Let $A_1$, $A_2$, and $A_3$ be three events such that $P(A_1) = 0.30$, $P(A_2) = 0.30$, $P(A_3) = 0.35$, $P(A_1 \cap A_2) = 0$, $P(A_2 \cap A_3) = 0$, and $P(A_1 \cap A_3) = 0.1$.

(a) Draw a Venn diagram.

(b) Find the following probabilities.

(i) $P(A_1 \cup A_2)$.

(ii) $P(A_1 \cup A_3)$.

(iii) $P(A_1 \cup A_2 \cup A_3)$.

(iv) $P(A'_1 \cap A'_2)$.

(v) $P(A_1 \cap A'_3)$.

2 If 4 fair six-sided dice are rolled, what is the probability that each of the four numbers that appear will be different?
Three married couples have purchased theater tickets and are seated in a row consisting of 6 seats. If they take their seats in a completely random fashion, what is the probability Mr. X and Mrs. X will sit next to each other?

Suppose that 12 fair dice are to be rolled. Find the probability that each of the six different numbers will appear twice.

Suppose that \( P(A) = 0.5 \), \( P(B) = 0.3 \), and \( P(B | A) = 0.5 \). Find the following:

(a) \( P(A \cap B) \).

(b) \( P(A \cup B) \).

(c) \( P(A \cap B | A) \).

(d) \( P(A \cap B | A \cup B) \).
6 If $A$ and $B$ are independent events, then prove that $A$ and $B'$ are also independent events.

7 Let $P(A_1) = 0.20$, $P(A_2) = 0.30$, and $P(A_3) = 0.40$. Find the following:

(a) $P(A_1 \cap A_2 \cap A_3)$ when $A_1$, $A_2$, and $A_3$ are mutually independent.

(b) $P(A_1 \cup A_2 \cup A_3)$ when $A_1$, $A_2$, and $A_3$ are mutually independent.

(c) $P(A_1 \cap A_2 \cap A_3)$ when $A_1$, $A_2$, and $A_3$ are mutually exclusive (disjoint).

(d) $P(A_1 \cup A_2 \cup A_3)$ when $A_1$, $A_2$, and $A_3$ are mutually exclusive (disjoint).
In a certain city, 30% of the people are Conservatives, 50% are Liberals, and 20% are Independents. Records show that in a particular election, 65% of the Conservatives voted, 82% of the Liberals voted, and 50% of the Independents voted.

(a) If a person in the city who is eligible to vote is selected at random what is the probability that s/he did not vote?
(b) If a person in the city who is eligible to vote is selected at random and it is learned that s/he did not vote in the last election, what is the probability that s/he is a Liberal?

A small grocery store had 10 cartons of milk, of which 3 were sour. If you are going to buy the **fourth** carton of the milk sold that day at random, compute the probability of selecting a carton of sour milk.