Problem 1. Give an example of three sets to show that
\[ A \subseteq B \quad \text{and} \quad B \in C \]
does not always imply \[ A \in C. \]
Give a second example where \( A \subseteq B \) and \( B \in C \) and \( A \in C \).

Problem 2. Show that the following pairs of sets are not equal by exhibiting an element of one that is not an element of the other.
(a) \[ A = \{1, 2\} \]
\[ B = \{\{1, 2\}\} \]
(b) \[ C = \mathcal{P}(\{1, 2\}) \]
\[ D = \{\{1, 2\}\} \]
(c) \[ E = \{1, 2\} \times \{2, 3\} \]
\[ F = \{2, 3\} \times \{1, 2\} \]
(d) In this example, \( n \) is restricted to being an integer.
\[ G = \{2n + 2| 0 \leq n \leq 200\} \]
\[ H = \{2n - 2| 1 \leq n \leq 201\} \]

Problem 3. Let
\[ A = \{1, 3, 4\} \]
\[ B = \{1, 2, 3\} \]
List the elements of the following sets, \textit{without repeating} any elements:
(a) \[ \{\{m, n\}| m \in A \text{ and } n \in B\} \]
(b) \[ \{(m, n)| m \in A \text{ and } n \in B\} \]

Problem 4. Show that if \[ A \not\subseteq B \]
then \[ \mathcal{P}(A) \neq \mathcal{P}(B). \]
Problem 5. Find an example that shows it is possible to have

\[ A \times B = A \times C \]

and also

\[ B \neq C. \]

Problem 6. True or false:

(a) \((1, 1) \in \{(1, 1), (1, 2), (2, 1)\} \cap \{(1, 2), (2, 1)\} \);
(b) \(\{1, 2\} \in \{(1, 1), (1, 2), (2, 1)\}\);
(c) \((1, 2) \in \{1, 2\} \times \{2, 3\}\).