Section 1.1

1.2 Let $S = \{-2, -1, 0, 1, 2, 3\}$. Describe each of the following sets as \( \{ x \in S : p(x) \} \), where \( p(x) \) is some condition on \( x \).

(a) \( A = \{1, 2, 3\} \)
(b) \( B = \{0, 1, 2, 3\} \)
(c) \( C = \{-2, -1\} \)
(d) \( D = \{-2, 2, 3\} \).

1.4 Write each of the following sets by listing its elements within braces.

(a) \( A = \{n \in \mathbb{Z} : -4 < n \leq 4\} \)
(b) \( B = \{n \in \mathbb{Z} : n^2 < 5\} \)
(c) \( C = \{n \in \mathbb{N} : n^3 < 100\} \)
(d) \( D = \{x \in \mathbb{R} : x^2 - x = 0\} \)
(e) \( E = \{x \in \mathbb{R} : x^2 + 1 = 0\} \)

1.8 Let \( A = \{n \in \mathbb{Z} : 2 \leq |n| < 4\} \), \( B = \{x \in \mathbb{Q} : 2 < x \leq 4\} \), \( C = \{x \in \mathbb{R} : x^2 - (2 + \sqrt{2})x + 2\sqrt{2} = 0\} \), and \( D = \{x \in \mathbb{Q} : x^2 - (2 + \sqrt{2})x + 2\sqrt{2} = 0\} \).

(a) Describe the set \( A \) by listing its elements.
(b) Give an example of three elements that belong to \( B \) but do not belong to \( A \).
(c) Describe the set \( C \) by listing its elements.
(d) Describe the set \( D \) in another manner.
(e) Determine the cardinality of each of the sets \( A \), \( C \) and \( D \).

1.68 Let \( S = \{-10, -9, \ldots, 9, 10\} \). Describe each of the following sets as \( \{ x \in S : p(x) \} \), where \( p(x) \) is some condition on \( x \).

(a) \( A = \{-10, -9, \ldots, -1, 1, \ldots, 9, 10\} \)
(b) \( B = \{-10, -9, \ldots, -1, 0\} \)
(c) \( C = \{-5, -4, \ldots, 0, 1, \ldots, 7\} \)
Section 1.2

1.12 Which of the following sets are equal?

\[ A = \{ n \in \mathbb{Z} : |n| < 2 \}, \quad B = \{ n \in \mathbb{Z} : n^3 = n \}, \quad C = \{ n \in \mathbb{Z} : n^2 \leq n \}, \]
\[ D = \{ n \in \mathbb{Z} : n^2 \leq 1 \}, \quad E = \{-1, 0, 1\}. \]

1.14 Find \( P(A) \) and \( |P(A)| \) for

(a) \( A = \{1, 2\} \)

(b) \( B = \{\emptyset, 1, \{a\}\} \).

Section 1.3

1.22 Let \( U = \{1, 3, ..., 15\} \) be the universal set, \( A = \{1, 5, 9, 13\} \) and \( B = \{3, 9, 13\} \). Determine the following:

(a) \( A \cup B \)

(b) \( A \cap B \)

(c) \( A - B \)

(d) \( B - A \)

(e) \( \bar{A} \)

(f) \( A \cap \bar{B} \).

1.26 Let \( U \) be a universal set and let \( A \) and \( B \) be two subsets of \( U \). Draw a Venn diagram for each of the following sets:

(a) \( \bar{A} \cup B \)

(b) \( \bar{A} \cap B \)

(c) \( \bar{A} \cap \bar{B} \)

(d) \( \bar{A} \cup B \).

What can you say about parts (a) and (b)? parts (c) and (d)?

1.30 Let \( A = \{ x \in \mathbb{R} : |x - 1| \leq 2 \}, \ B = \{ x \in \mathbb{R} : |x - 1| \geq 1 \} \) and \( C = \{ x \in \mathbb{R} : |x + 2| \leq 3 \} \).

(a) Express \( A, B \) and \( C \) using interval notation.

(b) Determine each of the following sets using interval notation:

\[ A \cup B, \quad A \cap B, \quad B \cap C, \quad B - C. \]

1.76 Which of the following sets are equal?

\[ A = \{ n \in \mathbb{Z} : -4 \leq n \leq 4 \}, \quad B = \{ x \in \mathbb{N} : 2x + 2 = 0 \}, \quad C = \{ x \in \mathbb{Z} : 3x - 2 = 0 \}, \]
\[ D = \{ x \in \mathbb{Z} : x^3 = 4x \}, \quad E = \{-2, 0, 2\}. \]