

Task. Two cards are drawn from a deck, at random, in succession and without replacement.

a. What is the probability that the first draw is an ace?

b. What is the probability that both the first and the second draws are aces?

Solution. Recall that the deck contains 52 cards and 4 aces among them.

a) Since two cards are drawn from a deck, at random, in succession and without replacement, the probability that first card is ace does not depend on the second card. So the probability that the first draw is an ace is equal to

$$p = \frac{\text{number of aces}}{\text{total number of cards}} = \frac{4}{52} = \frac{1}{13} \approx 0.076923.$$

b) The number of pairs among 52 cards is equal to

$$C_{52}^2 = \frac{52!}{2!(52-2)!} = \frac{52!}{2!50!} = \frac{52 * 51}{2} = 1326.$$

The number of pairs among 4 aces is

$$C_4^2 = \frac{4!}{2!2!} = \frac{24}{4} = 6.$$

Hence the probability that both the first and the second draws are aces is equal to

$$p = \frac{\text{number of pairs among 4 cards}}{\text{number of pairs among 52 cards}} = \frac{6}{1326} = \frac{1}{221} = 0.0045249.$$

Answer.