(e) True: Theorem 13.17(a).
(f) True: Definition 13.14.
(g) False: $\mathbb{R}$ is both open and closed.
(h) False: see Example 13.12.
(i) True: Corollary 13.11(a).

13.3 Answers in book: (a) $\varnothing$; (b) (0,5); (c) $\varnothing$; (d) $\varnothing$; (e) $\varnothing$.

13.4 (a) $\{0\} \cup \{1/n : n \in \mathbb{N}\}$ (b) $\{0, 5\}$ (c) $[0, \sqrt{2}]$
(d) $[\sqrt{2}, \infty)$ (e) $\{2\}$

13.5 (a) neither (b) closed (c) neither
(d) both (e) closed (f) open

13.6 (a) $\{0\} \cup \{1/n : n \in \mathbb{N}\}$ (b) $\mathbb{N}$ (c) $\mathbb{R}$
(d) $\varnothing$ (e) $[9/2, 11/2]$ (f) $\mathbb{R}$

13.7 (a) Let $S = \{1/n : n \in \mathbb{N}\}$. Then $P = S$, and P is not closed.
(b) Let $S = [0,1] \cup \{2\}$. Then S is closed, but cl (int S) $= [0, 1] \neq S$.
(c) Let $S = (0,1) \cup (1,2)$. Then S is open, but int (cl S) $= (0, 2) \neq S$.
(d) Let $S = (0,1) \cup (1,2)$. Then bd $S = \{0, 1, 2\}$, but cl $S = [0,2]$, so bd (cl S) $= \{0, 2\} \neq$ bd S.
(e) Let $S = [0, 1] \cap \mathbb{Q}$. Then bd $S = [0, 1]$, but bd (bd S) $= \{0, 1\}$.
(f) Let $S = [0,2]$ and $T = [1,3]$. Then bd $(S \cup T) = \{0,3\}$, but (bd S) $\cup$ (bd $(T) = \{0, 1, 2, 3\}$.
(g) Let $S = [0,2]$ and $T = [1,3]$. Then bd $(S \cap T) = \{1,2\}$, but (bd S) $\cap$ (bd $(T) = \varnothing$.

13.8 If $x \in$ int S, then there exists a neighborhood of x that is contained in S. If $x \notin$ int S, then every neighborhood of x intersects $\mathbb{R} \setminus S$. There are two possibilities. It may be that some neighborhood of x is contained in $\mathbb{R} \setminus S$. In this case, $x \in$ int $(\mathbb{R} \setminus S)$. If not, then every neighborhood of x must intersect both S and $\mathbb{R} \setminus S$. This means $x \in$ bd $S =$ bd $(\mathbb{R} \setminus S)$.

13.9 (a) Let x be an accumulation point of set S, suppose x is not an interior point of S, and let N be an arbitrary neighborhood of x. Since x is not an interior point of S, N cannot be contained in S. That is $N \cap (\mathbb{R} \setminus S) \neq \varnothing$. On the other hand, since x is an accumulation point of S, every deleted neighborhood of x, and hence every neighborhood of x, must contain a point of S. Thus $N \cap S \neq \varnothing$. It follows that x is a boundary point of S.
(b) Let $x \in$ bd S and suppose $x \in S$. If x is not an accumulation point of S, then by definition x is an isolated point of S. On the other hand, suppose $x \notin S$. Since $x \in$ bd S, every neighborhood of x must intersect S in a point, but this point cannot be x since $x \notin S$. This means every deleted neighborhood of x must contain a point of S, and x is an accumulation point of S.

13.10 Let x be an isolated point of S, let N be an arbitrary neighborhood of x, and suppose $N \subseteq S$. Since every deleted neighborhood of x will have nonempty intersection with N, this would imply that x is an accumulation point of S, a contradiction. Thus N is not a subset of S and $N \cap (\mathbb{R} \setminus S) \neq \varnothing$. Since $x \in S$ and $x \in N$, we have $N \cap S \neq \varnothing$. Thus x is a boundary point of S.

13.11 through 13.18 are routine. Here are the hints in the book:

13.11 $A \setminus B = A \cap (\mathbb{R} \setminus B)$.

13.13 Look at neighborhoods.

13.15 Suppose that some neighborhood of x contains only a finite number of points of S and then find a smaller deleted neighborhood that misses S completely.