Exercise 1.1

(a)

(b)

Exercise 1.2

Proof by contradiction to establish the following theorem:

For all sets A and B: If $(A \cap B) = \emptyset$, then $(A \setminus B) = A$.

Proof. Assume if $A \cap B = \emptyset$, then $A \setminus B \neq A$
Since $(A \setminus B) \neq A$ there is a $x \in B$ that's also $x \in A$. But since $A \cap B = \emptyset$ this is impossible. Hence the original statement must hold. □

Exercise 1.3

(a)

(b)

Exercise 1.4

We examine the following statement:

For all sets A, B and C: if $A \subseteq (B \cup C)$, then $A \subseteq B$ or $A \subseteq C$.

We choose a set $A = B \cup C$ where $B \neq C$ and $B, C \neq \emptyset$. It follows that $A \nsubseteq B$ and $A \nsubseteq C$ since B and C are now strict subsets of A. Since $A \subseteq (B \cap C)$ holds this contradicts the statement.