1. Let $A, B, C$ be events in sample space $S$. Show that

$$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(A \cap C) - P(B \cap C) + P(A \cap B \cap C)$$

2. A number is selected uniformly at random from the set of even natural numbers $\{2, 4, 6, \ldots, 100\}$.
   (a) Draw the venn diagram.
   (b) What is the probability that it is divisible by 2, but neither by 4 nor by 7?

3. An experiment consists of tossing two six sided dice.
   (a) Find the sample space $S$.
   (b) Find the event $A$ that the sum of the dots on the dice equals 7.
   (c) Find the event $B$ that the sum of the dots on the dice is greater than 10.
   (d) Find the event $C$ that the sum of the dots on the dice is greater than 12.
   (e) Calculate $P(A \cup B \cup C)$

4. Let $\Omega$ be a sample space and let $\omega_0$ be a fixed point in $\Omega$. For any event $A$,

$$P(A) = \begin{cases} 
1, & \omega_0 \in A \\
0, & \text{otherwise}
\end{cases}$$

Show that $P$ satisfies the axioms of a probability.