1: Use a Venn diagram to illustrate the relationship $B \subseteq A$ and $C \subseteq B$.

2: Let $A = \{a, b\}$ and $B = \{w, x, y, z\}$.

(a) Find $A \times B$.

(b) Find $B \times A$.

3: Let $A = \{a, b, c, d, e, f\}$ and $B = \{a, b, c, d, e, f, g, h\}$.

(a) Find $A \cup B$

(b) Find $A \cap B$

(c) Find $A - B$

(d) Find $B - A$

4: Can you conclude that $A = B$ if A, B, and C are sets such that

(a) $A \cup C = B \cup C$

(b) $A \cap C = B \cap C$

(c) $A \cup C = B \cup C$ and $A \cap C = B \cap C$

5: Find $\bigcup_{i=1}^{\infty} A_i$ and $\bigcap_{i=1}^{\infty} A_i$ if for every positive integer i

(a) $A_i = \{i, i+1, i+2, \dots\}$

(b) $A_i = \{0, i+1\}$

(c) $A_i = (0, i+1)$, that is the set of real numbers x with $0 < x < i+1$.

(d) $A_i = (i+1, \infty)$, that is the set of real numbers x with $x > i+1$.

6: Determine whether f is a function from $\mathbb{Z}$ to $\mathbb{R}$ if

(a) $f(n) = \pm n$

(b) $f(n) = \sqrt{n^2 + 1}$

(c) $f(n) = 1/(n^2 - 1.21)$

7: Find the domain and range of these functions.

(a) The function that assigns to each pair of nonnegative integers the first integer of the pair.

(b) The function that assigns to each nonnegative integer its largest decimal digit.

(c) The function that assigns to a bit string the number of ones minus the number of zeroes in the string.

(d) The function that assigns to each nonnegative integer the largest integer not exceeding the square root of the integer.

(e) The function that assigns to a bit string the longest string of ones in the string.

8: Determine whether each of these functions from $\mathbb{Z}$ to $\mathbb{Z}$ is one-to-one.

(a) $f(n) = n - 1$

(b) $f(n) = n^2 - 1$

(c) $f(n) = n^3$

9: Which functions in the previous question are onto?

(a) $f(n) = n - 1$

(b) $f(n) = n^2 - 1$

(c) $f(n) = n^3$

10: Suppose that g is a function from A to B and f is a function from B to C.

(a) If f and g are one-to-one functions, is $f \circ g$ also one-to-one?

(b) If f and g are onto functions, is $f \circ g$ is also onto?