

NCERT CBSE Solutions for Class 10 Mathematics**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 equally likely event. If condition of car is good, it's starting chance is high and if condition is bad it's starting chance is low. Also, it depends on various other factors and factors for both the conditions are not same.
- (II) It is not equally likely event, as it depends on player to player along with their ability.
- (III) It is an equally likely event. We have only two possible outcome and chances for both to happen is equal.
- (IV) It is an equally likely event. We have only two possible outcome and chances for both to happen is equal.

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:

When a coin is tossed, it has only two possible outcomes and they are equally likely. Hence, tossing of a coin is considered as a fair way to decide which team should get the ball at the beginning of a football game.

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:

As we know that the probability of an event is always greater than or equal to 0 and less than or equal to one. Hence, from given alternatives -1.5 can't be a probability of an event.

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

Solution:

$$P(\bar{E}) = 1 - P(E) = 1 - 0.05 = 0.95$$

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) The bag contains lemon flavoured candies only. Hence, event that Malini takes out an orange flavoured candy, is an impossible event.

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

(ii) The bag contains lemon flavoured candies only. So, the event that Malini takes out a lemon flavoured candy, is a sure event.

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

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:

Two students will either have same birthday, or they will not have the same birthday. Hence these two events are complementary events to each other. So,

Probability that two students are not having same birthday $= P(E) = 0.992$

$$\therefore \text{Probability that two students are having same birthday } P(E') = 1 - P(E) = 1 - 0.992 = 0.008$$

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:

Total number of balls in the bag $= 3 + 5 = 8$

(i) Number of red balls $= 3$

Probability of drawing a red ball

$$= \frac{\text{Number of favourable outcomes}}{\text{The total number of outcomes}} = \frac{\text{Number of red ball}}{\text{Total number of ball}} = \frac{3}{8}$$

(ii) Probability of not drawing a red ball $= 1 - \text{Probability of drawing a red ball}$

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

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

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 drawing a red marble

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{\text{Number of red marbles}}{\text{Total number of marbles}} = \frac{5}{17}$$

(ii) Number of white marbles = 8

Probability of drawing a white marble

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{\text{Number of white marbles}}{\text{Total number of marbles}} = \frac{8}{17}$$

(iii) Number of green marbles = 4

Probability of drawing a green marble

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{\text{Number of green marbles}}{\text{Total number of marbles}} = \frac{4}{17}$$

Hence, probability of not drawing a green marble

$$= 1 - \text{Probability of drawing a green marble} = 1 - \frac{4}{17} = \frac{13}{17}$$

10. A piggy bank contains hundred 50p coins, fifty ₹ 1 coins, twenty ₹ 2 coins and ten ₹ 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 ₹ 5 coin?

Solution:

Total number of coins in a piggy bank = $100 + 50 + 20 + 10 = 180$

(I) Number of 50p coins = 100

Probability that the fallen coin will be a 50p coin

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{100}{180} = \frac{5}{9}$$

(II) Number of ₹ 5 coins = 10

Probability that the fallen coin will be a ₹ 5 coin

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{10}{180} = \frac{1}{18}$$

$$\text{Probability that the fallen coin will not be a ₹ 5 coin} = 1 - \frac{1}{18} = \frac{17}{18}$$

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 figure). What is the probability that the fish taken out is a male fish?

**Solution:**

Total number of fishes in the tank = $5 + 8 = 13$

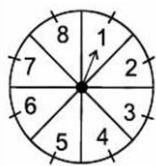
Number of male fishes in the tank = 5

Probability that a male fish is taken out

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{\text{Number of male fishes in the tank}}{\text{Total number of fishes in the tank}} = \frac{5}{13}$$

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.), 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?



Solution:

Total number of possible outcomes = 8

$$(i) \quad \text{Probability of pointing at 8} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{1}{8}$$

$$(ii) \quad \text{Total odd numbers} = 4$$

$$\text{Probability of pointing at an odd number} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{4}{8} = \frac{1}{2}$$

$$(iii) \quad \text{Total numbers greater than 2} = 6$$

Probability of pointing at a number greater than 2

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{6}{8} = \frac{3}{4}$$

$$(IV) \quad \text{Total numbers less than 9} = 8$$

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

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

- a prime number;
- a number lying between 2 and 6;
- an odd number.

Solution:

Possible outcomes in throwing a die are 1, 2, 3, 4, 5, 6.

Hence, total number of possible outcomes = 6

$$(i) \quad \text{Number of Prime numbers} = 3 \quad (2, 3 \text{ and } 5)$$

$$\text{Probability of getting a prime number} = \frac{\text{Number of prime number}}{\text{Total number of possible outcomes}} = \frac{3}{6} = \frac{1}{2}$$

$$(ii) \quad \text{Number of numbers lying between 2 and 6} = 3$$

Probability of getting a number lying between 2 and 6

$$= \frac{\text{Number of numbers lying between 2 and 6}}{\text{Total number of possible outcomes}} = \frac{3}{6} = \frac{1}{2}$$

$$(iii) \quad \text{Number of Odd numbers} = 3 \quad (1, 3 \text{ and } 5)$$

$$\text{Probability of getting an odd number} = \frac{3}{6} = \frac{1}{2}$$

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

- (i) a king of red 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 = 52

- (i) Total number of kings of red colour = 2

$$\begin{aligned}\text{Probability of getting a king of red colour} &= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} \\ &= \frac{2}{52} = \frac{1}{26}\end{aligned}$$

- (ii) Total number of face cards = 12

$$\text{Probability of getting a face card} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{12}{52} = \frac{3}{13}$$

- (iii) Total number of red face cards = 6

$$\text{Probability of getting a red face card} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{6}{52} = \frac{3}{26}$$

- (iv) Total number of jacks of hearts = 1

$$\text{Probability of getting a jack of hearts} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{1}{52}$$

- (v) Total number of spade cards = 13

$$\text{Probability of getting a spade card} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{13}{52} = \frac{1}{4}$$

- (vi) Total number of queen of diamonds = 1

$$\text{Probability of getting a queen of diamonds} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}} = \frac{1}{52}$$

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 queen = 1

$$\text{Probability of picking up a queen} = \frac{\text{Number of favourable outcomes}}{\text{total number of outcomes}} = \frac{1}{5}$$

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

- (a) Total number of aces = 1

$$\text{Probability of picking up an ace} = \frac{1}{4}$$

- (b) As queen is already drawn out, total number of queens left = 0

$$\text{Probability of picking up a queen} = \frac{0}{4} = 0$$

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

$$\text{Probability that a good pen is taken out} = \frac{\text{Number of favourable outcomes}}{\text{total number of outcomes}} = \frac{132}{144} = \frac{11}{12}$$

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 drawing a defective bulb = $\frac{\text{Number of defective bulbs}}{\text{Total number of bulbs}} = \frac{4}{20} = \frac{1}{5}$
- (ii) Remaining number of bulbs = 19
 Remaining total number of non-defective bulbs = $20 - 4 = 16$
 Probability that drawn bulb is not defective = $\frac{16}{19}$

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
 Probability of drawing a two-digit number = $\frac{81}{90} = \frac{9}{10}$
- (ii) Perfect squares from 1 to 90 are 1, 4, 9, 16, 25, 36, 49, 64, and 81
 \therefore Total number of perfect squares from 1 to 90 = 9
 Probability of drawing a perfect square = $\frac{9}{90} = \frac{1}{10}$
- (iii) Numbers from 1 to 90 that are 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 drawing 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:

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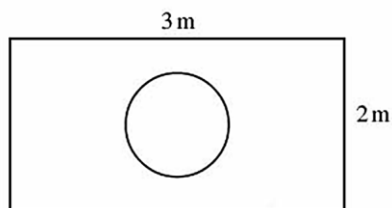
The die is thrown once. What is the probability of getting (i) A? (ii) D?

Solution:

Total number of possible outcomes on die = 6

- (i) Total number of faces with letter A on it = 2
 Hence, $P(\text{getting A}) = \frac{2}{6} = \frac{1}{3}$
- (ii) Total number of faces with letter D on it = 1
 Hence, $P(\text{getting D}) = \frac{1}{6}$

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

**Solution:**

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

Diameter of the circle = 2

\therefore Radius of the circle = $\frac{1}{2}$

Area of the circle = $\pi r^2 = \pi \left(\frac{1}{2}\right)^2 = \frac{\pi}{4} \text{ m}^2$

$P(\text{die will land inside the circle}) = \frac{\text{favourable area}}{\text{Total area}} = \frac{\frac{\pi}{4}}{6} = \frac{\pi}{24}$

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:

The total number of pens = 144

Total number of defective pens = 20

Total number of good pens = $144 - 20 = 124$

(i) $P(\text{Nuri buys a pen}) = \text{probability of drawing a good pen}$

$$= \frac{\text{Total number of good pens}}{\text{The total number of pens}} = \frac{124}{144} = \frac{31}{36}$$

(ii) $P(\text{Nuri will not buy a pen}) = \text{probability of drawing a defective pen}$

$$= \frac{\text{Total number of defective pens}}{\text{The total number of pens}} = \frac{20}{144} = \frac{5}{36}$$

22. Two dice, one blue and one grey, are thrown at the same time.

- (i) Complete the following table:

Event 'Sum on two.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 $\frac{1}{11}$. Do you agree with this argument? Justify your answer.

Solution:

- (i) To get sum as 2, possible outcome is (1, 1).
 To get sum as 3, possible outcomes are (2, 1) and (1, 2).
 To get sum as 4, possible outcomes are (3, 1), (1, 3), (2, 2).
 To get sum as 5, possible outcomes are (4, 1), (1, 4), (2, 3), (3, 2).
 To get sum as 6, possible outcomes are (5, 1), (1, 5), (2, 4), (4, 2), (3, 3).
 To get sum as 7, possible outcomes are (6, 1), (1, 6), (2, 5), (5, 2), (3, 4), (4, 3).

To get sum as 8, possible outcomes are (6, 2), (2, 6), (3, 5), (5, 3), (4, 4).

To get sum as 9, possible outcomes are (3, 6), (6, 3), (4, 5), (5, 4).

To get sum as 10, possible outcomes are (4, 6), (6, 4), (5, 5).

To get sum as 11, possible outcomes are (5, 6), (6, 5).

To get sum as 12, possible outcomes are (6, 6).

Total number of outcomes = 36

Event 'Sum of two 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) Student is arguing by thinking that events are equally likely but since, the sum 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 are not equally likely, so the probability of each of the sums will not be $\frac{1}{11}$.

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:

There are 8 possible outcomes, which are {HHH, TTT, HHT, HTH, THH, TTH, THT, HTT}.

Number of favourable outcomes = 2 (TTT and HHH)

$$P(\text{Hanif will win the game}) = \frac{2}{8} = \frac{1}{4}$$

$$\therefore P(\text{Hanif will lose the game}) = 1 - \frac{1}{4} = \frac{3}{4}$$

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 = $6 \times 6 = 36$

(i) Number of outcomes when 5 comes up 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).

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) Number of cases when 5 will come up at least once = 11

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

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:

- (i) The given statement is incorrect since, all three outcomes are not equally likely. When two coins are tossed simultaneously, then possible outcomes are (H, H), (H, T), (T, H), and (T, T).
So, the probability of getting two heads is $\frac{1}{4}$; probability of getting two tails is $\frac{1}{4}$ and probability of getting one of each is $\frac{2}{4} = \frac{1}{2}$.
- (ii) The given statement is correct since, an odd number and an even number are equally likely.
When a die is thrown possible outcomes are 1, 2, 3, 4, 5, and 6. Out of which 1, 3, 5 are odd and 2, 4, 6 are even numbers.
In other words, it can be said that when a die is thrown, there are two possible outcomes – an odd number or an even number as these outcomes are equally likely.
So, the probability of getting an odd number $= \frac{3}{6} = \frac{1}{2}$.

EXERCISE 15.2 (Optional)*

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
- the same day?
 - consecutive days?
 - different days?

Solution:

There are a total 5 days (Tuesday to Saturday). Shyam can go to the shop on any of 5 days and Ekta can also go to the shop on 5 days

So total of outcomes $= 5 \times 5 = 25$

- They can reach on same day in 5 ways, i. e. (T, T), (W, W), (Th, Th), (F, F), (S, S).
 $\therefore P(\text{both will reach on same day}) = \frac{5}{25} = \frac{1}{5}$
- They can reach on consecutive day in 8 ways,
i. e., (T, W), (W, Th), (Th, F), (F, S), (W, T), (Th, W), (F, Th), (S, F).
 $\therefore P(\text{both will reach on consecutive days}) = \frac{8}{25}$
- Since, $P(\text{both will reach on same days}) = \frac{1}{5}$
 $\therefore P(\text{both will reach on different days}) = 1 - \frac{1}{5} = \frac{4}{5}$

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 second throw		Number in first 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?

Solution:

The given table can be completed as below:

+	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 when two dice are thrown = $6 \times 6 = 36$

- (i) Total number of outcomes when the sum is even = 18

$$P(\text{getting an even number}) = \frac{18}{36} = \frac{1}{2}$$

- (ii) Total number of outcomes when the sum is 6 = 4

$$P(\text{getting sum as 6}) = \frac{4}{36} = \frac{1}{9}$$

- (iii) Total times when the sum is at least 6 = 15

$$P(\text{getting sum at least 6}) = \frac{15}{36} = \frac{5}{12}$$

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.

Solution:

Let the number of blue balls be x .

Number of red balls = 5

Total number of balls = $x + 5$

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

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

As per the given information,

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

$$\Rightarrow 10(x+5) = x^2 + 5x$$

$$\Rightarrow x^2 - 5x - 50 = 0$$

$$\Rightarrow x^2 - 10x + 5x - 50 = 0$$

$$\Rightarrow x(x-10) + 5(x-10) = 0$$

$$\Rightarrow (x-10)(x+5) = 0$$

$$\Rightarrow x-10 = 0 \text{ or } x+5 = 0$$

$$\Rightarrow x = 10 \text{ or } x = -5$$

Hence, number of blue balls is 10. (Since, the number of balls cannot be negative)

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 .

Solution:

Total number of balls = 12

Total number of black balls = x

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

Now, 6 more black balls are put in the box.

Total number of balls = $12 + 6 = 18$

Total number of black balls = $x + 6$

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

As per the given information,

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

$$3x = x + 6$$

$$2x = 6$$

$$x = 3$$

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 marbles in the jar.

Solution:

Total Number of marbles = 24

Let the total number of green marbles be x .

\therefore Total number of the blue marbels = $24 - x$

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

As per the given information,

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

$$x = 16$$

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

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