8.1abcd
(a) \{0, 3, 6, 9\}
(b) \{2\}
(c) \{-2, 2\}
(d) \{\}

8.2
(a) \{x \in \mathbb{Z} : |x| \leq 10\} = \{-10, -9, -8, \ldots, -1, 0, 1, \ldots, 8, 9, 10\}, which has cardinality 21.
(b) \{x \in \mathbb{Z} : 1 \leq x^2 \leq 2\} = \{-1, 1\}, which has cardinality 2.
(c) \{x \in \mathbb{Z} : x \in \emptyset\} = \emptyset since there is no integer contained in \emptyset. Thus the cardinality of this set is 0.
(f) \{1, 2, 3\} is the power set of \{1, 2, 3\} which has cardinality \(2^3 = 8\). \(2^8 = 256\).
(g) \{x \in 2^{\{1, 2, 3\}} : |x| = 1\} = \{\{1\}, \{2\}, \{3\}, \{4\}\}, which has cardinality 4.

8.3
(a) 2 \in \{1, 2, 3\}.
(b) \{2\} \subseteq \{1, 2, 3\}.
(c) \{2\} \in \{\{1\}, \{2\}, \{3\}\}.
(d) \emptyset \subseteq \{1, 2, 3\}.
(e) \mathbb{N} \subseteq \mathbb{Z}.
(f) \{2\} \subseteq \mathbb{Z}.
(g) \{2\} \in 2^{\mathbb{Z}}.

8.5 (2 points) Let \(x \in A\). Thus \(x\) is an integer with 4|x. It follows that for some integer \(a\), \(x = 4a = 2(2a)\), showing that 2|x. Hence \(x \in B\). QED

8.7 Let \(x \in C\). Thus, by the definition of \(C\), we know that \(x\)|12. By the definition of divisible it follows that 12 = xa for some integer \(a\). Observe that 36 = 3 \times 12 = 3(xa) = x(3a), showing that \(x\)|36. Hence \(x \in D\). QED

8.8 (\(\Rightarrow\)) Suppose \(C \subseteq D\). Note that \(c \in C\) and thus \(c \in D\). Since \(c \in D\) we have \(c|d\).

(\(\Leftarrow\)) On the other hand, suppose \(c|d\). To show \(C \subseteq D\) let \(x \in C\). Thus \(x\)|c. We have \(c|d\), so by Proposition 3.3, we have \(x|d\) and so \(x \in D\). Therefore \(C \subseteq D\). QED

8.9 If \(x = \emptyset\) then \(x \subseteq \{x\}\) because \(\emptyset\) is a subset of any set.