Chapter-15

Probability

Exercise-15.1

Q.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 _____.

Answer:

(i) 1

The probability of two complementary events is 1.

(ii) 0, impossible event

An event which can't happen is known as an impossible event.

(iii) 1, sure event or certain event

(iv) 1

(v) 0, 1

Q.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.

Answer:

(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.

Q.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?

Answer:

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.

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

A. $\frac{2}{3}$

B. –1.5

C. 15%

D. 0.7

Answer:

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,

(A) 2/3 = 0.67

As the value 0.67 is greater than 0 and less than 1, the value can be probability of an event(B) - 1.5 The value is less than 0 and therefore cannot be the probability of an event.(C) 15% = 0.15As the value 0.15 is greater than 0 and less than 1, the value can be probability of an event.(D) 0.7As the value is greater than 0 and less than 1, the value can be probability of an event.

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

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

Answer:

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

Q.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?

Answer:

(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 (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 (a lemon flavoured candy) = 1

Q.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?

Answer:

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

Q.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?

Answer:

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

No of red balls = 3

Let E be the event of getting a red ball, thenNo of favorable outcomes = No of red balls = 3 No of possible outcomes = No of total balls = 8

Probability of the ball drawn to be red. :

$$= \frac{Favourbe\ outcomes}{Total\ outcomes}$$

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

(ii) We know that:

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

where E and ($\bar{E}$) are complementary events, as getting a red ball and not getting a red ball are complementary events

Hence,

Probability of not getting red ball

= 1 - Probability of getting a red ball

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

= $\frac{5}{8}$

Q.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?

Answer:

Total number of marbles = 5 + 8 + 4

= 17

(i) Number of red marbles = 5

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

$= \frac{5}{17}$

(ii) Number of white marbles = 8

Probability of white marble= $\frac{Favour\,be\ outcomes}{Total\ outcomes}$

$= \frac{8}{17}$

(iii) Number of green marbles = 4

Probability of green marbles

$= \frac{Favour\,be\ outcomes}{Total\ outcomes}$

$= \frac{4}{17}$

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

$= \frac{13}{17}$

Q.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?

Answer:

According to the question,

Total number of coins in a piggy bank = 100 + 50 + 20 + 10

= 180

(i) Number of 50 p coins = 100

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

$= \frac{100}{180}$

$= \frac{5}{9}$

(ii) Number of Rs 5 coins = 10

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

$= \frac{10}{180}$

$= \frac{1}{18}$

Hence,

Probability of not getting a Rs 5 coin =

$1 - \frac{1}{18}$

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

$= \frac{17}{18}$

Q.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

Answer:

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 = $\frac{Favourbe\ outcomes}{Total\ outcomes}$

= $\frac{5}{13}$

Q.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?

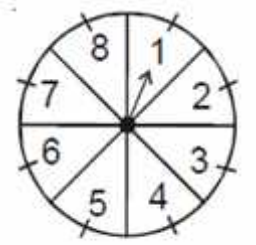


Fig. 15.5

Answer:

Total number of possible outcomes = 8

(i) Probability of getting 8 = $\frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{1}{8}$

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

Probability of getting odd number

$= \frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{4}{8} = \frac{1}{2}$

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

Therefore, total numbers greater than 2 = 6

Probability = $\frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{6}{8}$

$= \frac{3}{4}$

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

Therefore, total numbers less than 9 = 8

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

Q.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

Answer:

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 $= \frac{3}{6}$

$= \frac{1}{2}$

Q.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

Answer:

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 $= \frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{2}{52}$

$= \frac{1}{26}$

(ii) Total number of face cards = 12

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

$= \frac{12}{52}$

$= \frac{3}{13}$

(iii) Total number of red face cards = 6

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

$= \frac{6}{52}$

$= \frac{3}{26}$

(iv) Total number of Jack of hearts = 1

Probability of obtaining a Jack of hearts $= \frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{1}{52}$

(v) Total number of spade cards = 13

Probability of obtaining a spade card $= \frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{13}{52}$

$= \frac{1}{4}$

(vi) Total number of queen of diamonds = 1

Probability of getting a queen of diamond

$= \frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{1}{52}$

Q.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?

Answer:

(i) Total number of cards = 5

Total number of queens = 1

Probability of getting a queen = $\frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{1}{5}$

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

(a) Total number of aces = 1

Probability of getting an ace = $\frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{1}{4}$

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

Probability of getting a queen

$= \frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{0}{4}$

$= 0$

Q.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.

Answer:

Total number of pens = 12 + 132 = 144

Total number of good pens = 132

Probability of getting a good pen = $\frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{132}{144}$

$= \frac{11}{12}$

Q.17A 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?

Answer:

Total number of bulbs = 20

Total number of defective bulbs = 4

Probability of getting a defective bulb

$= \frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{4}{20}$

$= \frac{1}{5}$

Q.17B 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?

Answer:

Remaining total number of bulbs = 19

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

= 15

P (obtaining a not defective bulb)

$= \frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{15}{19}$

Q.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

Answer: Total number of discs = 90

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

P (getting a two-digit number)

$= \frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{81}{90}$

$= \frac{9}{10}$

(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)

$= \frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{9}{90}$

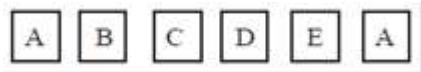
$= \frac{1}{10}$

(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 = $\frac{18}{90}$

$= \frac{1}{5}$

Q.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?

Answer:

Total number of possible outcomes on the dice = 6

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

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

$= \frac{2}{6}$

$= \frac{1}{3}$

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

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

$= \frac{1}{6}$

Q. 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?

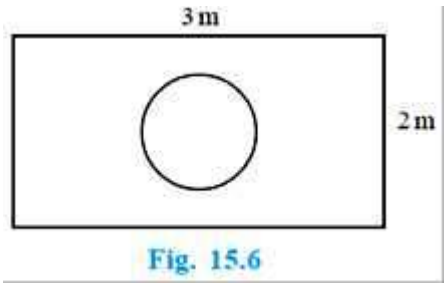


Fig. 15.6

Answer:

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

Area of circle (of diameter 1 m) = πr^2

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

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

P (die will land inside the circle)

$= \frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{\frac{\pi}{4}}{6}$

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

Q.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?

Answer:

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 (Nuri buys a pen) = $\frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{31}{36}$

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

= $\frac{5}{36}$

Q.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 and12. Therefore, each of them has a probability $\frac{1}{11}$, Do you agree with this argument? Justify your answer

Answer:

(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
P	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

(ii) The probability of each of these sums will not be $\frac{1}{11}$ as their sums are not equally likely.

Q.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.

Answer:

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 (Hanif will win the game) = $\frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{2}{8}$

$= \frac{1}{4}$

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

$= \frac{3}{4}$

Q.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]

Answer:

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 will come up either time) = $\frac{11}{36}$

P (5 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 will come at least once) = $\frac{Favour\,be\ outcomes}{Total\ outcomes}$

$= \frac{11}{36}$

Q.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 $\frac{1}{2}$.

Answer:

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

Probability of an event = $\frac{Favour\,be\ outcomes}{Total\ outcomes}$

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

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.

Exercise 15.2

Q.1 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?

Answer:

There are a total of 5 days. Shyam can go to the shop in 5 ways and Ekta can go to the shop in 5 ways.

Therefore, total number of outcomes = 5 × 5 = 25

(i) They can reach on the same day in 5 ways.

i.e., (t, t), (w, w), (th, th), (f, f), (s, s)

P (both will reach on same day) $= \frac{5}{25}$

$= \frac{1}{5}$

(ii) They can reach on consecutive days in these 8 ways - (t, w), (w, th), (th, f), (f, s), (w, t), (th, w), (f, th), (s, f)

Therefore, P (both will reach on consecutive days) $= \frac{8}{25}$

(iii) P (both will reach on same day)

$= \frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{1}{5}$

P (both will reach on different days) = 1 - $\frac{1}{5}$

$= \frac{4}{5}$

Q.2 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:

	Number in first throw					
Number in second throw / +	1	2	2	3	3	6
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?

Answer:

Total number of possible outcomes when two dice are thrown = 6 × 6 = 36

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

(i) Total times when the sum is even = 18

P (getting an even number) = $\frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{18}{36}$

$= \frac{1}{2}$

(ii) Total times when the sum is 6 = 4

P (getting sum as 6) = $\frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{4}{36}$

$= \frac{1}{9}$

(iii) Total times when the sum is at least 6 (i.e., greater than 5) = 15

P (getting sum at least 6) = $\frac{Favourbe\ outcomes}{Total\ outcomes}$

$= \frac{15}{36}$

$= \frac{5}{12}$

Q.3 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

Answer:

et the number of blue balls be x.

Number of red balls = 5

Total number of balls = $x + 5$

Probability of getting a red ball = $\frac{Number\ of\ red\ Ball}{Total\ number\ of\ balls}$

P (getting a red ball) = $\frac{5}{x+5}$

Probability of getting a blue ball = $\frac{Number\ of\ blueBall}{Total\ number\ of\ balls}$

P (getting a blue ball) = $\frac{x}{x+5}$

It is given that,

Probability of getting a blue ball is two times the probability of getting a

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

Therefore,

$\frac{10}{x+5} = \frac{x}{x+5}$

x = 10

Hence, number of blue balls = 10.

Q.4 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

Answer:

Total number of balls = 12

Total number of black balls = x

P (getting a black ball) = $\frac{x}{12}$

If 6 more black balls are put in the box, then

Total number of balls = 12 + 6 = 18

Total number of black balls = $x + 6$

P (getting a black ball now) = $\frac{x+6}{18}$

According to the given condition,

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

$3x = x + 6$
$2x = 6$
$x = 3$

Q.5 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

Answer:

Total number of marbles = 24

Let the total number of green marbles be *x*

Then, total number of blue marbles = 24 - *x*

P (getting a green marble) = $\frac{x}{24}$

According to the condition given in the question,

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

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

$x = 16$

Therefore, total number of green marbles in the jar = 16

Hence, total number of blue marbles = 24 - *x*

= 24 - 16

= 8