \) is a collection of open sets in \( X \) such that \( X = \bigcup_i A_i \). Suppose that for each \( i \) there is a continuous function \( g_i : A_i \to W \) such that \( g_i(x) = g_j(x) \) when \( x \in A_i \cap A_j \), and let \( f : X \to W \) be defined by \( f(x) = g_i(x) \) when \( x \in A_i \). Show that \( f \) is continuous.

6. Exercise 4, page 52 of textbook. If \((X_k, \mathcal{F}_k)\) is a topological space for \( 1 \leq k \leq n \) and \( X = X_1 \times \cdots \times X_n \), show that \( \{\pi_k^{-1}(G_k) : 1 \leq k \leq n \text{ and } G_k \in \mathcal{F}_k\} \) is a subbase for the product topology on \( X \).

7. Exercise 7, page 52 of textbook, modified. If \( X_k \) and \( Z_k \) are topological spaces for \( 1 \leq k \leq n \), \( X = X_1 \times \cdots \times X_n \), and \( Z = Z_1 \times \cdots \times Z_n \), show that \( X \) and \( Z \) are homeomorphic if \( X_k \) and \( Z_k \) are homeomorphic for \( 1 \leq k \leq n \).