(b) $(-2,4) \cup (-\infty,2)$.
(c) $(-\infty,0] \setminus (-\infty,2]$.
(d) $\mathbb{R} \setminus (2,\infty)$.
(e) $(\mathbb{R} \setminus (-\infty,2]) \cup (1,\infty)$.

2. Express the following sets as truth sets.

(a) $A = \{1,4,9,16,25,\dots\}$
(b) $B = \{\dots,-15,-10,-5,0,5,10,15,\dots\}$.

3. Evaluate the truth sets.

(a) $A = \{x \in \mathbb{N} : 0 < x^2 < 24\}$
(b) $B = \{y \in \mathbb{Z} : y \mid 12\}$
(c) $C = \{z \in \mathbb{N} : 4 \mid z\}$
(d) $D = \{y \in \mathbb{R}^- : 1 \leq y^2 \leq 4\}$.

4. Let A, B, and C be the sets in Exercise 3. Evaluate the following sets: $A \cup B$, $A \cap C$, $A \setminus B$, $B \setminus A$, and $C \setminus (A \cup B)$.
5. Find two elements in the set $\mathbb{R} \setminus \mathbb{Q}$. Explain why $\mathbb{Q} \setminus \mathbb{R} = \varnothing$.
6. Let $A = \{2,3\}$ and $B = \{a,b,c\}$. Evaluate $A \times A$, $A \times B$, $B \times A$, and $B \times B$.
7. Let $A = \{2,3\}$ and $B = \{3,a\}$. Evaluate $\mathcal{P}(A \cup B)$ and $\mathcal{P}(A) \cup \mathcal{P}(B)$.
8. Find $\mathcal{P}(\varnothing)$ and $\mathcal{P}(\mathcal{P}(\varnothing))$.
9. Let $A = \{2,3\}$, $B = \{a,b\}$ and $C = \{x,y\}$. Evaluate $(A \times B) \times C$ and $\mathcal{P}(A \times B)$.
10. Let $A = \{2,3\}$, $B = \{3,4\}$ and $C = \{3,y\}$. Is $A \times (B \cup C) = (A \times B) \cup (A \times C)$?
11. Let A, B, and C be sets. Determine which of the following statements are always true and which are not always true.

(a) If $x \in A$, then $x \in A \cup B$.
(b) If $x \in A \cup B$, then $x \in A$.
(c) If $x \in B$ and $A \subseteq B$, then $x \in A$.
(d) If $x \notin B$ and $A \subseteq B$, then $x \notin A$.
(e) If $x \in A$ and $A \not\subseteq B$, then $x \notin B$.
(f) If $x \in C$ and $A = C$, then $x \in A$.
(g) If $x \in A \cap B$, then $x \in A \cup B$.
(h) If $x \notin A \cap B$, then $x \notin A \cup B$.
(i) If $x \notin A \setminus B$, then $x \notin A$ or $x \in B$.
(j) If $(x,y) \in A \times B$, then $x \in A$ and $y \in B$.
(k) If $(x,y) \notin A \times B$, then $y \in A$ and $x \in B$.
(l) If $A \in \mathcal{P}(B)$, then $A \subseteq B$.

12. Let E be the set of even integers and let O be the set of odd integers. Is $\{E,O\}$ a partition of $\mathbb{Z}$? Justify your answer.
13. Find a partition $P = \{S_0,S_1,S_2,S_3\}$ of $\mathbb{Z}$, similar to the one in Example 7 on page 148, that breaks $\mathbb{Z}$ up into 4 disjoint subsets.
14. Find a partition $P = \{S_0,S_1,S_2,S_3,S_4\}$ of $\mathbb{Z}$, similar to the one in Example 7, that breaks $\mathbb{Z}$ up into 5 disjoint subsets.