Note: As with any proof, clarity of presentation is as important as solving the problem. Strive to make your proofs clear, concise and precise. Feel free to use results from earlier problems in subsequent ones.

1. Give an upper bound on the number $T(n)$ of distinct topologies that a finite set of n elements can have. (There is no known explicit formula for $T(n)$.)
2. Textbook Exercise 3.2
3. Textbook Exercise 3.5
4. Textbook Exercise 3.6
5. Prove the assertion made in Example 3.13: $m : \mathbb{R} \to \mathbb{R}$ defined by $m(x, y) = xy$ is continuous.
6. Textbook Exercise 3.8
7. Textbook Exercise 3.9
8. Textbook Exercise 3.10
9. Textbook Exercise 3.11
10. Let $\mathcal{B}$ be the set of all lines in $\mathbb{R}^2$. If $\mathcal{B}$ is contained in a basis for $\mathbb{R}^2$, what must be the resulting topology? Prove your assertion.