1. Draw the Venn diagrams for each of these combinations of the sets $A, B,$ and $C$.
   a) $A \cap (B \cup C)$
   b) $\overline{A} \cap B \cap \overline{C}$
   c) $(B - A) \cup (C - A) \cup (C - B)$

2. Suppose that the universal set is $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. Express each of these sets with bit strings where the $i$-th bit in the string is 1 if $i$ is in the set and 0 otherwise.
   a) $\{3, 4, 5\}$
   b) $\{1, 3, 6, 10\}$
   c) $\{2, 3, 4, 7, 8, 9\}$

3. Give an example of a function from $\mathbb{N}$ to $\mathbb{N}$ that is
   a) one-to-one but not onto.
   b) onto but not one-to-one.
   c) both onto and one-to-one (but different from the identity function).
   d) neither one-to-one nor onto.
   Prove that your functions have the desired properties.

4. Find $f \circ g$ and $g \circ f$, where $f(x) = x^2 + 1$ and $g(x) = x + 2$, are functions from $\mathbb{R}$ to $\mathbb{R}$.

5. Is it true that $x^3$ is $O(g(x))$, if $g$ if the given function?
   a) $g(x) = x^2$
   b) $g(x) = x^3$
   c) $g(x) = x^2 + x^3$
   d) $g(x) = x^2 + x^4$
   e) $g(x) = 3^x$
   f) $g(x) = \frac{x^3}{2}$
   Prove your answers.

6. Show that for all real numbers $a$ and $b$ with $a > 1$ and $b > 1$, if $f(x)$ is $O(\log_b x)$, then $f(x)$ is $O(\log_a x)$.