

Probability

Exercise 15.1

Q1. Complete the following statements:

- (i) Probability of an event E + Probability of the event 'not E ' = 1.
- (ii) The probability of an event that cannot happen is 0. Such an event is called impossible event.
- (iii) The probability of an event that is certain to happen is 1. Such an event is called sure event.
- (iv) The sum of the probabilities of all the elementary events of an experiment is 1.
- (v) The probability of an event is greater than or equal to 0 and less than or equal to 1.

Q2. 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.

Solution:

It is not equally likely outcomes because the probability of it depends on many factors.

- (ii) A player attempts to shoot a basketball. She/he shoots or misses the shot.

Solution:

It is not equally likely outcomes because the probability here depends on the ability of the player.

- (iii) A trial is made to answer a true-false question. The answer is right or wrong.

Solution:

It is equally likely outcomes because the probability is equal in both the cases, it can be either true or false.

- (iv) A baby is born. It is a boy or a girl.

Solution:

It is equally likely outcomes because the probability is equal in both the cases, it can be a boy or girl.

Q3. 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 it is an equally likely event, it has only two outcomes either head or tail, so the probability for both the team is equal.

Q4. 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 the probability of an event is in between 0 and 1 i.e. $0 \leq P(E) \leq 1$ and it cannot be less than 0 and greater than 1. So, (B) i.e. -1.5 cannot be the probability of an event because it cannot be negative.

Q5. If $P(E) = 0.05$, what is the probability of 'not E'?

Solution:

$$P(E) = 0.05$$

We know that

$$P(E) + P(\text{not } E) = 1$$

$$0.05 + P(\text{not } E) = 1$$

$$P(\text{not } E) = 1 - 0.05$$

$$P(\text{not } E) = 0.95$$

Thus, the probability of 'not E' is 0.95.

Q6. 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) A bag contains only lemon flavoured candy so there is no probability to take out orange flavoured candy. Therefore, the probability of taking out orange flavoured candy is 0.

(ii) As the bag has only lemon flavoured candy, so every time she will take out only lemon flavoured candy. Therefore, the event is sure event and the probability of taking out lemon flavoured candy is 1.

Q7. 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?

Difficulty Level: Easy

What is given /known?

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 unknown?

The probability that the 2 students have the same birthday.

How can you use the known information to arrive at the solution?

This question is straight forward. We know that the sum of two complementary events are 1.

$$P(E) + P(\text{not } E) = 1.$$

By putting the given values in the above equation, we can find out the probability of not happening of event.

Solution:

Probability that 2 students not having the same birthday $p(\text{not } E) = 0.992$

$$\begin{aligned} \text{Probability that 2 students having the same birthday } p(E) &= 1 - 0.992 \\ &= 0.008 \end{aligned}$$

Thus, the probability that the 2 students have the same birthday is 0.008

Q8. 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?

Difficulty Level: Easy

What is given /known?

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

What is the unknown?

The probability that the ball drawn is (i) red? (ii) not red.

How can you use the known information to arrive at the solution?

This question can be solved easily in two steps;

- (i) First find out the probability of drawing red ball by using the formula

$$\text{Probability of an event} = \frac{\text{Number of possible outcomes}}{\text{total no of favourable outcomes}}$$

- (ii) Then by using the formula of sum of complementary event find out the probability of not getting a red ball.

$$P(E) + P(\text{not } E) = 1$$

Solution:

No of red balls in a bag = 3

No of black balls in a bag = 5

Total no of balls = 3 + 5 = 8

$$\text{Probability of drawing red ball} = \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}}$$

$$\text{Probability of drawing red ball} = \frac{3}{8}$$

$$(ii) \text{ Probability of not getting red ball } P(R) = 1 - P(\text{not E}) = 1 - \frac{3}{8} = \frac{5}{8}$$

Q9. 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?

Difficulty Level: Easy

What is given /known?

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 unknown?

The probability that the marble taken out will be (i) red? (ii) white? (iii) not green?

How can you use the known information to arrive at the solution?

This question can be solved easily;

- (i) Find out the probability of getting red, white and green marble by using the formula

$$\text{Probability of} = \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}}$$

- (ii) Then by using the formula of sum of complementary event find out the probability of not getting green ball.

$$P(E) + P(\text{not E}) = 1$$

Solution:

No of red balls in a bag = 5

No of white balls in a bag = 8

No of green balls in a bag = 4

Total no of balls = $5 + 8 + 4 = 17$

$$\text{Probability of drawing red ball} = \frac{5}{17}$$

$$\text{Probability of drawing white ball} = \frac{8}{17}$$

$$\text{Probability of drawing a ball which is green} = \frac{4}{17}$$

$$P(\text{not E}) = 1 - P(E)$$

$$= 1 - \frac{4}{17}$$

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

Q10. 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 50p coin? (ii) will not be a Rs 5 coin?

Solution:

We can use Same approach as we used in question no 9

Total no of coins = $100 + 50 + 20 + 10 = 180$

No of 50 p coins = 100

No of 1 Re coins = 50

No of 2 Rs coins = 20

No of 5 Rs coins = 10

(i) Probability of drawing 50p coin = $\frac{100}{180}$

(ii) Probability of getting a Rs 5 coin = $\frac{10}{180} = \frac{1}{18}$

Probability of not getting a Rs 5 coin = $1 - \frac{1}{18} = \frac{17}{18}$

Q11. 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?

What is given /known?

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

What is the unknown?

The probability that the fish taken out is a male fish.

How can you use the known information to arrive at the solution?

This question can be solved easily by using the formula

$$\text{Probability of} = \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}}$$

Solution:

No of male fish = 5

No of female fish = 8

Total no of fishes = $5 + 8 = 13$

Probability that the fish taken out is a male fish = $\frac{\text{No of male fish}}{\text{total no of fishes}}$

Probability that the fish taken out is a male fish = $\frac{5}{13}$

Q12. 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 8?

an odd number?

a number greater than 2?

a number less than 9?

Same formula used as in question no 11

Solution:

We can use Same approach as we used in question no 11

Total possible outcomes = 8

Probability of getting 8 = $\frac{\text{probability of getting 8}}{\text{total no of outcomes}}$

(i) Probability of getting 8 = $\frac{1}{8}$

(ii) Total no of odd numbers = 1,3,5,7 = 4

$$\begin{aligned} \text{Probability of getting odd number} &= \frac{\text{Toatl no of odd number}}{\text{total no of outcomes}} \\ &= \frac{4}{8} \\ &= \frac{1}{2} \end{aligned}$$

(iii) Numbers greater than 2 are 3,4,5,6,7,8 = 6

$$\begin{aligned} \text{Probability of getting numbers greater than 2} &= \frac{\text{Numbers greater than 2}}{\text{total no of outcomes}} \\ &= \frac{6}{8} \\ &= \frac{3}{4} \end{aligned}$$

(iv) Numbers less than 9 are 1,2,3,4,5,6,7,8 = 8

$$\begin{aligned} \text{Probability of getting numbers less than 9} &= \frac{\text{Numbers greater than 9}}{\text{total no of outcomes}} \\ &= \frac{8}{8} = 1 \end{aligned}$$

Q13. 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:

No of outcomes when you throw a die (1,2,3,4,5,6) = 6

No of prime numbers on dice are 1,3 and 5 = 3

$$\begin{aligned}
 \text{(i) Probability of getting a prime number} &= \frac{\text{Number of prime numbers}}{\text{total no of outcomes}} \\
 &= \frac{3}{6} \\
 &= \frac{1}{2}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{Probability of getting a number lying between 2 and 6} &= \frac{\text{Number lying between 2 and 6}}{\text{total no of outcomes}} \\
 &= \frac{3}{6}
 \end{aligned}$$

(iii) Total number of odd numbers are 1,3 and 5 = 3

$$\begin{aligned}
 \text{Probability of getting a odd number} &= \frac{\text{Number of odd numbers}}{\text{total no of outcomes}} \\
 &= \frac{3}{6}
 \end{aligned}$$

Q14. One card is drawn from a well-shuffled deck of 52 cards. Find the probability of getting

- | | | |
|--------------------------|------------------|----------------------------|
| (i) a king of red colour | (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 from a well-shuffled deck = 52

No of spade cards = 13

No of heart cards = 13

No of diamond cards = 13

No of club cards = 13

Total number of kings = 4

Total number of queens = 4

Total number of jacks = 4

No of face cards = 12

$$\begin{aligned}
 \text{(i) Probability of getting a king of red colour} &= \frac{\text{Number of red colour king}}{\text{total no of outcomes}} \\
 &= \frac{2}{52} = \frac{1}{26}
 \end{aligned}$$

$$\begin{aligned} \text{(ii) Probability of getting a face card} &= \frac{\text{Number of face cards}}{\text{total no of outcomes}} \\ &= \frac{12}{52} = \frac{3}{13} \end{aligned}$$

$$\begin{aligned} \text{(iii) Probability of getting a red face card} &= \frac{\text{Number of red face cards}}{\text{total no of outcomes}} \\ &= \frac{6}{52} = \frac{3}{26} \end{aligned}$$

$$\begin{aligned} \text{(iv) Probability of getting the jack of hearts} &= \frac{\text{Number of jack of hearts}}{\text{total no of outcomes}} \\ &= \frac{1}{52} \end{aligned}$$

$$\begin{aligned} \text{(v) Probability of getting a spade card} &= \frac{\text{Number of spade cards}}{\text{total no of outcomes}} \\ &= \frac{13}{52} = \frac{1}{4} \end{aligned}$$

$$\begin{aligned} \text{(vi) Probability of getting the queen of diamonds} &= \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}} \\ &= \frac{1}{52} \end{aligned}$$

Q15. 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:

Total no of cards = 5

No of queen cards = 1

$$\begin{aligned} \text{(i) Probability that the card is the queen} &= \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}} \\ &= \frac{1}{5} \end{aligned}$$

(ii) If the queen is drawn and put aside, then four cards are left the ten, jack, king and ace of diamonds

$$\begin{aligned} \text{(a) Probability that the card an ace} &= \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}} \\ &= \frac{1}{4} \end{aligned}$$

$$\begin{aligned}
 \text{(b) Probability that the card is the queen} &= \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}} \\
 &= \frac{0}{4} \\
 &= 0
 \end{aligned}$$

Q16. 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:

$$\text{No of defective pens} = 12$$

$$\text{No of good pens} = 132$$

$$\begin{aligned}
 \text{Total no of pens} &= 12 + 132 \\
 &= 144
 \end{aligned}$$

$$\begin{aligned}
 \text{Probability that the pen taken out is a good one} &= \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}} \\
 &= \frac{132}{144} \\
 &= \frac{11}{12}
 \end{aligned}$$

Thus, the probability that the pen taken out is a good $\frac{11}{12}$

Q17.

- (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:

$$\text{Total no of bulbs} = 20$$

$$\text{No of defective pieces} = 4$$

$$\begin{aligned}
 \text{Probability that this bulb is defective} &= \frac{\text{Number of possible outcome}}{\text{No of favourable outcomes}} \\
 &= \frac{4}{20} \\
 &= \frac{1}{5}
 \end{aligned}$$

$$\text{Remaining total number of bulbs} = 20 - 1 = 19$$

$$\text{Remaining total number of non-defective bulbs} = 16 - 1 = 15$$

$$\begin{aligned} \text{Probability that this bulb is not defective} &= \frac{\text{Number of possible outcomes}}{\text{total no of favourable outcomes}} \\ &= \frac{15}{19} \end{aligned}$$

Q18. 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

Total number of 2digit numbers between 1 to 90 = 81

Total number of perfect square numbers between 1 to 90 are 1,4,9,16,25,36,49,64,81= 9

Total numbers that are divisible by 5 are 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90 = 18

$$\begin{aligned} \text{(i) Probability of getting a two digit number} &= \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}} \\ &= \frac{81}{90} = \frac{9}{10} \end{aligned}$$

$$\begin{aligned} \text{(ii) Probability of getting a perfect square number} &= \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}} \\ &= \frac{9}{90} = \frac{1}{10} \end{aligned}$$

$$\begin{aligned} \text{(iii) Probability of getting a number divisible by 5} &= \frac{\text{Number of possible outcomes}}{\text{No of favourable outcomes}} \\ &= \frac{18}{90} \\ &= \frac{1}{5} \end{aligned}$$

Q19. A child has a die whose six faces show the letters as given below:

A	B	C	D	E	A
---	---	---	---	---	---

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

Solution:

Total number of outcomes = 6

$$\begin{aligned} \text{(i) Probability of getting A} &= \frac{\text{Number of possible outcomes}}{\text{Noof favourable outcomes}} \\ &= \frac{2}{6} \end{aligned}$$

$$\begin{aligned} \text{(ii) Probability of getting D} &= \frac{\text{Number of possible outcomes}}{\text{No of favourable outcomes}} \\ &= \frac{1}{6} \end{aligned}$$

The probability of getting A and D is $\frac{2}{6}$ and $\frac{1}{6}$

Q20. 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?

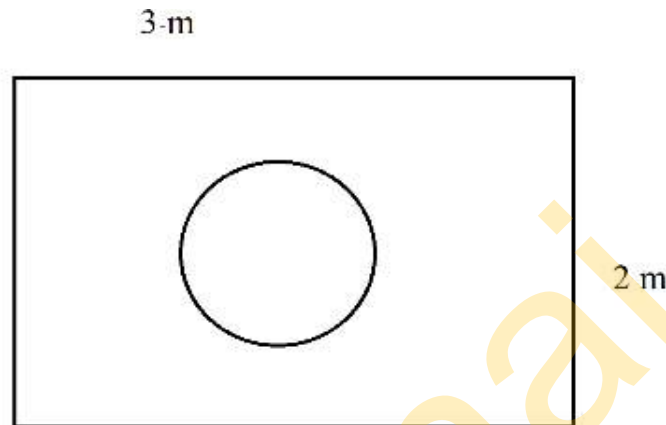


Fig. 15.6

Solution:

Length of rectangular region = 3m

Breadth of rectangular region = 2m

Area of rectangular region = $L \times B$

$$= 3 \times 2$$

$$= 6\text{m}^2$$

Diameter of circular region = 1m

Radius of circular region = $\frac{1}{2}\text{m}$

Area of circular region = πr^2

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

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

Probability that it will land inside the circle = $\frac{\text{Number of possible outcomes}}{\text{No of favourable outcomes}}$

$$= \frac{\text{Area of circular region}}{\text{Area of rectangular region}}$$

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

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

The probability that it will land inside the circle is $\frac{\pi}{24}$

Q21. 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 no of ball pens = 144

No of defective ball pens = 20

No of good ball pens = $144 - 20 = 124$

$$\begin{aligned} \text{(i) Probability that She will buy it} &= \frac{\text{Number of possible outcomes}}{\text{No of favourable outcomes}} \\ &= \frac{124}{144} \\ &= \frac{31}{36} \end{aligned}$$

$$\begin{aligned} \text{(ii) Probability that She will not buy it} &= \frac{\text{Number of possible outcome}}{\text{No of favourable outcomes}} \\ &= \frac{20}{144} \\ &= \frac{5}{36} \end{aligned}$$

Q22. Refer to Example 13. (i) Complete the following table:

Event 'Sum of 2 dice'	2	3	4	5	6	7	8	9	10	11	12
Probability	$\frac{1}{36}$						$\frac{5}{36}$				$\frac{1}{36}$

(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 $1/11$. Do you agree with this argument? Justify your answer.

Solution:

No of possible outcomes to get the sum as 2 = (1,1)

No of possible outcomes to get the sum as 3 = (2,1), (1,2)

No of possible outcomes to get the sum as 4 = (2,2), (1,3), (3,1)

No of possible outcomes to get the sum as 5 = (3,2), (2,3), (4,1), (1,4)

No of possible outcomes to get the sum as 6 = (5,1), (1,5), (3,3), (4,2), (2,4)

No of possible outcomes to get the sum as 7 = (4,3), (3,4), (6,1), (1,6), (5,2), (2,5)

No of possible outcomes to get the sum as 8 = (4,4), (6,2), (2,6), (5,3), (3,5)

No of possible outcomes to get the sum as 9 = (5,4), (4,5), (6,3), (3,6)

No of possible outcomes to get the sum as 10 = (5,5), (6,4),(4,6)

No of possible outcomes to get the sum as 11 = (6,5)(5,6)

No of possible outcomes to get the sum as 12 = (6,6)

Event 'Sum of 2 dice'	2	3	4	5	6	7	8	9	10	11	12
Probability	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

(ii)Probability of each of them is not $\frac{1}{11}$ as these are not equally likely.

Q23. 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:

Total possible outcomes are = {HHH, TTT, HTH, HHT, THH, THT, TTH, HTT} = 8

No of possible outcomes to get three heads or three tails = 2

$$\begin{aligned} \text{probability that Hanif will win the game} &= \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}} \\ &= \frac{2}{8} = \frac{1}{4} \end{aligned}$$

$$\begin{aligned} \text{probability that Hanif will lose the game} &= 1 - \frac{1}{4} \\ &= \frac{3}{4} \end{aligned}$$

The probability that Hanif will lose the game is $\frac{3}{4}$

Q24. 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 when dies is thrown twice = $6 \times 6 = 36$

(i)No of possible outcomes when 5 will come up either time =

(5,1),(5,2),(5,3),(5,4),(5,5),(5,6),(1,5),(2,5),(3,5),(4,5),(6,5) = 11

$$\begin{aligned} \text{probability that 5 will come up either time} &= \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}} \\ &= \frac{11}{36} \end{aligned}$$

$$\begin{aligned} \text{probability that 5 will not come up either time} &= 1 - \frac{11}{36} \\ &= \frac{25}{36} \end{aligned}$$

(ii) No of possible outcomes when 5 will come up at-least once = 11

$$\begin{aligned} \text{probability that 5 will come up at-least once} &= \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}} \\ &= \frac{11}{36} \end{aligned}$$

probability that 5 will not come up either time is $\frac{25}{36}$ and probability that 5 will come up at least once is $\frac{11}{36}$

Q25. 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 $1/3$.

(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 $1/2$

Solution:

Incorrect

If two coins are tossed simultaneously then,

Total possible outcomes are (H,H), (T,T), (H,T), (T,H) = 4

No of outcomes to get two heads = (H,H) = 1

No of outcomes to get two tails = (T,T) = 1

No of outcomes to one of each = (H,T), (T,H) = 2

$$\begin{aligned} \text{probability of getting two head} &= \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}} \\ &= \frac{1}{4} \end{aligned}$$

$$\begin{aligned} \text{probability of getting two tails} &= \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}} \\ &= \frac{1}{4} \end{aligned}$$

$$\begin{aligned}\text{probability of getting one of each} &= \frac{\text{Number of possible outcomes}}{\text{Total no of favourable outcomes}} \\ &= \frac{2}{4} = \frac{1}{2}\end{aligned}$$

It can be observed that,

Thus, the probability of each of the outcome is not $\frac{1}{3}$.

(ii) correct

Total no of possible outcomes when a dice is thrown = (1,2,3,4,5,6)

No of possible outcomes to get odd number (1,3,5)=3

No of possible outcomes to get even number (2,4,6)=3

$$\begin{aligned}\text{probability of getting odd number} &= \frac{\text{Number of possible outcomes}}{\text{No of favourable outcomes}} \\ &= \frac{3}{6} = \frac{1}{2}\end{aligned}$$

Thus, the probability of getting an odd number is $\frac{1}{2}$.

Probability

Exercise 15.2

Q1. Two customers Shyam and Ekta are visiting a particular shop in the same week (Tuesday to Saturday). Each is equally likely to visit the shop on any day as on another day. What is the probability that both will visit the shop on
(i) the same day? (ii) consecutive days? (iii) different days?

Difficulty Level: Easy

What is given /known?

Two customers Shyam and Ekta are visiting a particular shop in the same week (Tuesday to Saturday). Each is equally likely to visit the shop on any day as on another day.

What is the unknown?

The probability that both will visit the shop on (i) the same day? (ii) consecutive days? (iii) different days

How can you use the known information to arrive at the solution?

To solve this question, first find out the total number of outcomes and all the possible outcomes. Now, to find the probability use the formula given below

$$\text{Probability} = \frac{\text{No of possible outcomes}}{\text{Total no of outcomes}}$$

Solution:

Total outcomes = $5 \times 5 = 25$

(i) (i) No of possible outcomes that both will visit the shop on the same day =
(T,T), (W,W), (TH,TH), (F,F), (S,S) = 5

$$\begin{aligned} \text{Probability that both will visit the shop on the same day} &= \frac{\text{No of possible outcomes}}{\text{Total}} \\ &= \frac{5}{25} \end{aligned}$$

(ii) No of possible outcomes that both will visit the shop on consecutive days =
(t,w), (w,Th), (th,f), (f,s), (w,t), (th,w), (f,th), (s,f) = 8

$$\begin{aligned} \text{Probability that both will visit the shop on the consecutive days} &= \frac{\text{No of possible outcomes}}{\text{Total no of outcomes}} \\ &= \frac{8}{25} \end{aligned}$$

- (iii) No of possible outcomes that both will visit the shop on different days
 $= (t,w), (w,Th), (th,f), (f,s), (w,t), (th,w), (f,th), (s,f) = 8$

$$\begin{aligned} \text{Probability that both will visit the shop on the different days} &= 1 - \frac{5}{25} \\ &= \frac{20}{25} \\ &= \frac{4}{5} \end{aligned}$$

Q2. A die is numbered in such a way that its faces show the numbers 1, 2, 2, 3, 3, 6. It is thrown two times and the total score in two throws is noted. Complete the following table which gives a few values of the total score on the two throws:

		No in first throw					
		1	2	2	3	3	6
No in second throw	1	2	3	3	4	4	7
	2	3	4	4	5	5	8
	2					5	
	3						
	3			5			9
	6	7	8	8	9	9	12

What is the probability that the total score is (i) even? (ii) 6? (iii) at least 6?

Difficulty Level: Moderate

What is given /known?

A die is numbered in such a way that its faces show the numbers 1, 2, 2, 3, 3, 6. It is thrown two times and the total score in two throws is noted

What is the unknown?

The probability that the that the total score is (i) even? (ii) 6? (iii) at least 6.

How can you use the known information to arrive at the solution?

To solve this question, first find out the total number of outcomes and all the possible outcomes. Now, to find the probability use the formula given below

$$\text{Probability} = \frac{\text{No of possible outcomes}}{\text{Total no of outcomes}}$$

Solution:

+	1	2	2	3	3	6
1	2	3	3	4	4	7
2	3	4	4	5	5	8
2	3	4	4	5	5	8
3	4	5	5	6	6	9
3	4	5	5	6	6	9
6	7	8	8	9	9	12

Total number of possible outcomes = $6 \times 6 = 36$

(i) No of possible outcomes when the sum is even = 18

$$\begin{aligned} \text{Probability that the total score is even} &= \frac{\text{No of possible outcomes}}{\text{Total no of outcomes}} \\ &= \frac{18}{36} = \frac{1}{2} \end{aligned}$$

(ii) No of possible outcomes when the sum is 6 = 4

$$\begin{aligned} \text{Probability that of getting the sum 6} &= \frac{\text{No of possible outcomes}}{\text{Total no of outcomes}} \\ &= \frac{4}{36} = \frac{1}{9} \end{aligned}$$

(iii) No of possible outcomes when the sum is at-least 6 (greater than 5) = 15

$$\begin{aligned} \text{Probability that of getting the sum at-least 6} &= \frac{\text{No of possible outcomes}}{\text{Total no of outcomes}} \\ &= \frac{15}{36} = \frac{5}{12} \end{aligned}$$

Q3. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball is double that of a red ball, determine the number of blue balls in the bag.

Difficulty Level: Easy

What is given /known?

A bag contains 5 red balls and some blue balls and the probability of drawing a blue ball is double that of a red ball.

What is the unknown?

The number of blue balls in the bag.

How can you use the known information to arrive at the solution?

First find out the total number of outcomes and all the possible outcomes. Now, to find the probability use the formula given below

$$\text{Probability} = \frac{\text{No of possible outcomes}}{\text{Total no of outcomes}}$$

As it is given in the question that the probability of drawing a blue ball is double that of a red ball, that means

$2 \times$ probability of drawing red ball = probability of drawing blue ball.

Put the values in the above and you can find out the number of blue balls.

Solution:

No of red balls = 5

Let the no of blue balls be x

Total number of balls = $x + 5$

$$\begin{aligned} \text{Probability of drawing red ball} &= \frac{\text{No of possible outcomes}}{\text{Total no of outcomes}} \\ &= \frac{5}{x+5} \end{aligned}$$

$$\begin{aligned} \text{Probability of drawing blue ball} &= \frac{\text{No of possible outcomes}}{\text{Total no of outcomes}} \\ &= \frac{x}{x+5} \end{aligned}$$

Thus, the probability of drawing a blue ball is double that of a red ball

$$2\left(\frac{5}{x+5}\right) = \frac{x}{x+5}$$

Now compare the both sides
 $x=10$

Hence the number of blue balls = 10

Q4. A box contains 12 balls out of which x are black. If one ball is drawn at random from the box, what is the probability that it will be a black ball? If 6 more black balls are put in the box, the probability of drawing a black ball is now double of what it was before. Find x .

Difficulty Level: Moderate

What is given /known?

A box contains 12 balls out of which x are black and one ball is drawn at random from the box. If 6 more black balls are put in the box, the probability of drawing a black ball is now double of what it was before.

What is the unknown?

The probability that the ball drawn at random will be a black ball and also find the value of x .

How can you use the known information to arrive at the solution?

First suppose the number of black balls as x . Then find the total number of possible outcomes. Now, find the probability by using the formula –

$$\text{Probability} = \frac{\text{No of possible outcomes}}{\text{Total no of outcomes}}$$

Now 6 more balls are put in the box and the probability of drawing a black ball is now double of what it was before,

Now, the probability of drawing a black ball = 2 x probability of drawing black ball before.

Solution:

Total Number of balls = 12

Let the number of black balls = x

$$\begin{aligned}\text{Probability of getting black ball} &= \frac{\text{No of possible outcomes}}{\text{Total no of outcomes}} \\ &= \frac{x}{12}\end{aligned}$$

If 6 more black balls are put in the box, the probability of drawing a black ball is now double of what it was before,

Total number of balls = 12 + 6

Number of black balls = $x + 6$

Now,

$2 \times$ Probability of drawing black ball before = probability of drawing black ball.

$$2 \times \text{Probability of drawing black ball before} = \frac{\text{No of possible outcomes}}{\text{Total no of outcomes}}$$

$$2 \left(\frac{x}{12} \right) = \frac{x+6}{18}$$

$$2x \times 18 = 12(x+6)$$

$$3x = x + 6$$

$$3x - x = 6$$

$$2x = 6$$

$$x = 3$$

Number of black balls are 3

Q5. A jar contains 24 marbles, some are green, and others are blue. If a marble is drawn at random from the jar, the probability that it is green is $\frac{2}{3}$. Find the number of blue balls in the jar.

Difficulty Level:

Moderate

What is given /known?

A jar contains 24 marbles, some are green, and others are blue. If a marble is drawn at random from the jar, the probability that it is green is $\frac{2}{3}$.

What is the unknown?

The number of blue balls in the jar.

Reasoning:

It is given in the question that total number of balls are 24. suppose the number of green marbles be x . Now to find the number of blue balls, subtract the green balls from the total number of marbles i.e. number of blue balls are $24 - x$. It is given in the question that probability of getting green ball is $\frac{2}{3}$, probability of getting green ball = $\frac{2}{3}$

Put the values in the above and you will get the value of x i.e. the number of blue balls.

Solution:

Total number of marbles = 24

Let the green marbles be x and the blue colour marbles be $24 - x$

Probability of getting green marbles = $\frac{2}{3}$

$$\frac{\text{No of possible outcomes}}{\text{Total no of outcomes}} = \frac{2}{3}$$

$$\frac{x}{24} = \frac{2}{3}$$

$$x = \frac{2}{3} \times 24$$

$$x = 16$$

Therefore, the number of green marbles = 16

Hence, total number of blue marbles = $24 - x$
= $24 - 16 = 8$

Thus, the number of blue marbles is 8.