Probability

NCERT TEXTBOOK QUESTIONS SOLVED

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 ..... .*

Sol. (*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 or certain 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**.

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.

Sol. (*i*) Since, the car may or may not start, thus the outcomes are **not** equally likely.

(*ii*) The player may shoot or miss the shot.

∴ The outcomes are **not** equally likely.

(*iii*) In advance it is known that the answer is to be either right or wrong.

∴ The outcomes right or wrong are **equally likely to occur.**

(*iv*) In advance it is known the newly born baby has to be either a boy or a girl.

∴ The outcomes either a boy or a girl are **equally likely to occur.**

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?*

Sol. Since on tossing a coin, the outcomes '*head*' and '*tail*' are equally likely, the result of tossing a coin is completely unpredictable and so it is a fair way.

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

Sol. Since, the probability of an event cannot be negative,

∴ **(B) –1.5** cannot be the probability of **an event.**

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

Sol. ∵ $P_{(E)} + P_{(\text{not } E)} = 1$

∴ $0.05 + P_{(\text{not } E)} = 1 \Rightarrow P_{(\text{not } E)} = 1 - 0.05$

$= 0.95$

Thus, probability of 'not E' = **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?

Sol. (*i*) Since, there are lemon flavoured candies only in the bag,

∴ Taking out any orange flavoured candy is not possible.

⇒ Probability of taking out an orange flavoured candy = **0.**

(*ii*) Also, probability of taking out 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?*

Sol. ∴ Let the probability of 2 students having same birthday = $P_{(SB)}$
And the probability of 2 students not having the same birthday = $P_{(nSB)}$
∴ $P_{(nSB)} + P_{(nSB)} = 1$
⇒ $P_{(SB)} + 0.992 = 1$
⇒ $P_{(SB)} = 1 - 0.992 = 0.008$
So, the required probability of 2 boys having the same birthday = **0.008**.

Q. 8. *A bag contains 3 red balls and 5 black balls. A ball is drawn at random frm the bag. What is the probability that the ball drawn is (i) red? (ii) not red?* (CBSE 2012)

Sol. Total number of balls = 3 + 5 = 8
∴ Number of all possible outcomes = 8

(*i*) **For red balls:**
∵ There are 3 red balls.
∴ Number of favourable outcomes = 3

$$\therefore \quad P_{Red} = \frac{\text{Number of favourable outcomes}}{\text{Number of all possible outcomes}} = \frac{\mathbf{3}}{\mathbf{8}}$$

(*ii*) **For not red balls:**
Probability of the ball drawn which is not red

$$= 1 - \frac{3}{8} = \frac{8-3}{8} = \frac{\mathbf{5}}{\mathbf{8}}.$$

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? and (ii) white? (iii) not green?*

Sol. Total number of marbles = 5 + 8 + 4 = 17

(*i*) **For red marbles:**
∵ Number of red marbles = 5
∴ Number of favourable outcomes = 5

∴ Probability of red marbles, $P_{(red)} = \frac{\mathbf{5}}{\mathbf{17}}$

(*ii*) **For white balls:**
∵ Number of white balls = 8
∴ Probability of white balls,

$$P_{(white)} = \frac{\mathbf{8}}{\mathbf{17}}$$

(*iii*) **For not green balls:**
∵ Number of white balls = 4
∴ Number of 'not green' balls = 17 – 4 = 13
i.e., Favourable outcomes = 13
∴ Probability of ball 'not green'

$$P_{(\text{not green})} = \frac{\mathbf{13}}{\mathbf{17}}$$

OR

Number of green marbles' = 4
∴ Number of 'not green balls' = 17 – 4 = 13
⇒ Favourable outcomes = 13

$$\therefore \quad P_{(\text{not green})} = \frac{\mathbf{13}}{\mathbf{17}}$$

Q. 10. *A piggy bank contains hundred 50p coins, fifty Re 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 50p coin? and (ii) will not be ₹ 5 coin?*

Sol. Number of:

50 p coins = 100
Re 1 coins = 50
₹ 2 coins = 20
₹ 5 coins = 10

Total number of coins = 100 + 50 + 20 + 5 = 180

(*i*) **For a 50 p coin:**

Favourable events = 100

$\therefore P_{(50\text{ p})} = \frac{100}{180} = \mathbf{\frac{5}{9}}$

(*ii*) **For not a ₹ 5 coin:**

$\because$ Number of ₹ 5 coins = 10

$\therefore$ Number of 'not ₹ 5' coins = 180 – 10 = 170

$\Rightarrow$ Favourable outcomes = 170

$\therefore P_{(\text{not 5 rupee coin})} = \frac{170}{180} = \mathbf{\frac{17}{18}}$.

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

Sol. Number of:

Male fishes = 5
Female fishes = 8

$\therefore$ Total number of fishes = 5 + 8 = 13

$\Rightarrow$ Total number of outcomes = 13

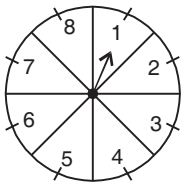
For a male fish:

Number of favourable outcomes = 5

$\therefore P_{(\text{male fish})} = \mathbf{\frac{5}{13}}$.

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 figure), 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?*



Sol. Total numbers marked = 8

(*i*) **When pointer points at 8:**

Total number of outcomes = 8

Number of favourable outcomes = 1

$\therefore P_{(8)} = \frac{\text{No. of favourable outcomes}}{\text{Total number of possible outcomes}}$

$= \mathbf{\frac{1}{8}}$

(*ii*) **When pointer points at an odd number:**

Number of odd numbers from 1 to 8 = 4 [$\because$ *Odd numbers are 1, 3, 5 and 7*]

$\Rightarrow$ Number of favourable outcomes = 4

$$\therefore \quad P_{(\text{odd})} = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} = \frac{4}{8} = \mathbf{\frac{1}{2}}$$

(*iii*) **When pointer points at a number greater than 2:**

Number of numbers greater than 2 = 6

[$\because$ *The numbers 2, 3, 4, 5, 6, 7 and 8 are greater than 2*]

$\Rightarrow$ Number of favourable outcomes = 6

$$\therefore \quad P_{(\text{greater than 2})} = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$= \frac{6}{8} = \mathbf{\frac{3}{4}}.$$

(*iv*) **When pointer points a number less than 9:**

Number of numbers less than 9 = 8

[$\because$ *The numbers 1, 2, 3, 4, 5, 6, 7 and 8 are less than 9*]

$\therefore$ Number of favourable outcome = 8

$$\Rightarrow \quad P_{(\text{greater than 9})} = \frac{\text{Favourable outcomes}}{\text{Total possible outcomes}}$$

$$= \frac{8}{8} = \mathbf{1}.$$

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.

Sol. Since, numbers on a die are 1, 2, 3, 4, 5, and 6.

$\therefore$ Number of total outcomes = 6

(*i*) **For prime numbers:**

Since 2, 3, and 5 are prime number,

$\therefore$ Favourable outcomes = 3

$$P_{(\text{prime})} = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$= \frac{3}{6} = \mathbf{\frac{1}{2}}.$$

(*ii*) **For a number lying between 2 and 6:**

Since the numbers between 2 and 6 are 3, 4 and 5

$\therefore$ Favourable outcomes = 3

$$\therefore \quad \text{Required probability} = \frac{\text{Favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$= \frac{3}{6} = \mathbf{\frac{1}{2}}$$

(*iii*) **For an odd number:**

Since 1, 3 and 5 are odd numbers.

$\Rightarrow$ Favourable outcomes = 3

$$\therefore \quad \text{Required probability} = \frac{3}{6} = \mathbf{\frac{1}{2}}.$$

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

(i) a king of red colour *(ii) a face card* *(iii) a red face card*

(iv) the jack of hearts *(v) a spade* *(vi) the queen of diamonds*

Sol. Number of cards in deck = 52

$\therefore$ Total number of possible outcomes = 52

(*i*) **For a king of red colour:**

$\because$ Number of red colour kings = 2 [$\because$ *Kings of diamond and heart are red*]

$\therefore$ Number of favourable outcomes = 2

$$\Rightarrow \quad E_{(\text{red king})} = \frac{2}{52} = \frac{\mathbf{1}}{\mathbf{26}}.$$

(*ii*) **For a face card:**

$\because$ 4 kings, 4 queens and 4 jacks are face cards

$\therefore$ Number of face cards = 12

$\Rightarrow$ Number of favourable outcomes = 12

$$\therefore \quad P_{(\text{face})} = \frac{12}{52} = \frac{\mathbf{3}}{\mathbf{13}}$$

(*iii*) **For a red face card:**

Since, cards of diamond and heart are red

$\therefore$ There are [2 kings, 2 queens, 2 jacks] 6 cards are red

$\Rightarrow$ Favourable outcomes = 6

$$\therefore \quad P_{(\text{red face})} = \frac{6}{52} = \frac{\mathbf{3}}{\mathbf{26}}$$

(*iv*) **For a jack of hearts:**

Since, there is only 1 jack of hearts.

$\therefore$ Number of favourable outcomes = 1

$$\therefore \quad P_{(\text{Jack of hearts})} = \frac{\text{Number of favourable outcomes}}{\text{All possible outcomes}}$$

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

(*v*) **For a spade:**

$\because$ There are 13 spades in a pack of 52 cards:

$\therefore$ Favourable outcomes are 13.

$$\Rightarrow \quad P_{(\text{spade})} = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$= \frac{13}{52} = \frac{\mathbf{1}}{\mathbf{4}}$$

(*vi*) **For the queen of diamonds:**

$\because$ There is only one queen of diamond.

$\therefore$ Number of favourable outcomes.

$$\Rightarrow \quad P_{(\text{queen of diamonds})} = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$= \frac{\mathbf{1}}{\mathbf{52}}.$$

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? and (b) a queen?*

Sol. We have five cards.

$\therefore$ All possible outcomes = 5

(*i*) **For a queen:**

$\because$ Number of queens = 1

$$\Rightarrow \quad P_{(\text{queen})} = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

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

(*ii*) The queen is drawn and put aside,

$\therefore$ Only 5 – 1 = 4 cards are left,

$\Rightarrow$ All possible outcomes = 4

(*a*) **For an ace:**

$\because$ There is only one ace

$\therefore$ Number favourable outcomes = 1

$$\Rightarrow P_{(\text{an ace})} = \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}}$$

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

(*b*) **For a queen:**

Since, the only queen has already been put aside.

$\therefore$ Number of possible outcomes = 0

$$\Rightarrow P_{(\text{a queen})} = \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}}$$

$$= \frac{0}{4} = 0.$$

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.*

Sol. We have

Number of good pens = 132

Number of defective pens = 12

$\therefore$ Total number of pens = 132 + 12 = 144

For good pens:

$\because$ There are 132 good pens

$\therefore$ Number of favourable outcomes = 132

$$\Rightarrow \quad P_{(\text{good pens})} = \frac{\text{Number of favourable outcomes}}{\text{Total possible outcomes}}$$

$$= \frac{132}{144} = \mathbf{\frac{11}{12}}.$$

Q. 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?*

Sol. Since, there are 20 bulbs in the lot.

$\therefore$ Total number of possible outcomes = 20

(*i*) $\because$ Number defective bulbs = 4

i.e., Favourable outcomes = 4

$$\Rightarrow \quad P_{(\text{defective bulb})} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

$$= \frac{4}{20} = \frac{1}{5}$$

(*ii*) $\because$ The bulb drawn above is not included in the lot.

$\therefore$ Remaining number of bulbs = 20 – 1 = 19.

$\Rightarrow$ Total number of possible outcomes = 19.

$\because$ Number of bulbs which are not defective = 19 – 4 = 15

$\Rightarrow$ Favourable number of outcomes = 15

$$\therefore \quad P_{(\text{not defective bulb})} = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

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

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 and (iii) a number divisible by 5.*

Sol. We have:

Total number of discs = 90

$\therefore$ Total number of possible outcomes = 90

(*i*) **For a two-digit number:**

Since the two-digit numbers are 10, 11, 12, ..., 90.

$\therefore$ Number of two-digit numbers = 90 – 9 = 81

[$\because$ *1, 2, 3, 4, 5, 6, 7, 8, and 9 are 1-digit numbers*]

$\Rightarrow$ Number of favourable outcomes = 81

$$\therefore \quad P_{(\text{two-digit number})} = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$= \frac{81}{90} = \mathbf{\frac{9}{10}}$$

(*ii*) **For a perfect square:**

Perfect squares from 1 to 90 are 1, 4, 9, 16, 25, 36, 49, 64, and 81

$\therefore$ Number of perfect numbers = 9

$\Rightarrow$ Number of favourable outcomes = 9

$$\therefore \quad P_{(\text{perfect number})} = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$= \frac{9}{90} = \mathbf{\frac{1}{10}}$$

(*iii*) **For a number divisible by 5:**

Numbers divisible by 5 [from 1 to 90] are: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90

i.e. There are 18 number (1 to 90) which are divisible by 5.

$\therefore$ Number of favourable outcomes = 18

$$\Rightarrow \quad P_{(\text{Divisible by 5})} = \frac{\text{Number of favourable outcomes}}{\text{All possible outcomes}}$$

$$= \frac{18}{90} = \mathbf{\frac{1}{5}}.$$

Q. 19. *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? and (ii) D?

Sol. Since there are six faces of the given die and these faces are marked with letters

A	B	C	D	E	A

$\therefore$ Total number of letters = 6

$\Rightarrow$ Number of possible outcomes = 6

(*i*) **For the letter *A***

$\because$ Two faces are having the letter *A*.

$\therefore$ Number of favourable outcomes = 2

$$\text{Now, } P_{(\text{letter } A)} = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

$$= \frac{2}{6} = \frac{\mathbf{1}}{\mathbf{3}}$$

(*ii*) **For the letter *D*:**

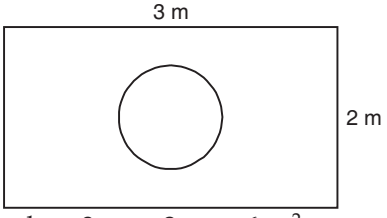
$\because$ Number of *D*'s = 1

$\therefore$ Number of possible outcomes = 1

$$\Rightarrow \quad P_{(\text{letter } D)} = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

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

Q. 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 1 m?*



Sol. Here, Area of the rectangle = 3 m × 2 m = 6 m^2

And, the area of the circle = πr^2

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

$$= \frac{\pi}{4} m^2$$

$\therefore$ Probability for the die to fall inside the circle

$$= \frac{\text{Area of the favourable region}}{\text{Area of the whole region}}$$

$$= \frac{\text{Area of the circle}}{\text{Area of the rectangle}}$$

$$= \frac{\left[\frac{\pi}{4}\right]}{6} = \frac{\pi}{4} \times \frac{1}{6} = \frac{\boldsymbol{\pi}}{\mathbf{24}}.$$

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? (CBSE 2012)

Sol. Total number of ball pens = 144

$\Rightarrow$ All possible outcomes = 144

(*i*) Since there are 20 defective pens

$\therefore$ Number of good pens 144 – 20 = 124

$\Rightarrow$ Number of favourable outcomes = 124

$\therefore$ Probability that she will buy it

$$= \frac{124}{144} = \frac{\mathbf{31}}{\mathbf{36}}$$

(*ii*) Probability that she will not buy it

= 1 – [Probability that she will buy it]

$$= 1 - \frac{31}{36}$$

$$= \frac{36 - 31}{36} = \frac{\mathbf{5}}{\mathbf{36}}.$$

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	$\frac{1}{36}$						$\frac{5}{36}$				$\frac{1}{36}$

(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.*

Sol. $\because$ The two dice are thrown together.

$\therefore$ Following are the possible outcomes:

(1, 1); (1, 2); (1, 3); (1, 4); (1, 5); (1, 6).
(2, 1); (2, 2); (2, 3); (2, 4); (2, 5); (2, 6).
(3, 1); (3, 2); (3, 3); (3, 4); (3, 5); (3, 6).
(4, 1); (4, 2); (4, 3); (4, 4); (4, 5); (4, 6).
(5, 1); (5, 2); (5, 3); (5, 4); (5, 5); (5, 6).
(6, 1); (6, 2); (6, 3); (6, 4); (6, 5); (6, 6).

$\Rightarrow$ Number of all possible outcomes is 6 × 6 = 36.

(*i*) Let the required probability be $P(E)$.

(*a*) $\because$ The sum on two dice is 3 for: (1, 2) and (2, 1)

$\therefore$ Favourable outcomes = 2

$$\Rightarrow \quad P(E) = \frac{2}{36}$$

(*b*) $\because$ The sum on two dice is 4 for: (1, 3), (2, 2) and (3, 1).

$\therefore$ Number of favourable outcomes = 3

$$\Rightarrow \quad P(2) = \frac{3}{36}$$

(*c*) ∵ The sum on two dice is 5 for:
(1, 4), (2, 3), (3, 2) and (4, 1)
∴ Number of favourable outcomes = 4

$\Rightarrow \quad P(E) = \frac{4}{36}$

(*d*) The sum on two dice is 6 for:
(1, 5), (2, 4), (3, 3), (4, 2) and (5, 1)
∴ Number favourable outcomes = 5

$\Rightarrow \quad P(E) = \frac{5}{36}$

(*e*) The sum on two dice is 7 for:
(1, 6), (2, 5), (3, 4), (4, 3), (5, 2) and (6, 1)
∴ Number of favourable outcomes = 6

$\Rightarrow \quad P(E) = \frac{6}{36}$

(*f*) The sum on two dice is 9 for:
(3, 6), (4, 5), (5, 4) and (6, 3)
∴ Number of favourable outcome = 4

$\Rightarrow \quad P(E) = \frac{4}{36}$

(*g*) The sum on two dice is 10 for:
(4, 6), (5, 5), (6, 4)
∴ Number of favourable outcomes = 3

$\Rightarrow \quad P(E) = \frac{3}{36}$

(*h*) The sum on two dice is 11 for:
(5, 6) and (6, 5)
∴ Number of favourable outcomes = 2

$\Rightarrow \quad P(E) = \frac{2}{36}$

Thus, the complete table is as under:

Event: 'Sum on 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*) No. The number of all possible outcomes is 36 and not 11.
∴ The argument is not correct.

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.*

Sol. Let *T* denotes the tail and *H* denotes the head.
∴ All the possible outcomes are:
H H H, H H T, H T T, T T T, T T H, T H T, T T H, H T H
∴ Number of all possible outcomes = 8
Let the event that Hanif will lose the game be denoted by *E*.

$\therefore$ Favourable events are:

$H\,H\,T,\quad H\,T\,H,\quad T\,H\,H,\quad T\,H\,T,\quad T\,T\,H,\quad H\,T\,T$

$\Rightarrow$ Number of favourable outcomes = 3

$$\therefore \qquad P(E) = \frac{6}{8} = \frac{\mathbf{3}}{\mathbf{4}}.$$

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.]*

Sol. Since, throwing a die twice or throwing two dice simultaneously is the same.

$\therefore$ All possible outcomes are:

(1, 1); (1, 2); (1, 3); (1, 4); (1, 5); (1, 6)
(2, 1); (2, 2); (2, 3); (2, 4); (2, 5); (2, 6)
(3, 1); (3, 2); (3, 3); (3, 4); (3, 5); (3, 6)
(4, 1); (4, 2); (4, 3); (4, 4); (4, 5); (4, 6)
(5, 1); (5, 2); (5, 3); (5, 4); (5, 5); (5, 6)
(6, 1); (6, 2); (6, 3); (6, 4); (6, 5); (6, 6)

$\therefore$ All possible outcomes = 36

(*i*) Let E be the event that 5 does not come up either time, then

The favourable outcomes are [36 – (5 + 6)] = 25

$$\Rightarrow \qquad P(E) = \frac{\mathbf{25}}{\mathbf{36}}$$

(*ii*) Let N be the event that 5 will come up at least once, then Number of favourable outcomes = 5 + 6 = 11

$$\therefore \qquad P(N) = \frac{\mathbf{11}}{\mathbf{36}}.$$

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 $\frac{1}{2}$.

Sol. (*i*) Not correct.

Because, the situation **'one of each'** can result in two ways HT and TH.

$\therefore$ The probability = $\frac{1}{4}$.

(*ii*) Correct.

Because the two outcomes are possible.

NCERT TEXTBOOK QUESTIONS SOLVED

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?*

Sol. Here, the number of all the possible outcomes

$= 5 \times 5 = 25$

(*i*) **For both customers visiting same day:**

Number of favourable outcomes = 5

[$\because$ *(Tue., Tue.), (Wed., Wed.), (Thu., Thu.), (Fri., Fri.), (Sat., Sat.)*]

$\therefore$ Required probability $= \frac{5}{25} = \mathbf{\frac{1}{5}}$

(*ii*) **For both the customers visiting on consecutive days:**

Number of outcomes are:

(Tue., Wed.), (Wed., Thu.), (Thu., Fri.), (Fri., Sat.), (Sat., Fri.), (Wed., Tue.), (Thu., Wed.), (Fri., Thu.)

$\therefore$ Number of favourable outcomes = 8

$\Rightarrow$ Required probability $= \mathbf{\frac{8}{25}}$

(*iii*) **For both the customers visiting on different days:**

We have probability for both visiting same day $= \frac{1}{5}$

$\therefore$ Probability for both visiting on different days

= 1 – [Probability for both visiting on the same day]

$= 1 - \left[\frac{1}{5}\right] = \frac{5-1}{5} = \frac{4}{5}$

$\Rightarrow$ The required probability $= \mathbf{\frac{4}{5}}$.

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						
	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?

Sol. The completed table is as under:

	1	2	3	4	5	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

$\therefore$ Number of all possible outcomes = 36

(*i*) **For total score being even:**

Favourable outcomes = 18

[$\because$ *The even outcomes are: 2, 4, 4, 4, 4, 8, 4, 4, 8, 4, 6, 6, 4, 6, 6, 8, 8*]

$\therefore$ The required probability = $\frac{18}{36} = \mathbf{\frac{1}{2}}$

(*ii*) **For the score being 6:**

In list of score, we have four 6' s.

$\therefore$ Favourable outcomes = 4

$\therefore$ Required probability = $\frac{4}{36} = \mathbf{\frac{1}{9}}$

(*iii*) **For the score being at least 6:**

The favourable scores are:

7, 8, 8, 6, 6, 9, 6, 6, 9, 7, 8, 8, 9, 9 and 12

$\therefore$ Number of favourable outcomes = 15

$\Rightarrow$ Required probability = $\frac{15}{36} = \mathbf{\frac{5}{12}}$.

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.*

Sol. Let the number of blue balls in the bag be x.

$\therefore$ Total number of balls = $x + 5$

Number of possible outcomes = $(x + 5)$.

For a blue ball favourable outcomes = x

$\therefore$ Probability of **drawing a blue ball**

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

Similarly, probability of **drawing a red ball**

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

Now, we have

$$\frac{x}{x+5} = 2\left[\frac{5}{x+5}\right]$$

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

Thus the required 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.

Sol. ∵ The total number of balls in the box = 12
∴ Number of possible outcomes = 12
Case-I: For drawing a black ball
Number of favourable outcomes = x

∴ Probability of getting a black ball = $\frac{x}{12}$

Case-II: When 6 more black balls are added
Now, the total number of balls
= 12 + 6
= 18
⇒ Number of possible outcomes = 18
Since, the number of black balls now
= $(x + 6)$.
⇒ Number of favourable outcomes = $(x + 6)$

∴ Required probability = $\frac{x+6}{18}$

Applying the given condition:

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

$$\therefore \quad 12(x+6) = 36x \Rightarrow 12x + 72 = 36x$$

$$\Rightarrow \quad 36x - 12x = 72 \Rightarrow 24x = 72$$

$$\Rightarrow \quad x = \frac{72}{24} = 3$$

Thus, the required value of x is **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.*

Sol. ∵ There are 24 marbles in the jar.
∴ Number of possible outcomes = 24.
Let there are x blue marbles in the jar.
∴ Number of green marbles = $24 - x$
⇒ Favourable outcomes = $(24 - x)$
∴ Required probability for drawing a green marble

$$= \frac{24-x}{24}$$

Now, according to the condition, we have:

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

$$\Rightarrow \quad 3(24-x) = 2 \times 24$$

$$\Rightarrow \quad 72 - 3x = 48$$

$$\Rightarrow \quad 3x = 72 - 48$$

$$\Rightarrow \quad 3x = 24$$

$$\Rightarrow \quad x = \frac{24}{3} = 8$$

Thus, the required number of blue balls is **8.**

MORE QUESTIONS SOLVED

I. VERY SHORT ANSWER TYPE QUESTIONS

Q. 1. *A letter is chosen at random from English alphabet. Find the probability that the letter chosen precedes 'g'.*

Sol. Total number of letters in English alphabet is 26.

$\therefore$ Total number of possible outcomes = 26

$\because$ Letters preceding '*g*' are:

a, b, c, d, e and *f*

$\therefore$ Favourable outcomes = 6

$\Rightarrow$ Required probability = $\frac{6}{26} = \frac{\mathbf{3}}{\mathbf{13}}$.

Q. 2. *A letter of English alphabet is chosen at random. Determine the probability that the letter is a consonant.* [NCERT Exemplar]

Sol. There are 26 letters in English alphabets.

$\Rightarrow$ Possible outcomes = 26

$\because$ There are 5 vowels (*a, e, i, o, u*) and remaining are consonants.

$\therefore$ Number of consonants = 26 – 5 = 21

$\Rightarrow$ Favourable outcomes = 21

$\therefore P_{(\text{consonants})} = \frac{21}{26}$

Q. 3. *A bag contains 9 black and 12 white balls. One ball is drawn at random. What is the probability that the ball drawn is black?*

Sol. Total number of balls = 9 + 12 = 21

$\Rightarrow$ Number of possible outcomes = 21

Number of black balls = 9

$\Rightarrow$ Number of favourable outcomes = 9

$\therefore$ Required probability = $\frac{9}{21} = \frac{\mathbf{3}}{\mathbf{7}}$.

Q. 4. *Find the probability that a number selected from the numbers 1 to 25 which is not a prime number when each of the given number is equally likely to be selected.*

Sol. Total number of given numbers = 25

Since the numbers 2, 3, 5, 7, 11, 13, 17, 19 and 23 are prime number.

There are 9 numbers.

$\therefore$ Number of numbers that are not prime = 25 – 9 = 16

$\therefore$ Number of favourable outcomes = 16

$\Rightarrow$ Required probability = $\frac{\mathbf{16}}{\mathbf{25}}$.

Q. 5. *A die is thrown once. Find the probability of getting an odd number.*

Sol. Total number of possible outcomes = 6

[$\because$ *Numbers 1 to 6 are marked on the faces of a die*]

$\because$ odd numbers are 1, 3 and 5

$\therefore$ Favourable outcomes = 3

$\therefore$ Required probability = $\frac{3}{6} = \frac{\mathbf{1}}{\mathbf{2}}$.

Q. 6. *Cards each marked with one of the numbers 6, 7, 8, ..., 15 and placed in a box and mixed thoroughly. One card is drawn at random from the box. What is the probability of getting a card with number less than 10?* (AI CBSE 2008 C)

Sol. ∵ There are 10 cards.

∴ Total number of possible outcomes = 10

Cards marked with a number less than 10 are: 6, 7, 8 and 9

i.e. The number of favourable outcomes = 4

$$\therefore \quad P(E) = \frac{4}{10} \quad \text{or} \quad \frac{\mathbf{2}}{\mathbf{5}}.$$

Q. 7. *A card is drawn at random from a well-shuffled deck of 52 cards. What is the probability of getting a black king?* (CBSE 2009 C)

Sol. ∵ Total number of cards = 52

∴ Number of possible outcomes = 52

Number of black king = 2

$$\therefore \quad P_{(\text{Black king})} = \frac{2}{52} = \frac{\mathbf{1}}{\mathbf{26}}.$$

Q. 8. *What is the probability that two different friends have different birthdays? (Ignoring leap year).* (CBSE 2009 C)

Sol. Number of days in a year = 365

⇒ Number of possible outcomes = 365

Since they have different birthdays.

∴ Number of favourable outcomes = 365 – 1 = 364

$$\therefore \quad P(E) = \frac{\mathbf{364}}{\mathbf{365}}.$$

Q. 9. *A box contains 3 blue, 2 white and 4 red marbles. If a marble is drawn at random from the box, what is the probability that it will not be a white marble?* (CBSE 2009 C)

Sol. Total number of balls = 3 + 2 + 4 = 9

∴ Number of possible outcomes = 9

Since, number of white balls = 2

∴ Number of balls which are not white

= 9 – 2 = 7

⇒ Number of favourable outcomes = 7

$$\therefore \quad P(E) = \frac{\mathbf{7}}{\mathbf{9}}.$$

Q. 10. *From a well-shuffled pack of cards, a card is drawn at random. Find the probability of getting a black queen.* (CBSE 2012)

Sol. ∵ Total number of cards = 52

Since, the number of black queens = 2

∴ Number of favourable outcomes = 2

$$\Rightarrow \quad P(E) = \frac{2}{52} = \frac{\mathbf{1}}{\mathbf{26}}.$$

Q. 11. *A bag contains 4 red and 6 black balls. A ball is taken out of the bag at random. Find the probability of getting a black ball.* (AI CBSE 2008)

Sol. Total number of balls = 4 + 6 = 10

⇒ All possible outcomes = 10

Since, number of black balls = 6

$\therefore$ Number of favourable outcomes = 6

$\Rightarrow$ $P(E) = \frac{6}{10}$ or $\frac{3}{5}$.

Q. 12. *A die is thrown once. Find the probability of getting a number less than 3.* (AI F 2008)

Sol. Numbers on the faces are 1, 2, 3, 4, 5 and 6.

$\therefore$ Number of possible outcomes = 6

Numbers less than 3 are 1 and 2.

$\Rightarrow$ Number of favourable outcomes = 2

$\therefore$ $P(E) = \frac{2}{6}$ or $\frac{1}{3}$.

Q. 13. *A die is thrown once. Find the probability of getting a number greater than 5.* (AI F 2008)

Sol. Total number of possible outcomes = 6

Since only one number *i.e.,* 6 is greater than 5

$\therefore$ Favourable number of outcomes = 1

$\Rightarrow$ $P(E) = \frac{1}{6}$.

Q. 14. *Find the probability of obtaining 7 on a single toss of one die.*

Sol. Numbers marked on a die are:

$\boxed{1}, \boxed{2}, \boxed{3}, \boxed{4}, \boxed{5}, \boxed{6}$

$\therefore$ There are six different possible outcomes.

But none of these outcomes would produce a 7.

$\Rightarrow$ Favouable outcome = 0

$\therefore$ $P_{(7)} = \frac{0}{6} = 0$

When an event cannot possibly succeed, we say it is an impossible event and probability of an impossible event is zero.

i.e. $P_{(\text{impossible event})} = 0$

Q. 15. *Cards bearing numbers 3 to 20 are placed in a bag and mixed thoroughly. A card is taken out from the bag at random. What is the probability that the number on the card taken out is an even number?* (CBSE 2008 C)

Sol. Total number of cards (3 to 20) = 18

$\therefore$ Number of possible outcomes = 18

Since cards having even numbers (4, 6, 8, 10, 12, 14, 16, 18 and 20) are 9,

$\therefore$ Number of favourable outcomes = 9

$\therefore$ $P(E) = \frac{9}{18}$ or $\frac{1}{2}$.

Q. 16. *Two friends were born in the year 2000. What is the probability that they have the same birthday ?* (AI CBSE 2008 C)

Sol. Since the year 2000 was a leap year,

$\therefore$ Total number of days in the year = 366

$\because$ They have the same birthday.

$\therefore$ Number of favourable outcomes = 1

$\Rightarrow$ $P(E) = \frac{1}{366}$.

Q. 17. *A box contains cards marked with numbers 5 to 20. A card is drawn from the bag at random. Find the probability of getting a number which is a perfact square.* (AI CBSE 2008 C)

Sol. ∵ Total number of cards = 16

∴ Possible outcomes are 16.

Since the numbers 9 and 16 are perfect numbers,

⇒ Number of favourable outcomes = 2

$$\therefore \quad P(E) = \frac{2}{16} \quad \text{or} \quad \mathbf{\frac{1}{8}}.$$

II. SHORT ANSWER TYPE QUESTIONS

Q. 1. *Two dice are thrown at the same time. Find the probability of getting different numbers on the dice.* (CBSE Sample Paper 2011)

Sol. Since the two dice are thrown simultaneously.

∴ Total number of outcomes = 6 × 6 = 36

Number of outcomes for getting same numbers on both dice = 6

$$\Rightarrow \quad P(\text{same numbers}) = \frac{6}{36} = \frac{1}{6}$$

Now, P (different numbers) + P (same numbers) = 1

$$\Rightarrow \quad P(\text{different numbers}) = 1 - P(\text{same numbers})$$

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

$$= \frac{5}{6}.$$

Q. 2. *Two dice are thrown at the same time. Find the probability of getting same number on both dice.*

Sol. Total number of outcomes = 6 × 6 = 36

∴ Following are the outcomes that have same number on both dice are:

(1, 1), (2, 2), (3, 3), (4, 4), (5, 5) and (6, 6)

∴ Favourable outcomes = 6

$$\Rightarrow \text{Required probability} = \frac{6}{36} = \mathbf{\frac{1}{6}}.$$

Q. 3. *A bag contains 10 red, 5 blue and 7 green balls. A ball is drawn at random. Find the probability of this ball being not a blue ball.*

Sol. Total number of balls = 10 + 5 + 7 = 22

∴ Number of possible outcomes = 22

Since there are 5 blue balls.

∴ Number of balls which are not blue

= 22 − 5 = 17

∴ Favourable outcomes = 17

$$\Rightarrow \text{Required probability} = \mathbf{\frac{17}{22}}.$$

Q. 4. *Two dice are thrown at the same time and the product of numbers appearing on them is noted. Find the probability that the product is less than 9.*

Sol. Total number of possible outcomes = 6 × 6 = 36

∵ The outcomes such that the product of numbers appearing on the faces is less than 9 are:

(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (3, 1), (3, 2), (4, 1), (4, 2), (5, 1) and (6, 1).

$\therefore$ Number of favourable outcomes = 16

$\Rightarrow$ Required probability = $\frac{16}{36} = \frac{\mathbf{4}}{\mathbf{9}}$.

Q. 5. *An integer is chosen between 0 and 100. What is the probability that it is divisible by 7?*

Sol. $\because$ Numbers between 0 and 100 are 99.

$\therefore$ Total possible outcomes = 99

Since following numbers are divisible by 7 :

7, 14, 21, 28, 35, 42, 49, 56, 63, 70, 77, 84, 91 and 98.

$\therefore$ Favourable outcomes = 14

$\Rightarrow$ Required probability = $\frac{14}{99}$.

Q. 6. *A letter of English alphabet is chosen at random. Determine the probability that the letter is consonant.*

Sol. $\because$ There are 26 letters of English alphabet

$\therefore$ Number of possible outcomes = 26

Since, there are 21 consonants of the English alphabets.

$\therefore$ Favourable outcomes = 21

$\Rightarrow$ Required probability = $\frac{\mathbf{21}}{\mathbf{26}}$.

Q. 7. *Cards with numbers 2 to 101 are placed in a box. A card is selected at random. Find the probability that the card has a square number.* [(CBSE Sample Paper 2011, CBSE 2012)]

Sol. Number of numbers between 2 to 101 are 100

$\therefore$ Total number of possible outcomes = 100

Since, the perfect numbers between 2 and 101 are:

4, 9, 16, 25, 36, 49, 64, 81 and 100

$\therefore$ Number of favourable outcomes = 9

$\Rightarrow$ Required probability = $\frac{\mathbf{9}}{\mathbf{100}}$.

Q. 8. *In a game of chance there is spinning of an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 and there are equally likely outcomes. What is the probability that it will point at*

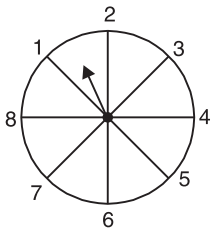
(i) 7? *(ii) an odd number?*

(iii) a number less than 9? (CBSE 2012)

Sol. Since, following numbers are marked on the disc:

1, 2, 3, 4, 5, 6, 7, 8

$\Rightarrow$ Possible outcomes in each case are 8.



(*i*) Possible outcomes = 8

Favourable otucome = 1 ($\therefore$ only the number 7)

$\therefore$ $P_{(\text{The number 7})} = \frac{1}{8}$

(*ii*) $\because$ Odd numbers on the disc are

1, 3, 5 and 7

$\therefore$ Favourable outcomes = 4

$\Rightarrow$ $P_{(\text{Odd number})} = \frac{4}{8} \quad \frac{1}{2}$

(*iii*) ∵ The numbers less than 9 on the disc are:

1, 2, 3, 4, 5, 6, 7, 8, (i.e. 8 outcomes)

∴ Favourable outcomes = 8

$$\Rightarrow \quad P_{(\text{number less than 9})} = \frac{8}{8} = 1$$

Q. 9. *From a group of 2 boys and 3 girls, two children are selected at random. Find the probability such that at least one boy is selected.*

Sol. Let B_1 and B_2 be two boys and G_1, G_2 and G_3 be the three girls

Since two children are selected at random,

∴ Following are the possible groups:

B_1B_2, B_1G_1, B_1G_2, B_1G_3, B_2G_1, B_2G_2, B_2G_3, G_1G_2, G_1G_3, G_2G_3

∴ Total number of possible outcomes = 10

Since, one boy is to be selected,

∴ Favourable outcomes are:

B_1B_2, B_1G_1, B_1G_2, B_1G_3, B_2G_1, B_2G_2 and B_2G_3.

⇒ Number of favourable outcomes = 7

∴ Required probability = $\mathbf{\frac{7}{10}}$.

Q. 10. *A bag contains 7 red, 5 white and 3 black balls. A ball is drawn at random from the bag. Find the probability that the drawn ball is neither white nor black.*

Sol. Total number of balls

= 7 + 5 + 3

= 15

∵ Number of white balls = 5

Number of black balls = 3

∴ Number of balls that are neither white nor black = 15 – [5 + 3]

= 15 – 8

= 7

∴ Required probability = $\mathbf{\frac{7}{15}}$.

Q. 11. *A box contains 20 cards, numbered from 1 to 20. A card is drawn from the box at random. Find the probability that the number on the drawn card is:*

(i) even (ii) multiple of 3.

Sol. Total numbers from 1 to 20 are 20

∴ Number of possible events = 20

(*i*) Even numbers are:

2, 4, 6, 8, 10, 12, 14, 16, 18 and 20

∴ Number of favourable outcomes = 10

⇒ Probability of getting an even number = $\frac{10}{20} = \mathbf{\frac{1}{2}}$

(*ii*) Since, multiples of 3 are:

3, 6, 9, 12, 15 and 18

∴ Number of favourable outcomes = 6

⇒ Probability of getting a multiple of 3

$$= \frac{6}{20} = \frac{3}{10}.$$

Q. 12. *Two dice are thrown at the same time. Find the probability that the sum of the two numbers appearing on the top of the dice is more than 9.* (AI CBSE 2009 C)

Sol. Following are the possible outcomes for two dice thrown simultaneously:

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

$\therefore$ Total number of possible outcomes = 36

Following outcomes have a sum of more than 9:

(4, 6), (6, 4), (5, 5), (5, 6), (6, 5) and (6, 6)

i.e. Favourable outcomes = 6

$\therefore$ The required probability = $\frac{6}{36}$ or $\mathbf{\frac{1}{6}}$.

Q. 13. *In a bag-X, there are four cards numbered 1, 3, 5 and 7 respectively. In an another bag-Y, there are three cards numbered 2, 4 and 6 respectively. A card is drawn at random from each bag.*

(a) Write all the possible outcomes.

(b) Find the probability that the sum of these two cards drawn is:

(i) 7 *(ii) even* *(iii) more than 7*

Sol. (*a*) There are 12 possible outcomes

Bag A →	1	3	5	7
Bag B ↓				
2	2, 1	2, 3	2, 5	2, 7
4	4, 1	4, 3	4, 5	4, 7
6	6, 1	6, 3	6, 5	6, 7

} 12 Possible outcomes

$\Rightarrow$ Possible outcomes are (2, 1), (4, 1), (6, 1), (2, 3), (4, 3), (6, 3), (2, 5), (4, 5), (6, 5), (2, 7), (4, 7) and (6, 7).

(*b*) (*i*) $\because$ Only (6 + 1), (4 + 3) and (2 + 5) gives sum as 7

$\therefore$ Possible outcomes = 3

$\Rightarrow$ $P_{(\text{Sum} = 7)} = \frac{3}{12} = \frac{1}{4}$

(*ii*) $\because$ There are no even sums

$\therefore$ Possible outcomes = 0

$\Rightarrow$ $P_{(\text{Sum = an even})} = \frac{0}{12} = 0$

(*iii*) $\because$ $6 + 3 = 9$

$2 + 7 = 9$

$4 + 7 = 11$

$4 + 5 = 9$

$6 + 5 = 11$

$6 + 7 = 13$

There are six sums which are more than 7

$\therefore$ Possible outcomes = 6

$\Rightarrow$ $P_{(\text{Sum more than 7})} = \frac{6}{12} = \frac{1}{2}$

Q. 14. *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.* (AI CBSE 2009 C)

Sol. *For Solution, please see the solution of Q. 23 of the Textbook Exercise 15.1.*

Q. 15. *Find the probability that a number selected at random from numbers 3, 4, 5, ..., 25 is prime.* (CBSE 2009 C)

Sol. Total numbers are 23.

$\therefore$ Number of possible outcomes = 23

Since, prime numbers are 3, 5, 7, 11, 13, 17, 19 and 23.

$\therefore$ Number of favourable outcomes = 8

$$\Rightarrow \qquad P(E) = \frac{8}{23}.$$

Q. 16. *The king, queen and jack of diamonds are removed from a pack of 52 cards are then the pack is well-shuffled. A card is drawn from the remaining cards. Find the probability of getting a card of*

(i) diamonds

(ii) a Jack (AI CBSE 2008 C)

Sol. $\because$ There are 52 card in the pack.

And number of cards removed = 3 [*1 king + 1 queen + 1 jack = 3 cards*]

$\therefore$ Remaining cards = 52 – 3 = 49

$$\therefore (i) \qquad P_{(\text{a diamond})} = \frac{13-3}{49} = \frac{10}{49} \qquad [\because \textit{Total diamonds are 13}]$$

$$(ii) \qquad P_{(\text{a jack})} = \frac{4-1}{49} = \frac{3}{49} \qquad [\because \textit{Total jacks are 4}]$$

Q. 17. *A bag contains 5 red, 4 blue and 3 green balls. A ball is taken out of the bag at random. Find the probability that the selected ball is*

(i) of red colour

(ii) not of green colour. (CBSE 2008 C)

Sol. Total number of balls = 5 + 4 + 3 = 12

$\Rightarrow$ Number of possible outcomes = 12

(*i*) $\because$ Number of red balls = 5

$\therefore$ Favourable outcomes = 5

$$\Rightarrow \qquad P_{(\text{red ball})} = \frac{5}{12}$$

(*ii*) $\because$ Number of green balls = 3

$\therefore$ Number of ball which are not green = 12 – 3 = 9

$\Rightarrow$ Favourable outcomes = 9

$$\therefore \qquad P_{(\text{not green})} = \frac{9}{12} = \frac{3}{4}.$$

Q. 18. *A card is drawn at random from a well-shuffled deck of playing cards. Find the probability of drawing a*

(i) face card

(ii) card which is neither a king nor a red card. (CBSE 2008 C)

Sol. Total number of cards = 52

(*i*) Total number of face cards = 12 [*4 Jacks + 4 Queens + 4 Kings*]

$\therefore$ Number of favourable outcomes = 12

$$\Rightarrow \qquad P_{(\text{face})} = \frac{12}{52} = \frac{3}{13}$$

(*ii*) Number of kings = 4
Number of red cards = 13 + 13 = 26
∴ Number of cards that are neither a red nor a king = 52 − 4 − 26 + 2 (red kings) = 24
⇒ Favourable outcomes = 24

$$\therefore \quad P_{(\text{neither king nor red})} = \frac{24}{52} = \frac{\mathbf{6}}{\mathbf{13}}.$$

Q. 19. *A bag contains tickets, numbered 11, 12, 13, ..., 30. A ticket is taken out from the bag at random. Find the probability that the number on the drawn ticket*
(i) is a multiple of 7
(ii) is greater than 15 and a multiple of 5. (AI CBSE 2008)

Sol. Total number of tickets = 20 [∵ *Numbers from 11 to 30 are 20*]
(*i*) ∵ Multiples of 7 are 14, 21 and 28
∴ Number of favourable outcomes = 3

$$\Rightarrow P_{(\text{a multiple of 7})} = \frac{\mathbf{3}}{\mathbf{20}}$$

(*ii*) ∵ The numbers that are greater than 15 and multiples of 5 are: 20, 25 and 30
∴ Number of favourable outcomes = 3

$$\Rightarrow P_{(\text{multiples of 5 and greater than 15})} = \frac{\mathbf{3}}{\mathbf{20}}.$$

Q. 20. *A bag contains 4 red, 5 black and 3 yellow balls. A ball is taken out of the bag at random. Find that the ball taken out is of:*
(i) yellow colour
(ii) not of red colour. (AI CBSE 2008)

Sol. Total number of balls = 4 + 5 + 3 = 12
⇒ Total number of possible outcomes = 12
(*i*) ∵ Number of yellow balls = 3
∴ Number of favourable outcomes = 3

$$\Rightarrow \quad P_{(\text{yellow})} = \frac{3}{12} = \frac{\mathbf{1}}{\mathbf{4}}$$

(*ii*) Number of balls that are not red = 12 − 4 = 8 [∵ There are 4 red balls]
∴ Favourable outcomes = 8

$$\Rightarrow \quad P_{(\text{not red})} = \frac{8}{12} = \frac{\mathbf{2}}{\mathbf{3}}.$$

Q. 21. *A coin is tossed two times. Find the probability of getting at most one head.* (CBSE Sample Paper 2011)

Sol. Since, the coin is thrown two times.
∴ Possible out comes = 4
Favourable outcomes are *TT, TH, HT*
i.e., Number of favourable outcomes = 3

$$\therefore \quad P(\text{atmost one head}) = \frac{3}{4}.$$

Q. 22. *There are 40 students in class X of whom 25 are girls and 15 are boys. The class teacher has to select one student as a class representative. She writes the name of each student on a separate card. The cards being identical and she puts cards in a bag and stirs throughly. She then draws one card from the bag. What is the probability that the name written on the card is the name of a:*
(i) girl *(ii) a boy*

Sol. Total number of students = 40

$\Rightarrow$ Number of possible outcomes = 40

(*i*) $\because$ There are 25 girls in the class

$\therefore$ Number of favourable outcomes = 25

$$\Rightarrow \quad P_{(\text{name of a girl})} = \frac{25}{40} \quad \frac{5}{8}$$

(*ii*) $\because$ Number of boys = 15

$\therefore$ Number of favourable outcomes = 15

$$\Rightarrow \quad P_{(\text{name of a boy})} = \frac{15}{40} \quad \frac{3}{8}$$

Q. 23. *Cards, marked with numbers 5 to 50, are placed in a box and mixed thoroughly. A card is drawn from the box at random. Find the probability that the number on the taken out card is:*

(i) a prime number less than 10.

(ii) a number which is a perfect square. (AI CBSE 2008)

Sol. Numbers from 5 to 50 are 46.

$\therefore$ Total number of possible outcomes = 46.

(*i*) Prime numbers (less than 10) are 5, 7.

$\therefore$ Favourable outcomes = 2

$$\Rightarrow P_{(\text{prime number less than 10})} = \frac{2}{46} = \mathbf{\frac{1}{23}}$$

(*ii*) Perfect square are 9, 16, 25, 36 and 49

$\therefore$ Number of favourable outcomes = 5

$$\Rightarrow P_{(\text{perfect square})} = \mathbf{\frac{5}{46}}.$$

Q. 24. *A die is thrown once. Find the probability of getting:*

(i) an even prime number.

(ii) a multiple of 3. (CBSE 2008)

Sol. Total numbers on the faces of a die are 1, 2, 3, 4, 5 and 6

$\Rightarrow$ Number of favourable outcomes = 6

(*i*) Even prime number is only one *i.e.* 2

$\therefore$ Favourable outcome = 1

$$\Rightarrow \quad P_{(\text{even prime number})} = \mathbf{\frac{1}{6}}$$

(*ii*) Multiples of 3 are 3 and 6

$\therefore$ Favourable outcomes are 2.

$$\Rightarrow P_{(\text{multiple of 3})} = \frac{2}{6} = \mathbf{\frac{1}{3}}.$$

Q. 25. *A die is thrown once. Find the probability of getting:*

(i) a prime number

(ii) a number divisible by 2. (CBSE 2008)

Sol. $\because$ The numbers on the faces of a die are 1, 2, 3, 4, 5 and 6.

$\therefore$ Number of possible outcomes = 6

(*i*) Prime numbers are 2, 3 and 5

$\therefore$ Number of prime numbers = 3

$\Rightarrow$ Number of favourable outcomes = 3

$\therefore P_{(\text{prime number})} = \frac{3}{6} = \mathbf{\frac{1}{2}}$

(*ii*) Numbers divisible by 2 are 2, 4 and 6

$\therefore$ Favourable outcomes are 3.

$\Rightarrow P_{(\text{divisible by 2})} = \frac{3}{6} = \mathbf{\frac{1}{2}}$.

Q. 26. *Two dice are thrown simultaneously. What is the probability that*

(i) 5 will not come up on either of them?

(ii) 5 will come up on at least one?

(iii) 5 will come up at both dice?

Sol. $\because$ The two dice are thrown simultaneously

$\therefore$ Possible outcomes are = $6 \times 6 = 36$

(*i*) **When 5 will not come up on either of them:**

Favourable outcomes are: $36 - 11 = 25$

$\therefore P_{(\text{5 will not come up on either dice})} = \mathbf{\frac{25}{36}}$

(*ii*) **When 5 will come on at least one dice:**

Favourable outcomes are: $36 - 25 = 11$

$\therefore P_{(\text{5 will come on at least one dice})} = \mathbf{\frac{11}{36}}$

(*iii*) **When 5 will come up on either dice:**

Favourable outcome is only one *i.e.* (5, 5)

$\therefore P_{(\text{5 on both dice})} = \mathbf{\frac{1}{36}}$.

Q. 27. *Two different dice are rolled simultaneously. Find the probability that the sum of numbers appearing on the two dice is 10.* [AI. CBSE (Foreign)2014]

Sol. When two different dice are rolled then possible outcomes are :

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

$\therefore$ Number of total outcomes = 36

$\because$ Sum of (5, 5), (6, 4) and (4, 6) is 10.

$\therefore$ No of favourable outcomes = 3

$\Rightarrow$ Required Probability = $\frac{3}{36}$ or $\frac{1}{12}$

TEST YOUR SKILLS

1. Cards bearing numbers 1, 3, 5, ..., 35 are kept in a bag. A card is drawn at random from the bag. Find the probability of getting a card bearing:

(*i*) a prime number less than 15.

(*ii*) a number divisible by 3 and 5.

2. Red kings, queens and jacks are removed from a deck of 52 playing cards and then well-shuffled. A card is drawn from the remaining cards. Find the probability of getting (*i*) King (*ii*) a red card (*iii*) a spade.

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

(*i*) A king of red suit. (*ii*) A queen of black suit.

(*iii*) A jack hearts. (*iv*) A red face card.

4. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball from the bag is thrice that of a red ball, find the number of blue balls in the bag.

Hint: *Let number of blue balls* $= x$

$\therefore$ *Total number of balls* $= (5 + x)$

$$P_{(\text{blue ball})} = 3 \times P_{(\text{red ball})} \quad \Rightarrow \quad \frac{x}{x+5} = 3\left[\frac{5}{x+5}\right]$$

5. In a throw of a coin, find the probability of getting a head.

6. Two coins are tossed together find the probability of getting:

(*i*) at least one tail.

(*ii*) one head

7. An unbiased die is thrown once, find the probability of getting:

(*i*) a number greater than 4.

(*ii*) a multiple of 3.

8. Two dice are thrown at the same time. Find the probability of getting different numbers on both the dice. [NCERT Exemplar]

Hint: $P_{(\text{different numbers on both dice})} = 1 - P_{(\text{same number on both dice})}$

9. Two dice are thrown at the same time. Find the probability of getting same number on both the dice.

10. A pair of dice is thrown once. Find the probability of getting an odd number on each die.

11. A lot consists of 48 mobile phones of which 42 are good, 3 have only minor defects and 3 have major defects. Varnika will buy a phone if it is good but the trader will only buy a mobile if it has no major defect. One phone is selected at random from the lot. What is the probability that it is:

(*i*) acceptable to Varnika?

(*ii*) acceptable to the trader? [NCERT Exemplar]

12. Find the probability that a number selected at random from the numbers 1, 2, 3, ..., 35 is a:

(*i*) prime number

(*ii*) multiple of 7

(*iii*) a prime number less than 15.

13. A bag contains 5 red marbles, 8 white marbles and 4 green marbles. What is the probability that if one marble is taken out of the bag at random it will not be a green marble?

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

(*i*) the queen of diamond

(*ii*) an ace of hearts

(*iii*) a spade.

Hint: *(i) There is only one queen of diamond.*

(ii) There is only one ace of hearts.

(iii) There are 13 spade cards.

15. Find the probability of getting 53 Sundays in a leap year. (CBSE 2012)

Hint: *Number of days in a normal year = 365*

Number of days in a leap year = 366

Number of weeks, in a normal year = 52, means 52 Sundays

[366 – (52 × 7)] = 2 extra days in a leap year.

These two extra days may have sample-space as:

(Monday – Tuesday), (Tuesday – Wednesday), (Wednesday – Thursday), (Thursday – Friday), (Friday – Saturday), (Saturday – Sunday), (Sunday – Monday).

i.e. out of 7 sample spaces, only two are favourable.

$\Rightarrow P_{\text{(53 Sundays in a leap year)}} = \frac{2}{7}$

16. One letter is chosen at random amongst letters of the word **Mathematics**. Find the probability that the letter chosen is a:

(*i*) vowel (*ii*) consonant

17. Two coins are tossed simultaneously. Find the probability of getting:

(*i*) two Heads (*ii*) at least one Head

(*iii*) no Head.

Hint: *In a throw of two coins simultaneously the four possible outcomes are*

HH, HT, TH, TT

18. A die is thrown once. What is the probability of getting a number greater than 4?

19. What is the probability that a number selected at random from the numbers 3, 4, 5, ..., 9 is a multiple of 4?

20. From a well suffled pack of playing cards, black jacks, black kings and black aces are removed. A card is then drawn from the pack. Find the probability of getting:

(*i*) a red card (*ii*) not a diamond card.

21. A bag contains cards which are numbered from 2 to 90. A card is drawn at random from the bag. Find the probability that it bears.

(*i*) a two-digit number (*ii*) a number which is a perfect square.

22. Cards numbered 1 to 30 are put in a bag. A card is drawn at random from this bag. Find the probability that the number on the drawn card is :

(*i*) not divisible by 3. (*ii*) a prime number greater than 7.

(*iii*) not a perfect square number. [AI CBSE (Foreign) 2014]

Hint: *Total possible outcomes = 30*

(i) Numbers not divisible by 3 [1 to 30] are :

1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 16, 17, 19, 20, 22, 23, 25, 26, 28, 29,

∴ Number of favourable outcomes = 20

$\Rightarrow$ *Required Probability* $= \frac{20}{30} = \frac{2}{3}$

(ii) Prime numbers greater than 7 are : 11, 13, 17, 19, 23, 29

∴ Required probability $= \frac{6}{30} = \frac{1}{5}$

(iii) Perfect squares are 1, 4, 9, 16, 25 $\Rightarrow$ *Total No. = 5*

∴ Required pribability $= \frac{30-5}{30} = \frac{25}{30} = \frac{5}{6}$

23. Two different dice are tossed together. Find the probability :

(*i*) That the numbers on either die is even.

(*ii*) That the sum of numbers appearing on the two dice is 5. [AI CBSE 2014]

Hint: *Total possible outcomes = 36*

(i) Numbers of favourable outcomes = 9

[∵ (2, 2), (2, 4), (2, 6), (4, 2), (4, 4) (4, 6) (6, 2), (6, 4) and (6, 6) are desired outcomes.

Required Probability $= \frac{9}{36} = \frac{1}{4}$

(ii) Desired (favourable) outcomes are : (1, 4), (2, 3), (3, 2), (4, 1)

Required Probability $= \frac{4}{36} = \frac{1}{9}$

24. Red queens and black jacks are removed from a pack of 52 playing cards. A card is drawn at random from the remaining cards, after reshuffling them. Find the probability that the card drawn is :

(*i*) a king (*ii*) of red colour

(*iii*) a face-card (*iv*) a queen [AI CBSE 2014]

Hint: *A pack of playing cards consists of 52 cards. 2 red queens and 2 black jacks are removed. Therefore, remaining number of cards = 52 - 4 = 48.*

(i) Numbers of kings = 4 $\Rightarrow$ *Required P* $= \frac{4}{48} = \mathbf{\frac{1}{12}}$

(ii) Remaining red cards = 26 – 2 = 24 $\Rightarrow$ *Required P* $= \frac{24}{48} = \mathbf{\frac{1}{2}}$

(iii) Remaining face-cards = 12 – 4 = 8 $\Rightarrow$ *Required P* $= \frac{8}{48} = \mathbf{\frac{1}{6}}$

(iv) Remaining queens = 4 – 2 = 2 $\Rightarrow$ *Required P* $= \frac{2}{48} = \mathbf{\frac{1}{24}}$

25. Rahim tosses two different coins simultaneously. Find the probability of getting at least one tail. [CBSE (Delhi) 2014]

Hint: *Total outcomes = 4* *(HH, HT, TH, TT)*

Fovourable outcomes = 3 *(HT, TH, TT)*

$\Rightarrow$ *Required P* $= \frac{3}{4}$

26. A bag contains cards numbered from 1 to 49. A card is drawn from the bag at random, after mixing the cards thoroughly. Find the probability that the number on the drawn card is :

(*i*) an odd number (*ii*) a multiple of 5

(*iii*) a perfect square (*iv*) an even prime number [CBSE (Delhi) 2014]

Hint: *Possible outcomes = 49*

(i) Odd numbers are : 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 57, 49 $\Rightarrow$ *Favourable outcomes = 25*

$\Rightarrow$ *Required* $P = \frac{25}{49}$

(ii) Multiples of 5 are = 5, 10, 15, 20, 25, 30, 35, 40, 45 $\Rightarrow P = \frac{9}{49}$

(iii) Perfect squares are : 1, 4, 9, 16, 25, 36, 49 $\Rightarrow P = \frac{7}{49} = \frac{1}{7}$

(iv) Even Primes are : only 2. $\Rightarrow P = \frac{1}{49}$

ANSWERS

Test Your Skills

1. (*i*) $\frac{1}{3}$, (*ii*) $\frac{1}{9}$ **2.** (*i*) $\frac{1}{23}$, (*ii*) $\frac{10}{23}$, (*iii*) $\frac{13}{46}$ **3.** (*i*) $\frac{1}{26}$, (*ii*) $\frac{1}{26}$, (*iii*) $\frac{1}{52}$, (*iv*) $\frac{3}{26}$

4. 15 **5.** $\frac{1}{2}$ **6.** (*i*) $\frac{3}{4}$, (*ii*) $\frac{1}{2}$

7. (*i*) $\frac{1}{3}$, (*ii*) $\frac{1}{3}$ **8.** $\frac{5}{6}$ **9.** $\frac{1}{6}$

10. $\frac{1}{4}$ **11.** (*i*) $\frac{7}{8}$, (*ii*) $\frac{15}{16}$ **12.** (*i*) $\frac{11}{35}$, (*ii*) $\frac{1}{7}$, (*iii*) $\frac{6}{35}$

13. $\frac{13}{17}$ **14.** (*i*) $\frac{1}{52}$, (*ii*) $\frac{1}{52}$, (*iii*) $\frac{1}{4}$ **15.** $\frac{2}{7}$

16. (*i*) $\frac{4}{11}$, (*ii*) $\frac{7}{11}$ **17.** (*i*) $\frac{1}{4}$, (*ii*) $\frac{3}{4}$, (*iii*) $\frac{1}{4}$ **18.** $\frac{1}{3}$

19. $\frac{2}{7}$ **20.** (*i*) $\frac{13}{23}$, (*ii*) $\frac{33}{46}$ **21.** (*i*) $\frac{81}{89}$, (*ii*) $\frac{8}{89}$