

1. A pair of dice is thrown. What is the probability that the sum of the spots is 5?
2. Two draws are made at random with replacement from a box with 5 tickets; labeled "1", "2", "3", "4", "5". What is the probability that the sum of the draws is equal to 6?
3. A pair of dice is thrown 1000 times. What total should appear most often? What total should appear least often?
4. Fifty children went to a party where cookies and ice cream were served: 12 children took cookies; 17 took ice cream. True or false: 29 children must have had cookies or ice cream. Explain briefly.
5. Two cards are dealt off the top of a well-shuffled deck. You have a choice:
 - (a) to win \$1 if the first card is an ace or the second card is an ace;
 - (b) to win \$1 if at least one of the two cards is an ace.

Which option is better? or are they same? Explain briefly.

6. Two dice will be rolled. The chance that the first one is an ace is $\frac{1}{6}$. The chance that the second one is a 2 is $\frac{1}{6}$. True or false: the chance that the first one is an ace or the second one is a 2 equals $\frac{2}{6}$.
7. A box contains 10 tickets numbered 1 through 10. Five draws will be made at random with replacement from this box. True or false: there are 5 chances in 10 of getting "7" at least once.
8. A number is drawn at random from a box. There is 20% chance for it to be 10 or less. There is 10% chance for it to be 50 or more. True or false: the chance of getting a number between 10 and 50 (exclusive) is 70%. Explain briefly.
9. A large group of people are competing for all-expense-paid weekends in Philadelphia. The Master of Ceremonies gives each contestant a well-shuffled deck of cards. The contestant deals two cards off the top of the deck, and wins a weekend in Philadelphia if the first card is a the ace of hearts or the second card is the king of hearts.
 - (a) All the contestants whose first card was the ace of hearts are asked to step forward. What fraction of the contestants do so?
 - (b) The contestants return to their original places. Then, the ones who got the king of hearts for their second card are asked to step forward. What fraction of the contestants do so?
 - (c) Do any of the contestants step forward twice?
 - (d) True or false, and explain: the chance of winning a weekend in Philadelphia is $\frac{2}{52}$.

10. A large group of people are competing for all-expense-paid weekends in Philadelphia. The Master of Ceremonies gives each contestant a well-shuffled deck of cards. The contestant deals two cards off the top of the deck, and wins a weekend in Philadelphia if the first card is the ace of hearts or the second card is the ace of hearts. (This is like the above exercise but the winning cards are a little different.)
- All the contestants whose first card was the ace of hearts are asked to step forward. What fraction of the contestants do so?
 - The contestants return to their original places. Then, the ones who got the ace of hearts for their second card are asked to step forward. What fraction of the contestants do so?
 - Do any of the contestants step forward twice?
 - True or false, and explain: the chance of winning a weekend in Philadelphia is $\frac{2}{52}$.
11. A deck of cards is shuffled. True or false, and explain briefly:
- The chance that the top card is the jack of clubs equals $\frac{1}{52}$.
 - The chance that the bottom card is the jack of diamonds equals $\frac{1}{52}$.
 - The chance that the top card is the jack of clubs or the bottom card is the jack of diamonds is $\frac{2}{52}$.
 - The chance that the top card is the jack of clubs or the bottom card is the jack of clubs is $\frac{2}{52}$.
 - The chance that the top card is the jack of clubs and the bottom card is the jack of diamonds is $\frac{1}{52} \times \frac{1}{52}$.
 - The chance that the top card is the jack of clubs and the bottom card is the jack of clubs is $\frac{1}{52} \times \frac{1}{52}$.
12. The unconditional probability of event A is $\frac{1}{2}$. The unconditional probability of event B is $\frac{1}{3}$. Say whether each of the following is true or false, and explain briefly.
- The chance that A and B both happen must be $\frac{1}{2} \times \frac{1}{3}$.
 - If A and B are independent, the chance that they both happen must be $\frac{1}{2} \times \frac{1}{3}$.
 - If A and B are mutually exclusive, the chance that they both happen must be $\frac{1}{2} \times \frac{1}{3}$.
 - The chance that at least one of A or B happens must be $\frac{1}{2} + \frac{1}{3}$.
 - If A and B are independent, the chance that at least one of them happens must be $\frac{1}{2} + \frac{1}{3}$.
 - If A and B are mutually exclusive, the chance that at least one of them happens must be $\frac{1}{2} + \frac{1}{3}$.

13. Two cards are dealt off the top of a well-shuffled deck.
- Find the chance that the second is an ace.
 - Find the chance that the second is an ace, given the first card is a king.
 - Find the chance the first card is a king and the second card is an ace.
14. A box contains four tickets, one marked with a star, and the other three blank. Two draws are made at random with replacement from this box.
- What is the chance of getting a blank ticket on the first draw?
 - What is the chance of getting a blank ticket on the second draw?
 - What is the chance of getting a blank ticket on the first draw and a blank ticket on the second draw?
 - What is the chance of not getting the star in two draws?
 - What is the chance of getting the star at least once in the two draws?
15. A die is rolled 3 times. What is the chance of getting at least one ace?
16. A die is rolled 6 times. What is the chance of getting at least one ace?
17. A die is rolled 12 times. What is the chance of getting at least one ace?
18. A pair of dice is rolled 36 times. What is the chance of getting at least one double-ace?
19. A pair of dice thrown.
- Find the chance that both dice show three spots.
 - Find the chance that both dice show the same number of spots.
20. In the game of Monopoly, a player rolls two dice, counts the number of spots, and moves that many squares. Find the chance that the player moves 11 squares (no more and no less).
21. True or false, and explain:
- If a die is rolled three times, the chance of getting at least one ace is $\frac{3}{36}$.
 - If a coin is tossed twice, the chance of getting at least one head is 100%.
22. Two cards are dealt off the top of a well-shuffled deck. You have a choice:
- to win \$1 if at least one of the two cards is a queen.
 - to win \$1 if the first is a queen.

Which is better? Or are they equivalent? Explain.

23. The chance of A is $\frac{1}{3}$; the chance of B is $\frac{1}{10}$. True or false, and explain:
- (a) If A and B are independent, they must also be mutually exclusive.
 - (b) If A and B are mutually exclusive, they cannot be independent.
24. Four draws are going to be made at random with replacement from a box with tickets labeled "1", "2", "2", "3", "3". Find the chance that a two is drawn at least once.
25. Repeat the above exercise, if the draws are made at random without replacement.
26. There are two options:
- (a) A die will be rolled 60 times. Each time it shows an ace or a six, you win \$1; on the other rolls, you win nothing.
 - (b) Sixty draws will be made at random with replacement from a box with 6 tickets, 3 of them labeled "0" and 3 labeled "1". On each draw, you will be paid the amount shown on the ticket, in dollars.
27. Three cards are dealt from a well-shuffled deck.
- (a) Find the chance that all of the cards are diamonds.
 - (b) Find the chance that none of the cards are diamonds.
 - (c) Find the chance that the cards are not all diamonds.
28. A coin is tossed 10 times. True or false, and explain:
- (a) The chance of getting 10 heads in a row is $\frac{1}{1024}$.
 - (b) Given that the first 9 tosses were heads, the chance of getting 10 heads in a row is $\frac{1}{2}$.
29. A box contains 2 red marbles and 98 blue ones. Draws are made at random with replacement. In _____ draws from the box, there is better than a 50% chance for a red marble to appear at least once. Fill in the blank with the smallest number that makes the statement true.