One of the problems below will be chosen at random in class for a quiz.

1. Let \( P(n) \) be the statement that \( n! < n^n \), where \( n \) is an integer greater than 1.
   (a) What is the statement \( P(2) \)?
   (b) Show that \( P(2) \) is true, completing the basis step of the proof.
   (c) What is the inductive hypothesis?
   (d) What do you need to prove in the inductive step?
   (e) Complete the inductive step.
   (f) Explain why these steps show that this inequality is true whenever \( n \) is an integer greater than 1

2. Prove that 3 divides \( n^3 + 2n \) whenever \( n \) is a positive integer. (Hint: use induction)

3. Suppose that \( A \times B = \emptyset \), where \( A \) and \( B \) are sets. What can you conclude?

4. Let \( A \) and \( B \) be sets. Show that
   (a) \( (A \cap B) \subseteq A \).
   (b) \( A \subseteq (A \cup B) \).
   (c) \( A \setminus B \subseteq A \).
   (d) \( A \cap (B \setminus A) = \emptyset \).
   (e) \( A \cup (B \setminus A) = A \cup B \).

5. Find the symmetric difference of \( \{1, 3, 5\} \) and \( \{1, 2, 3\} \)

6. Show that \( A \oplus B = (A \setminus B) \cup (B \setminus A) \).