1. Write the following set by listing their elements between braces.
   (a) \( \{ x \in \mathbb{R} : x^2 = 7 \} \)
   (b) \( \{ x \in \mathbb{Z} : 2x < 5 \} \)
   (c) \( \{ x \in \mathbb{Z} : -2 < x \leq 7 \} \)
   (d) \( \{ x \in \mathbb{Z} : -5 < x \leq 2 \} \)

2. Write the following set in set-builder notation.
   (a) \( \{ -3, -2, -1, 0, 1, 2, 3 \} \)
   (b) \( \{ 0, 1, 8, 27, 64, 125, \ldots \} \)
   (c) \( \{ 0, -1, -4, -9, \ldots \} \)

3. Let \( \mathbb{R} \) be the universal set. Let \( A = \{ 1 \} \), \( B = (0, 1) = \{ x : 0 < x < 1 \} \) and \( C = [0, 1] = \{ x : 0 \leq x \leq 1 \} \). Write down the following sets.
   - \( A \cup B \); \( A \cap B \); \( B \cap C \); \( A \cup C \); \( A \cap C \)

4. Let \( A, B, C, D \) be nonempty sets. Prove that \( A \times B \subseteq C \times D \) if and only if \( A \subseteq C \) and \( B \subseteq D \).

5. Let \( A, B \) and \( C \) be three arbitrary subsets of the universal set \( U \). Use an element containment proof (i.e. prove that the left side is a subset of the right side and the right side is a subset of the left side) to prove the following:
   - \( \overline{A \cap B} \cup C = \overline{A} \cup \overline{B} \cap \overline{C} \).
   - \( \overline{A \cup B} \cap \overline{C} = \overline{A} \cap \overline{B} \cup \overline{C} \).

6. Use the membership table method to determine which membership \( \subseteq, =, \supseteq \) is true for the following pair of sets.
   - \( (B - C), \quad (B - A) - (C - A) \)

7. Prove that \( A \times (B \cap C) = (A \times B) \cap (A \times C) \) by using the set builder notations.

8. Two fair six-sided dice are rolled and the sum \( s \) of the numbers coming up is recorded. What is the probability of \( s \geq 10 \)? Show your work for the case when the dice are distinguished and when they are not.

9. A random experiment consists of rolling an unfair, six-sided die. The digit 6 is three times as likely to appear as the numbers 2 and 4. The numbers 2 and 4 are twice as likely to appear as one of the numbers, 1, 3, and 5.

Assign appropriate probabilities to the six outcomes in the sample space.