

NCERT Solutions For Class 10 Maths Chapter 15 Probability

EXERCISE 15.1:

1. Complete the following statements:

- (i) Probability of an event E + Probability of the event 'not E ' = _____.
- (ii) The probability of an event that cannot happen is _____. Such an event is called _____.
- (iii) The probability of an event that is certain to happen is _____. Such an event is called _____.
- (iv) The sum of the probabilities of all the elementary events of an experiment is _____.
- (v) The probability of an event is greater than or equal to _____ and less than or equal to _____.

Solution:

- (i) 1
- (ii) 0, impossible event
- (iii) 1, sure event or certain event
- (iv) 1
- (v) 0, 1

2. Which of the following experiments have equally likely outcomes? Explain.

- (i) A driver attempts to start a car. The car starts or does not start.
- (ii) A player attempts to shoot a basketball. She/he shoots or misses the shot.
- (iii) A trial is made to answer a true-false question. The answer is right or wrong.
- (iv) A baby is born. It is a boy or a girl.

Solution:

- (i) It is not an equally likely event, since it relies on various factors such as whether the car will start or not. And factors for both the conditions are not alike.
- (ii) It is not an equally likely event, because it relies on the ability of the player and there is no detail given about that.
- (iii) It is an equally likely event.
- (iv) It is an equally likely event.

3. Why is tossing a coin considered to be a fair way of deciding which team should get the ball at the beginning of a football game?

Solution:

Tossing a coin considered to be a fair way of deciding which team should get the ball at the beginning of a football game because when we toss a coin, the possible outcomes are only two, head or tail, which are equally likely outcomes. Hence, the result of an individual toss is completely unpredictable and fair.

4. Which of the following cannot be the probability of an event?

- A. $\frac{2}{3}$
- B. -1.5
- C. 15%
- D. 0.7

Solution:

We know that probability of an event (E) is either greater than or equal to 0 and always less than or equal to one. This shows that the probability of an event can never be negative or greater than 1.

Hence,

Out of the given alternatives, -1.5 cannot be a probability of an event as it is negative which is not possible.

Hence, (B)

5. If $P(E) = 0.05$, what is the probability of 'not E'?

Solution:

We know:

$$P(\bar{E}) = 1 - P(E)$$

$$P(\bar{E}) = 1 - 0.05$$

$$= 0.95$$

Hence, the probability of 'not E' is 0.95

- 6. A bag contains lemon flavoured candies only. Malini takes out one candy without looking into the bag. What is the probability that she takes out**

(i) An orange flavoured candy?

(ii) A lemon flavoured candy?

Solution:

- (i) As per the question the bag contains lemon flavoured candies only. It does not contain even a single orange flavor candy.

This shows that every time, she will take out only lemon flavor candy.

Therefore, event that Malini will take out an orange flavoured candy is an impossible event.

Hence,

$$P(\text{an orange flavoured candy}) = 0$$

- (ii) As the bag has lemon flavoured candies, Malini will take out only lemon flavoured candies. Therefore, event that Malini will take out a lemon flavoured candy is a sure event

$$P(\text{a lemon flavoured candy}) = 1$$

- 7. It is given that in a group of 3 students, the probability of 2 students not having the same birthday is 0.992. What is the probability that the 2 students have the same birthday?**

Solution:

Given in the question that,

Probability of two students who are not having same birthday $P(\bar{E}) = 0.992$

Probability of two students having same birthday $P(E) = 1 - P(\bar{E})$
 $= 1 - 0.992$
 $= 0.008$

8. A bag contains 3 red balls and 5 black balls. A ball is drawn at random from the bag.

What is the probability that the ball drawn is

(i) Red?

(ii) Not red?

Solution:

(i) Total number of balls in the bag = 8

Probability of the ball drawn to be red:

$$= \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$
$$= \frac{3}{8}$$

(ii) We know that:

$$P(E) = 1 - P(\bar{E})$$

Hence,

Probability of not getting red ball

$= 1 - \text{Probability of getting a red ball}$

$$= 1 - \frac{3}{8}$$

$$= \frac{5}{8}$$

9. A box contains 5 red marbles, 8 white marbles and 4 green marbles. One marble is taken out of the box at random. What is the probability that the marble taken out will be

(i) Red?

(ii) White?

(iii) Not green?

Solution:

Total number of marbles = $5 + 8 + 4$

= 17

- (i) Number of red marbles = 5

Probability of red marble = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}}$

$$= \frac{5}{17}$$

- (ii) Number of white marbles = 8

Probability of white marble = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}}$

$$= \frac{8}{17}$$

- (iii) Number of green marbles = 4

Probability of green marbles

= $\frac{\text{Favourable outcomes}}{\text{Total outcomes}}$

$$= \frac{4}{17}$$

Probability of not getting a green marble = $1 - \frac{4}{17}$

$$= \frac{13}{17}$$

10. A piggy bank contains hundred 50p coins, fifty Re 1 coins, twenty Rs 2 coins and ten Rs 5 coins. If it is equally likely that one of the coins will fall out when the bank is turned upside down, what is the probability that the coin

(i) Will be a 50 p coin?

(ii) Will not be a Rs 5 coin?

Solution:

According to the question,

$$\begin{aligned}\text{Total number of coins in a piggy bank} &= 100 + 50 + 20 + 10 \\ &= 180\end{aligned}$$

(i) Number of 50 p coins = 100

$$\text{Probability of a 50p coin} = \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

$$= \frac{100}{180}$$

$$= \frac{5}{9}$$

(ii) Number of Rs 5 coins = 10

$$\text{Probability of a Rs 5 coin} = \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

$$= \frac{10}{180}$$

$$= \frac{1}{18}$$

Hence,

$$\text{Probability of not getting a Rs 5 coin} = 1 - \frac{1}{18}$$

$$= \frac{17}{18}$$

11. Gopi buys a fish from a shop for his aquarium. The shopkeeper takes out one fish at random from a tank containing 5 male fish and 8 female

fish (see Fig. 15.4). What is the probability that the fish taken out is a male fish?



Fig. 15.4

Solution:

As per the question,

Total number of fishes in a tank

= Number of male fishes + Number of female fishes

= 5 + 8 = 13

Probability of a male fish = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}}$

$$= \frac{5}{13}$$

12. A game of chance consists of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 (see Fig. 15.5), and these are equally likely outcomes. What is the probability that it will point at

- (i) 8?
- (ii) An odd number?
- (iii) A number greater than 2?
- (iv) A number less than 9?

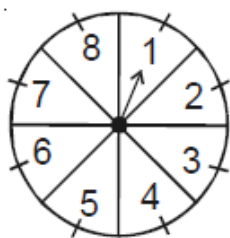


Fig. 15.5

Solution:

Total number of possible outcomes = 8

$$\begin{aligned} \text{(i) Probability of getting 8} &= \frac{\text{Favourable outcomes}}{\text{Total outcomes}} \\ &= \frac{1}{8} \end{aligned}$$

(ii) Total number of odd numbers on spinner = 4

Probability of getting odd number

$$\begin{aligned} &= \frac{\text{Favourable outcomes}}{\text{Total outcomes}} \\ &= \frac{4}{8} = \frac{1}{2} \end{aligned}$$

(iii) The numbers greater than 2 are 3, 4, 5, 6, 7, and 8

Therefore, total numbers greater than 2 = 6

$$\begin{aligned} \text{Probability} &= \frac{\text{Favourable outcomes}}{\text{Total outcomes}} \\ &= \frac{6}{8} \\ &= \frac{3}{4} \end{aligned}$$

(iv) The numbers less than 9 are 1, 2, 3, 4, 6, 7, and 8

Therefore, total numbers less than 9 = 8

$$\text{Probability of getting a number less than 9} = \frac{8}{8} = 1$$

13. A die is thrown once. Find the probability of getting

- (i) A prime number;**
- (ii) A number lying between 2 and 6;**
- (iii) An odd number**

Solution:

The possible outcomes when a dice is thrown = {1, 2, 3, 4, 5, 6}

Number of possible outcomes of a dice = 6

- (i) Prime numbers on a dice are 2, 3, and 5.

Total prime numbers on a dice = 3

Probability of obtaining a prime number = $\frac{3}{6}$

$$= \frac{1}{2}$$

- (ii) Numbers lying between 2 and 6 = 3, 4, 5

Total numbers lying between 2 and 6 = 3

Probability of obtaining a number that lies between 2 and 6 = $\frac{3}{6}$

$$= \frac{1}{2}$$

- (iii) Odd numbers on a dice = 1, 3, and 5

Total odd numbers on a dice = 3

Probability of obtaining an odd number = $\frac{3}{6}$

$$= \frac{1}{2}$$

14. One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting

- (i) A king of red color
- (ii) A face card
- (iii) A red face card
- (iv) The jack of hearts
- (v) A spade
- (vi) The queen of diamonds

Solution:

Total number of cards in a well-shuffled deck = 52

(i) Total number of kings of red color = 2

Probability of getting a king of red color = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}}$

$$= \frac{2}{52}$$
$$= \frac{1}{26}$$

(ii) Total number of face cards = 12

Probability of obtaining a face card = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}}$

$$= \frac{12}{52}$$

$$= \frac{3}{13}$$

(iii) Total number of red face cards = 6

Probability of getting a red face card = $\frac{\text{Favourable outcomes}}{\text{Total outcomes}}$

$$= \frac{6}{52}$$

$$= \frac{3}{26}$$

(iv) Total number of Jack of hearts = 1

$$\begin{aligned} \text{Probability of obtaining a Jack of hearts} &= \frac{\text{Favourable outcomes}}{\text{Total outcomes}} \\ &= \frac{1}{52} \end{aligned}$$

(v) Total number of spade cards = 13

$$\begin{aligned} \text{Probability of obtaining a spade card} &= \frac{\text{Favourable outcomes}}{\text{Total outcomes}} \\ &= \frac{13}{52} \\ &= \frac{1}{4} \end{aligned}$$

(vi) Total number of queen of diamonds = 1

Probability of getting a queen of diamond

$$\begin{aligned} &= \frac{\text{Favourable outcomes}}{\text{Total outcomes}} \\ &= \frac{1}{52} \end{aligned}$$

15. Five cards—the ten, jack, queen, king and ace of diamonds, are well-shuffled with their face downwards. One card is then picked up at random.

(i) What is the probability that the card is the queen?

(ii) If the queen is drawn and put aside, what is the probability that the second card picked up is (a) an ace? (b) a queen?

Solution:

(i) Total number of cards = 5

Total number of queens = 1

$$\begin{aligned}\text{Probability of getting a queen} &= \frac{\text{Favourable outcomes}}{\text{Total outcomes}} \\ &= \frac{1}{5}\end{aligned}$$

- (ii) When the queen is drawn and put aside, the total number of remaining cards will be 4.

(a) Total number of aces = 1

$$\begin{aligned}\text{Probability of getting an ace} &= \frac{\text{Favourable outcomes}}{\text{Total outcomes}} \\ &= \frac{1}{4}\end{aligned}$$

(b) As queen is already drawn, therefore, the number of queens will be 0

Probability of getting a queen

$$\begin{aligned}&= \frac{\text{Favourable outcomes}}{\text{Total outcomes}} \\ &= \frac{0}{4} \\ &= 0\end{aligned}$$

- 16. 12 defective pens are accidentally mixed with 132 good ones. It is not possible to just look at a pen and tell whether or not it is defective. One pen is taken out at random from this lot. Determine the probability that the pen taken out is a good one.**

Solution:

Total number of pens = 12 + 132 = 144

Total number of good pens = 132

$$\begin{aligned}\text{Probability of getting a good pen} &= \frac{\text{Favourable outcomes}}{\text{Total outcomes}} \\ &= \frac{132}{144} \\ &= \frac{11}{12}\end{aligned}$$

17. (i) A lot of 20 bulbs contain 4 defective ones. One bulb is drawn at random from the lot. What is the probability that this bulb is defective?
- (ii) Suppose the bulb drawn in (i) is not defective and is not replaced. Now one bulb is drawn at random from the rest. What is the probability that this bulb is not defective?

Solution:

(i) Total number of bulbs = 20

Total number of defective bulbs = 4

Probability of getting a defective bulb

$$= \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

$$= \frac{4}{20}$$

$$= \frac{1}{5}$$

(ii) Remaining total number of bulbs = 19

Remaining total number of non-defective bulbs = 16 - 1 = 15

P (obtaining a not defective bulb)

$$= \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

$$= \frac{15}{19}$$

18. A box contains 90 discs which are numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears
- (i) A two-digit number
- (ii) A perfect square number

(iii) A number divisible by 5

Solution:

Total number of discs = 90

(i) Total number of two-digit numbers between 1 and 90 = 81

P (getting a two-digit number)

$$= \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

$$= \frac{81}{90}$$

$$= \frac{9}{10}$$

(ii) Perfect squares between 1 and 90 are 1, 4, 9, 16, 25, 36, 49, 64, and 81. Therefore, total number of perfect squares between 1 and 90 is 9.

P (getting a perfect square)

$$= \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

$$= \frac{9}{90}$$

$$= \frac{1}{10}$$

(iii) Numbers that are between 1 and 90 and divisible by 5 are 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, and 90. Therefore, total numbers divisible by 5 = 18

Probability of getting a number divisible by 5 = $\frac{18}{90}$

$$= \frac{1}{5}$$

19. A child has a die whose six faces show the letters as given below:



The die is thrown once. What is the probability of getting (i) A? (ii) D?

Solution:

Total number of possible outcomes on the dice = 6

- (i) Total number of faces having A on it = 2

$$P(\text{getting A}) = \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

$$= \frac{2}{6}$$

$$= \frac{1}{3}$$

- (ii) Total number of faces having D on it = 1

$$P(\text{getting D}) = \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

$$= \frac{1}{6}$$

20. Suppose you drop a die at random on the rectangular region shown in Fig. 15.6. What is the probability that it will land inside the circle with diameter 1m?

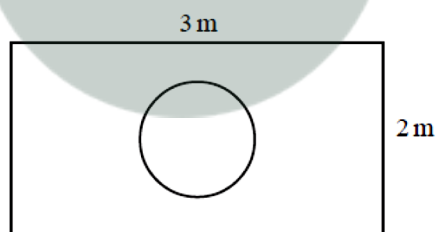


Fig. 15.6

Solution:

$$\text{Area of rectangle} = l \times b = 3 \times 2 = 6 \text{ m}^2$$

$$\text{Area of circle (of diameter 1 m)} = \pi r^2$$

$$= \pi * \left(\frac{1}{2}\right)^2$$

$$= \frac{\pi}{4}$$

$$P(\text{die will land inside the circle})$$

$$= \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

$$= \frac{\pi}{6}$$

$$= \frac{\pi}{24}$$

21. A lot consists of 144 ball pens of which 20 are defective and the others are good. Nuri will buy a pen if it is good, but will not buy if it is defective. The shopkeeper draws one pen at random and gives it to her. What is the probability that

(i) She will buy it?

(ii) She will not buy it?

Solution:

Total number of pens = 144

Total number of defective pens = 20

Total number of good pens = 144 - 20 = 124

(i) Probability of getting a good pen = $\frac{124}{144}$

$$= \frac{31}{36}$$

$$P(\text{Nuri buys a pen}) = \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

$$= \frac{31}{36}$$

(ii) $P(\text{Nuri will not buy a pen}) = 1 - \frac{31}{36}$

$$= \frac{5}{36}$$

22. Refer to Example 13. (i) Complete the following table:

Event : 'Sum on 2 dice'	2	3	4	5	6	7	8	9	10	11	12
Probability	1/36						5/36				1/36

(ii) A student argues that 'there are 11 possible outcomes 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12. Therefore, each of them has a probability $\frac{1}{11}$. Do you agree with this argument? Justify your answer

Solution:

(i) It can be observed that,

To get the sum as 2, possible outcomes = (1, 1)

To get the sum as 3, possible outcomes = (2, 1) and (1, 2)

To get the sum as 4, possible outcomes = (3, 1), (1, 3), (2, 2)

To get the sum as 5, possible outcomes = (4, 1), (1, 4), (2, 3), (3, 2)

To get the sum as 6, possible outcomes = (5, 1), (1, 5), (2, 4), (4, 2),
(3, 3)

To get the sum as 7, possible outcomes = (6, 1), (1, 6), (2, 5), (5, 2),
(3, 4), (4, 3)

To get the sum as 8, possible outcomes = (6, 2), (2, 6), (3, 5), (5, 3),
(4, 4)

To get the sum as 9, possible outcomes = (3, 6), (6, 3), (4, 5), (5, 4)

To get the sum as 10, possible outcomes = (4, 6), (6, 4), (5, 5)

To get the sum as 11, possible outcomes = (5, 6), (6, 5)

To get the sum as 12, possible outcomes = (6, 6)

Event	2	3	4	5	6	7	8	9	10	11	12
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P	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$
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(ii) Probability of each of these sums will not be $\frac{1}{11}$ as their sums are not equally likely

- 23. A game consists of tossing a one rupee coin 3 times and noting its outcome each time. Hanif wins if all the tosses give the same result i.e., three heads or three tails, and loses otherwise. Calculate the probability that Hanif will lose the game**

Solution:

The possible outcomes are:

{HHH, TTT, HHT, HTH, THH, TTH, THT, HTT}

Number of total possible outcomes = 8

Number of favourable outcomes = 2 {i.e., TTT and HHH}

$$P(\text{Hanif will win the game}) = \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

$$= \frac{2}{8}$$

$$= \frac{1}{4}$$

$$P(\text{Hanif will lose the game}) = 1 - \frac{1}{4}$$

$$= \frac{3}{4}$$

- 24. A die is thrown twice. What is the probability that**

- (i) 5 will not come up either time?
- (ii) 5 will come up at least once?

[Hint: Throwing a die twice and throwing two dice simultaneously are treated as the same experiment]

Solution:

Total number of outcomes = 6×6

= 36

- (i) Total number of outcomes when 5 comes up on either time are (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (1, 5), (2, 5), (3, 5), (4, 5), (6, 5)

Therefore, the total number of favourable cases = 11

$$P(5 \text{ will come up either time}) = \frac{11}{36}$$

$$P(5 \text{ will not come up either time}) = 1 - \frac{11}{36}$$

$$= \frac{25}{36}$$

- (ii) Total number of cases, where 5 comes at least once = 11

$$P(5 \text{ will come at least once}) = \frac{\text{Favourable outcomes}}{\text{Total outcomes}} = \frac{11}{36}$$

25. Which of the following arguments are correct and which are not correct? Give reasons for your answer.

- (i) If two coins are tossed simultaneously there are three possible outcomes—two heads, two tails or one of each. Therefore, for each of these outcomes, the probability is $\frac{1}{3}$.
- (ii) If a die is thrown, there are two possible outcomes—an odd number or an even number. Therefore, the probability of getting an odd number is $\frac{1}{2}$.

Solution:

All possible outcomes = (H, H), (H, T), (T, H), (T, T)

$$\text{Probability of an event} = \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$$

$$\text{Probability (2 heads)} = \frac{1}{4}$$

$$\text{Probability (2 tails)} = \frac{1}{4}$$

- (i) It is not correct.
If we want to get the probability of them we should categorize the outcomes like this but they are not equally likely because one of each can result in two ways from a head on first coin and tail on second or from tail on first and head on second
- (ii) Correct as the two outcomes which are considered in this question are equally likely

