1. In the context of exercise 5 (iii) on page 31:

   a. Give two examples of open sets that are not $\mathbb{R}$ or $\emptyset$. Use at least one complete sentence to explain why the given sets are open.

   $\tau_3$ consists of $\mathbb{R}$, $\emptyset$, and every interval $[n, \infty)$, for $n \in \mathbb{R}^+$.

   The sets $[1, \infty)$ and $[2, \infty)$ are open to $\tau\_3$. Either sets compliment is an interval from $-\infty$ to the start-point exclusive. Since the compliment of the sets is not in $\tau_3$, the sets are open to $\tau$.

   b. Give two examples of closed sets that are not $\mathbb{R}$ or $\emptyset$. Use at least one complete sentence to explain why the given sets are closed.

   The sets $(-\infty, 1)$ and $(-\infty, 2)$ are closed to $\tau_3$. These are, in fact, the compliments to the sets defined above. Since the compliment of either set is in $\tau_3$, these sets are closed to $\tau_3$.

2. In the context of exercise 6 (ii) on page 31:

   a. Give two examples of open sets that are not $\mathbb{N}$ or $\emptyset$. Use at least one complete sentence to explain why the given sets are open.

   $\tau_2$ consists of $\mathbb{N}$, $\emptyset$, and every set $\{n, n+1, \dots\}$, for $n \in \mathbb{Z}^+$. This is called the final segment topology.

   The sets $\{2, 3, 4, \dots\}$ and $\{3, 4, 5, \dots\}$ are in $\tau_2$ and are thus open sets.

   b. Give two examples of closed sets that are not $\mathbb{N}$ or $\emptyset$. Use at least one complete sentence to explain why the given sets are closed.

   The sets $\{1\}$ and $\{1, 2\}$ are closed sets to $\tau_2$. These sets are the compliments to the sets define above over the positive integers, $\mathbb{N}$, and are thus closed sets to $\tau_2$.

3. Exercise 1.2: #2 (page 36). Let $(X, \tau)$ be a topological space with the property that every subset is closed. Prove that this is a discrete space.

*Proof.* □