Section 2.4
2.20 (2.15 in 2nd edition) For statement $P$ and $Q$, construct a truth table for $(P \implies Q) \implies (\sim P)$.

2.24 Two sets $A$ and $B$ are nonempty disjoint subsets of a set $S$. If $x \in S$, then which of the following are true?

(a) It’s possible that $x \in A \cap B$.
(b) If $x$ is an element of $A$, then $x$ can’t be an element of $B$.
(c) If $x$ is not an element of $A$, then $x$ must be an element of $B$.
(d) It’s possible that $x \notin A$ and $x \notin B$.
(e) For each nonempty set $C$, either $x \in A \cap C$ or $x \in B \cap C$.
(f) For some nonempty set $C$, both $x \in A \cup C$ and $x \in B \cup C$.

2.28 Consider the statement (implication):
If Bill takes Sam to the concert, then Sam will take Bill to dinner.

Which of the following implies that this statement is true?

(a) Sam takes Bill to dinner only if Bill takes Sam to the concert.
(b) Either Bill doesn’t take Sam to the concert or Sam takes Bill to dinner.
(c) Bill takes Sam to the concert.
(d) Bill takes Sam to the concert and Sam takes Bill to dinner.
(e) Bill takes Sam to the concert and Sam doesn’t take Bill to dinner.
(f) The concert is canceled.
(g) Sam doesn’t attend the concert.

Section 2.5
2.32 (2.20 in 2nd edition) In each of the following, two open sentences $P(x)$ and $Q(x)$ over a domain $S$ are given. Determine all $x \in S$ for which $P(x) \implies Q(x)$ is a true statement.

(a) $P(x) : x - 3 = 4; Q(x) : x \geq 8; S = \mathbb{R}$.
(b) $P(x) : x^2 \geq 1; Q(x) : x \geq 1; S = \mathbb{R}$.
(c) $P(x) : x^2 \geq 1; Q(x) : x \geq 1; S = \mathbb{N}$. 
(d) $P(x) : x \in [-1, 2]; \ Q(x) : x \leq 2; \ S = [-1, 1].$

2.34 (a,b,e,f) Each of the following describes an implication. Write the implication in the form “if . . . , then . . . ”.

(a) Any point on the straight line with equation $2y + x - 3 = 0$ whose $x$-coordinate is an integer also has an integer for its $y$-coordinate.

(b) The square of every odd integer is odd.

(e) Let $C$ be a circle of circumference $4\pi$. Then the area of $C$ is also $4\pi$.

(f) Let $n \in \mathbb{Z}$. The integer $n^3$ is even only if $n$ is even.