

# What is probability? Sample spaces and events

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## Practice problems

1. A small deck contains 10 cards, 4 of which are Aces. If you draw 2 cards at random without replacement, what is the probability that both are Aces?
2. A fair six-sided die is rolled twice. What is the probability that the sum of the two rolls is exactly 7?
3. A committee of 3 people is chosen from a group of 5 men and 4 women. What is the probability that the committee contains at least 2 women?

## Solutions

1. A small deck contains 10 cards, 4 of which are Aces. If you draw 2 cards at random without replacement, what is the probability that both are Aces?

- The total number of ways to choose 2 cards from 10 is  $\binom{10}{2} = \frac{10 \times 9}{2} = 45$ .
- The number of ways to choose 2 Aces from the 4 available is  $\binom{4}{2} = \frac{4 \times 3}{2} = 6$ .
- The probability is the ratio of favorable outcomes to total outcomes:  $P = \frac{6}{45}$ .

**Answer:**  $2/15$

2. A fair six-sided die is rolled twice. What is the probability that the sum of the two rolls is exactly 7?

- The sample space size for two rolls is  $6 \times 6 = 36$ .
- The outcomes that sum to 7 are  $(1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1)$ .
- There are 6 such outcomes.
- The probability is  $P = \frac{6}{36}$ .

**Answer:**  $1/6$

3. A committee of 3 people is chosen from a group of 5 men and 4 women. What is the probability that the committee contains at least 2 women?

- The total number of ways to choose 3 people from 9 is  $\binom{9}{3} = \frac{9 \times 8 \times 7}{3 \times 2 \times 1} = 84$ .
- The event 'at least 2 women' includes two cases: exactly 2 women or exactly 3 women.
- Case 1 (2 women, 1 man):  $\binom{4}{2} \times \binom{5}{1} = 6 \times 5 = 30$ .
- Case 2 (3 women, 0 men):  $\binom{4}{3} \times \binom{5}{0} = 4 \times 1 = 4$ .
- Total favorable outcomes =  $30 + 4 = 34$ .
- The probability is  $P = \frac{34}{84}$ .

**Answer:**  $17/42$