Section 5

5.1 (a) True: Definition 5.3.  
(b) False: \( \mathbb{N} \) is the set of positive integers  
(c) True: Example 5.5.  
(d) True: Theorem 5.7.

5.2 (a) False: \( A \cap B = \emptyset \) means \( A \) and \( B \) are disjoint.  
(b) True: Definition 5.8.  
(c) False: \( x \in A \setminus B \) means \( x \in A \) and \( x \notin B \).  
(d) False: this is OK to use since \( S \) being nonempty is the only nontrivial case.

5.4 (a) \( \{2, 4\} \)  
(b) \( \{1, 2, 3, 4, 6, 8\} \)  
(c) \( \{6, 8\} \)  
(d) \( \emptyset \)  
(e) \( B \)  
(f) \( \{1, 3, 5, 7\} \)  
(g) \( \{6\} \)  
(h) \( \{5, 7\} \)

5.5, 5.6, 5.7, and 5.8 are routine.

5.10 (a) \( U \)  
(b) \( \emptyset \)  
(c) \( A \cap B \)  
(d) \( A \cup B \)  
(e) \( A \)  
(f) \( A \)

5.11 is similar to 5.9.

5.12 True. Both are equal to \( A \cap B \). Here is one of the proofs: If \( x \in A \cap B \), then \( x \in A \) and \( x \in B \). Thus \( x \in A \setminus B \), so \( x \in A \setminus (A \setminus B) \). Conversely, if \( x \notin A \setminus (A \setminus B) \), then \( x \notin A \) and \( x \notin A \setminus B \). If \( x \notin B \), then since \( x \in A \), \( x \in A \setminus \emptyset \), a contradiction. Thus \( x \notin B \) and so \( x \in A \cap B \).

5.13 False. The left side is \( A \) and the right side is \( B \).

5.14 (a) The diagram is the same as \( (A \cup B) \setminus (A \cap B) \).  
(b) \( \emptyset \)  
(c) \( A \)  
(d) \( U \setminus A \)

5.16 Similar to 5.9.

5.17 and 5.18 are routine.

5.19 (b) \( \cup B = \{1, 2\} \),  
\( \cap B = \emptyset \)  
(c) \( \cup B = [2, \infty) \),  
\( \cap B = \{2\} \)  
(d) \( \cup B = [0, 5) \),  
\( \cap B = [2, 3] \)