8 Probability

Topics Covered

1. Probability–A Theoretical Approach

1. Probability–A Theoretical Approach

In theoretical approach of probability, predictions about the happenings, on the basis of certain assumptions, are made without actually performing the experiment.

Probability of an event E is defined as P(E) and is given by the formula:

$$P(E) = \frac{\text{Number of trials in which the event happened}}{\text{Total number of trials}}$$

Example 1. A card is drawn from a deck of 52 cards. The event E is that the card is not an ace of hearts. The number of outcomes favourable to E is

(*a*) 52 (*b*) 53 (*c*) 51 (*d*) 31

Solution. There is only one ace of hearts. Therefore, number of outcomes favourable to E = 52 – 1 = 51.

Hence, option (*c*) is the correct answer.

Example 2. A card is selected from a deck of 52 cards. The probability of it being a red face card is

(*a*) $\frac{5}{52}$ (*b*) $\frac{7}{52}$ (*c*) $\frac{3}{26}$ (*d*) $\frac{5}{26}$

Solution. There are 6 red face cards in a deck of 52 cards.

$\therefore$ No. of favourable outcomes = 6 out of 52 possible outcomes

Thus, $$P(E) = \frac{\text{No. of favourable outcomes}}{\text{No. of possible outcomes}} = \frac{6}{52} = \frac{3}{26}$$

Hence, option (*c*) is the correct answer.

Example 3. A card is drawn at random from a well-shuffled pack of 52 playing cards. The probability of getting neither a red card nor a queen is

(*a*) $\frac{6}{13}$ (*b*) $\frac{7}{13}$ (*c*) $\frac{11}{13}$ (*d*) $\frac{9}{13}$

Solution. Total number of possible outcomes = 52

Number of red cards = 26

Number of queens = 2

So, number of red cards and queens = 28

Number of cards which are neither red card nor queen = 52 – 28 = 24

$\therefore$ P (getting neither a red card nor a queen) = $\frac{24}{52} = \frac{6}{13}$

Hence, option (*a*) is the correct answer.

Example 4. Two dice are thrown at the same time and the product of numbers appearing on them is noted. The probability that the product is a prime number is

(*a*) $\frac{1}{3}$ (*b*) $\frac{1}{6}$ (*c*) $\frac{1}{5}$ (*d*) $\frac{5}{6}$

Solution. Now for the product of the numbers on the dice is prime number can be have in these possible ways—(1, 2), (2, 1), (1, 3), (3, 1), (5, 1), (1, 5)

So, number of possible ways = 6

$\therefore$ required probability = $\frac{6}{36} = \frac{1}{6}$

Hence, option (*b*) is the correct answer.

Example 5. Rahim tosses two different coins simultaneously. The probability of getting at least one tail is

(*a*) $\frac{1}{4}$ (*b*) $\frac{3}{4}$ (*c*) $\frac{3}{5}$ (*d*) $\frac{1}{6}$

Solution. Number of possible outcomes = 4 as possible outcomes are HH, HT, TH, TT.

Favourable outcomes for getting at least one tail are HT, TH, TT

No. of favourable outcomes = 3

$\therefore$ P(getting at least one tail) = $\frac{3}{4}$

Hence, option (*b*) is the correct answer.

Example 6. A jar contains 24 marbles, some are green and other are blue. If a marble is drawn at random from the jar, the probability that it is green is $\frac{2}{3}$. The number of blue marbles in the jar is

(*a*) 5 (*b*) 6 (*c*) 4 (*d*) 8

Solution. Let E be the probability of getting green marbles.

They, $P(E) = \frac{2}{3}$

$\Rightarrow$ $P(E) = \frac{\text{No. of green marbles}}{\text{No. of total marbles in jar}} \Rightarrow \frac{2}{3} = \frac{\text{No. of green marbles}}{24}$

$\Rightarrow$ $\frac{2 \times 24}{3}$ = No. of green marbles

$\Rightarrow$ Number of green marbles = 16

$\therefore$ Number of blue marbles = 24 – 16 = 8

Hence, option (*d*) is the correct answer.

Example 7. A game consists of tossing a 10 rupee coin 3 times and noting its outcome each time. Sudhir wins if all the tosses give the same result, *i.e.*, three heads or three tails and loses otherwise. The probability that Sudhir will not win the game is

(*a*) $\frac{1}{4}$ (*b*) $\frac{1}{6}$ (*c*) $\frac{3}{4}$ (*d*) 10

Solution. The possible outcomes are HHH, HHT, HTH, THH, TTH, THT, HTT, TTT

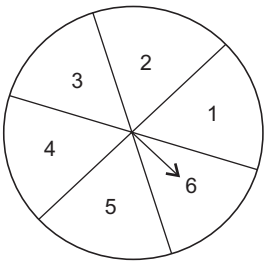
Number of possible outcomes = 8

Number of favourable outcomes when he will not win = 8 – 2 = 6

$\therefore$ P(Sudhir will not win) = $\frac{6}{8} = \frac{3}{4}$

Hence, option (*c*) is the correct answer.

Example 8. In the given figure, a disc is shown on which a player spins arrow twice. The fraction $\frac{a}{b}$ is formed, where 'a' is the number of sector on which arrow stops in the first spin and 'b' is the number of the sector in which the arrow stops in the second spin. On each spin, each sector has equal chance of selection by the arrow. The probability that the fraction $\frac{a}{b} > 1$ is



(*a*) $\frac{1}{12}$ (*b*) $\frac{5}{6}$

(*c*) $\frac{5}{12}$ (*d*) 1

Solution. For $\frac{a}{b} > 1$, when $a = 1$, b cannot take any value.

$a = 2$, b can take 1 value
$a = 3$, b can take 2 values
$a = 4$, b can take 3 values
$a = 5$, b can take 4 values
$a = 6$, b can take 5 values

Thus, the favourable outcomes are:
(2,1), (3,1), (3,2), (4,1), (4,2), (4,3), (5,1), (5,2), (5,3), (5,4), (6,1), (6,2), (6,3), (6,4), (6,5)
Total no. of possible outcomes = 36

$\therefore \quad P\left(\frac{a}{b} > 1\right) = \frac{15}{36}$ or $\frac{5}{12}$

Hence, option (*c*) is the correct answer.

Exercise 8.1

A. Multiple Choice Questions (MCQs)

Choose the correct answer from the given options:

1. One card is drawn from a well shuffled deck of 52 cards. The probability that it is black queen is

(*a*) $\frac{1}{26}$ (*b*) $\frac{1}{13}$ (*c*) $\frac{1}{52}$ (*d*) $\frac{2}{13}$

2. The probability of an impossible event is

(*a*) 1 (*b*) $\frac{1}{2}$ (*c*) not defined (*d*) 0

3. If P(A) denotes the probability of an event A, then

(*a*) $P(A) < 0$ (*b*) $P(A) > 1$ (*c*) $0 \le P(A) \le 1$ (*d*) $-1 \le P(A) \le 1$

4. If the probability of an event is p, the probability of its complementary event will be

(*a*) $p - 1$ (*b*) p (*c*) $1 - p$ (*d*) $1 - \frac{1}{p}$

5. Someone is asked to take a number from 1 to 100. The probability that it is a prime is

(*a*) $\frac{1}{5}$ (*b*) $\frac{6}{25}$ (*c*) $\frac{1}{4}$ (*d*) $\frac{13}{15}$

6. A number is chosen at random from the numbers –5, –4, –3, –2, –1, 0, 1, 2, 3, 4, 5. Then the probability that square of this number is less than or equal to 1 is

(*a*) $\frac{1}{11}$ (*b*) $\frac{2}{11}$ (*c*) $\frac{3}{11}$ (*d*) $\frac{3}{26}$

7. If the probability of an event E happening is 0.023, then $P(\bar{E}) =$

(*a*) 0.245 (*b*) 0.977 (*c*) 0.678 (*d*) 0.5

8. A card is drawn at random from a well shuffled pack of 52 playing cards. The probability of getting a red face card is

(*a*) $\frac{3}{26}$ (*b*) $\frac{5}{26}$ (*c*) $\frac{2}{13}$ (*d*) $\frac{1}{26}$

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

(*a*) $\frac{1}{2}$ (*b*) $\frac{1}{3}$ (*c*) $\frac{1}{4}$ (*d*) $\frac{1}{5}$

10. Two players, Sangeeta and Reshma, play a tennis match. It is known that the probability of winning the match by Sangeeta is 0.62. What is the probability of winning the match by Reshma?

(*a*) 0.22 (*b*) 0.24 (*c*) 0.38 (*d*) 0.35

11. Cards marked with number 3, 4, 5, …, 50 are placed in a box and mixed thoroughly. A card is drawn at random from the box. The probability that the selected card bears a perfect square number is

(*a*) $\frac{1}{4}$ (*b*) $\frac{1}{6}$ (*c*) $\frac{1}{5}$ (*d*) $\frac{1}{8}$

12. 20 tickets, on which numbers 1 to 20 are written, are mixed thoroughly and then a ticket is drawn at random out of them. The probability that the number on the drawn ticket is a multiple of 3 or 7 is

(*a*) $\frac{1}{5}$ (*b*) $\frac{2}{5}$ (*c*) $\frac{3}{5}$ (*d*) 1

13. Two different dice are tossed together. The probability that the product of the two numbers on the top of the dice is 6 is

(*a*) $\frac{4}{9}$ (*b*) $\frac{5}{9}$ (*c*) $\frac{8}{9}$ (*d*) $\frac{1}{9}$

14. A number is chosen at random from the numbers −3, −2, −1, 0, 1, 2, 3. What will be the probability that square of this number is less than or equal to 1?

(*a*) $\frac{3}{7}$ (*b*) $\frac{4}{7}$ (*c*) $\frac{5}{7}$ (*d*) $\frac{6}{7}$

15. The probability of selecting a rotten apple randomly from a heap of 900 apples is 0·18. What is the number of rotten apples in the heap?

(*a*) 122 (*b*) 144 (*c*) 162 (*d*) 184

16. A letter of English alphabet is chosen at random. The probability that the chosen letter is a consonant is

(*a*) $\frac{7}{26}$ (*b*) $\frac{5}{26}$ (*c*) $\frac{11}{26}$ (*d*) $\frac{21}{26}$

17. A die is thrown once. What is the probability of getting a number less than 3?

(*a*) $\frac{1}{2}$ (*b*) $\frac{1}{3}$ (*c*) $\frac{1}{5}$ (*d*) $\frac{1}{9}$

18. If the probability of winning a game is 0.07, what is the probability of losing it?

(*a*) 0.33 (*b*) 0.63 (*c*) 0.93 (*d*) 0.57

19. The probability of getting a doublet in a throw of a pair of dice is

(*a*) $\frac{1}{2}$ (*b*) $\frac{1}{4}$ (*c*) $\frac{1}{5}$ (*d*) $\frac{1}{6}$

20. The probability of getting a black queen when a card is drawn at random from a well-shuffled pack of 52 cards is

(*a*) $\frac{1}{26}$ (*b*) $\frac{3}{26}$ (*c*) $\frac{8}{13}$ (*d*) 1

21. Cards numbered 7 to 40 were put in a box. Poonam selects a card at random. What is the probability that Poonam selects a card which is a multiple of 7?

(*a*) $\frac{3}{28}$ (*b*) $\frac{5}{34}$ (*c*) $\frac{7}{34}$ (*d*) $\frac{9}{34}$

22. 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 and these are equally likely outcomes. The probability that the arrow will point at any factor of 8 is

(*a*) 0 (*b*) $\frac{1}{2}$ (*c*) $\frac{1}{4}$ (*d*) 1

23. A game consists of tossing a coin 3 times and noting the outcomes each time. If getting the same result in all the tosses is a success, the probability of losing the game is

(*a*) $\frac{3}{4}$ (*b*) $\frac{1}{4}$ (*c*) $\frac{3}{8}$ (*d*) 1

24. A ticket is drawn at random from a bag containing tickets numbered from 1 to 40. The probability that the selected ticket has a number which is a multiple of 5 is

(*a*) $\frac{1}{5}$ (*b*) $\frac{3}{5}$ (*c*) $\frac{4}{5}$ (*d*) 1

25. Three cards of spades are lost from a pack of 52 playing cards and the remaining cards are shuffled and then a card was drawn at random from them. The probability that the drawn card is of black colour is

(*a*) $\frac{11}{52}$ (*b*) $\frac{19}{52}$ (*c*) $\frac{23}{52}$ (*d*) $\frac{27}{52}$

26. The king, queen and jack of clubs are removed from a deck of 52 playing cards and the remaining cards are shuffled. A card is drawn from the remaining cards. The probability of getting a card of queen is

(*a*) $\frac{1}{49}$ (*b*) $\frac{2}{49}$ (*c*) $\frac{3}{49}$ (*d*) $\frac{5}{49}$

27. A coin is tossed two times. Find the probability of getting at least one head is

(*a*) $\frac{1}{4}$ (*b*) $\frac{3}{4}$ (*c*) $\frac{1}{8}$ (*d*) $\frac{3}{8}$

28. A ticket is drawn at random from a bag containing tickets numbered from 1 to 40. The probability that the selected ticket has a number which is a multiple of 10 is

(*a*) $\frac{7}{10}$ (*b*) $\frac{3}{10}$ (*c*) $\frac{1}{10}$ (*d*) $\frac{9}{10}$

29. 1000 tickets of a lottery were sold and there are 5 prizes on these tickets. If John has purchased one lottery ticket, what is the probability of winning a prize?

(*a*) $\frac{1}{100}$ (*b*) $\frac{7}{200}$ (*c*) $\frac{3}{200}$ (*d*) $\frac{1}{200}$

30. The probability of guessing the correct answer to a certain test is $\frac{p}{12}$. If the probability of not guessing the correct answer to this question is $\frac{1}{3}$, then the value of p is

(*a*) 2 (*b*) 4 (*c*) 6 (*d*) 8

31. A lot of 25 bulbs contain 5 defective ones. One bulb is drawn at random from the lot. What is the probability that the bulb is good?

(*a*) $\frac{1}{5}$ (*b*) $\frac{2}{5}$ (*c*) $\frac{3}{5}$ (*d*) $\frac{4}{5}$

32. If a number x is chosen at random from the numbers –3, –2, –1, 0, 1, 2, 3. What is probability that $x^2 \leq 4$?

(*a*) $\frac{5}{7}$ (*b*) $\frac{3}{7}$ (*c*) $\frac{4}{7}$ (*d*) $\frac{6}{7}$

33. A letter is selected at random from the set of English alphabets. What is the probability that it is a vowel?

(a) $\frac{1}{26}$ (b) $\frac{3}{26}$ (c) $\frac{5}{26}$ (d) $\frac{7}{26}$

34. A bag contains 15 white and some black balls. If the probability of drawing a black ball from the bag is thrice that of drawing a white ball, the number of black balls in the bag is

(a) 15 (b) 30 (c) 30 (d) 45

35. The probability of selecting a red ball at random from a jar that contains only red, blue and orange balls is $\frac{1}{4}$. The probability of selecting a blue ball at random from the same jar is $\frac{1}{3}$. The jar contains 10 orange balls, the total number of balls in the jar is

(a) 16 (b) 20 (c) 24 (d) 26

36. A bag contains, white, black and red balls only. A ball is drawn at random from the bag. If the probability of getting a white ball is $\frac{3}{10}$ and that of a black ball is $\frac{2}{5}$, then find the probability of getting a red ball. If the bag contains 20 black balls, then total number of balls in the bag is

(a) 30 (b) 50 (c) 38 (d) 54

37. A number x is selected at random from the numbers 1, 4, 9, 16 and another number y is selected at random from the numbers 1, 2, 3, 4. The probability that the value of xy is more than 16 is

(a) $\frac{3}{8}$ (b) $\frac{5}{8}$ (c) $\frac{7}{8}$ (d) 1

B. Assertion-Reason Type Questions

In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Choose the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

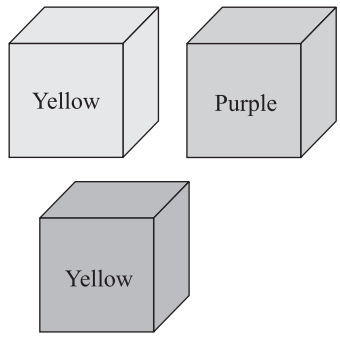
1. **Assertion (A):** If a pair of dice is thrown once, then the probability of getting a sum of 8 is $\frac{5}{36}$.

Reason (R): In a simultaneous toss of two coins, the probability of getting exactly one head is $\frac{1}{2}$.

2. **Assertion (A):** The probability of a sure event is 1.
Reason (R): Let E be an event. Then $0 \le P(E) \le 1$.

Case Study Based Questions

I. Garima has two children, Tapan and Maya. Every Sunday is a game night in the family. Tonight Garima has planned for a game with three cubes, one purple and two yellow. She placed the three cubes in a bag and called for her children.



Garima: Do you want to play a game of probability?
Maya: What is probability?
Garima: Let me ask you something before I answer you. Can you predict what is in this bag?
Tapan: I cannot guess that!
Maya: I am 100% sure it is a toy!
Garima: I am glad you think that Maya. Just now you used the concept of probability.

Whether an event can happen or not, can't be predicted with total certainty. But we can always predict how likely or unlikely it is for an event to happen.
And for predicting that, we use a concept called probability.

$$\text{Probability (an event to happen)} = \frac{\text{Number of ways event can happen}}{\text{Total number of ways all events can happen}}$$

Placing the bag of cubes in the centre, Garima explained the rules of the game to the children.
Garima: Without looking, the first player will pick out a cube from the bag and then the second player will also pick out one cube without looking. If the two cubes picked out were the same colour, then the first person will win the game. If the boxes picked out are of two differently coloured cubes, then the second player will be the winner.

1. In the first round, Maya pulled out a cube, which was yellow. What is the probability that Tapan will win the game?

(*a*) $\frac{1}{2}$ (*b*) $\frac{1}{3}$ (*c*) $\frac{2}{3}$ (*d*) 0

2. In the second round, Tapan started by picking out a purple cube. What is the probability for Tapan to win the round?

(*a*) 1 (*b*) $\frac{1}{3}$ (*c*) 0 (*d*) $\frac{2}{3}$

3. In the third round, Maya pulled out a cube. The probability that the pulled out cube is not of yellow colour is

(*a*) 1 (*b*) $\frac{1}{2}$ (*c*) $\frac{1}{3}$ (*d*) $\frac{2}{3}$

4. In the fourth round, Tapan pulled out a cube. The probability that the pulled out cube is either purple or yellow is

(*a*) 1 (*b*) $\frac{1}{2}$ (*c*) $\frac{1}{3}$ (*d*) $\frac{2}{3}$

5. In the last round, Maya pulled out a cube. The probability that the pulled out cube is of green colour is

(*a*) 1 (*b*) $\frac{1}{2}$ (*c*) $\frac{1}{3}$ (*d*) 0

II. Rahul and Ravi planned to play Business (board game) in which they were supposed to use two dice.

1. Ravi got first chance to roll the dice. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is 8?

(*a*) $\frac{1}{26}$ (*b*) $\frac{5}{36}$ (*c*) $\frac{1}{18}$ (*d*) 0

2. Rahul got next chance. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is 13?

(*a*) 1 (*b*) $\frac{5}{36}$ (*c*) $\frac{1}{18}$ (*d*) 0

3. Now it was Ravi's turn. He rolled the dice. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is less than or equal to 12?

(*a*) 1 (*b*) $\frac{5}{36}$ (*c*) $\frac{1}{18}$ (*d*) 0

4. Rahul got next chance. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is equal to 7?

(*a*) $\frac{5}{9}$ (*b*) $\frac{5}{36}$ (*c*) $\frac{1}{6}$ (*d*) 0

5. Now it was Ravi's turn. He rolled the dice. What is the probability that he got the sum of the two numbers appearing on the top face of the dice is greater than 8?

(*a*) 1 (*b*) $\frac{5}{36}$ (*c*) $\frac{1}{18}$ (*d*) $\frac{5}{18}$

Answers and Hints

1. (*a*) $\frac{1}{26}$ **2.** (*d*) 0

3. (*c*) $0 \le P(A) \le 1$ **4.** (*c*) $1 - p$

5. (*c*) $\frac{1}{4}$ **6.** (*c*) $\frac{3}{11}$

7. (*b*) 0.977

8. (*a*) $\frac{3}{26}$

Required probability $= \frac{6}{52} = \frac{3}{26}$

9. (*b*) $\frac{1}{3}$

Total number of outcomes = 6,
i.e.,{1, 2, 3, 4, 5, 6}
No. of fabourable outcomes = 2, i.e.{5, 6}

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

10. (*c*) 0.38

P(winning the match by Sangeeta)
+ P(winning the match by Reshma) = 1
$\Rightarrow$ P(winning the match by Reshma)
$= 1 - 0.62 = 0.38$

11. (*d*) $\frac{1}{8}$

Total possible outcomes when one card is drawn = 48
When the number on drawn card is a perfect square, total favourable cases are 4, 9, 16, 25, 36, 49, i.e. = 6
P(perfect square number)

$$= \frac{\text{Number of total possible outcomes}}{\text{Number of favourable outcomes}}$$

$$= \frac{6}{48} = \frac{1}{8}$$

12 (*b*) $\frac{2}{5}$

When one ticket is drawn, total possible cases are 20.
Favourable cases when the number is a multiple of 3 or 7 are 3, 6, 9, 12, 18, 7, 14, *i.e.*, 8 cases
Required probability

$$= \frac{\text{Number of favourable cases}}{\text{Number of total possible cases}}$$

$$= \frac{8}{20} = \frac{2}{5}$$

13. (*d*) $\frac{1}{9}$

Total number of possible outcomes = 36
A = Product of the numbers on the top of the dice is 6.
$\therefore$ Favourable outcomes (1,6), (2,3), (3,2), (6,1), *i.e.* 4.

$$P(A) = \frac{\text{Favourable outcomes}}{\text{Total number of possible outcomes}}$$

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

14. (*a*) $\frac{3}{7}$

Favourable outcomes are –1, 0, 1

$\therefore$ Required Probability $= \frac{3}{7}$

15. (*c*) 162

Let the number of rotten apples in the heap be n.

$\therefore$ $\frac{n}{900} = 0.18 \Rightarrow n = 162$

16. (*d*) $\frac{21}{26}$

Total number of possible outcomes = 26

No. of favourable outcomes = 21

$\therefore$ Required probability = $\frac{21}{26}$

17. (*b*) $\frac{1}{3}$

Total number of outcomes = 6, *i.e.*, {1, 2, 3, 4, 5, 6}

Number of favourable outcomes = 2, *i.e.*, {1, 2}

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

18. (*c*) 0.93

We know that for any event E,

$P(E) + P(\bar{E}) = 1 \Rightarrow 0.07 + P(\bar{E}) = 1$

$\Rightarrow P(\bar{E}) = 1 - 0.07 = 0.93$

19. (*d*) $\frac{1}{6}$ **20.** (*a*) $\frac{1}{26}$

21. (*b*) $\frac{5}{34}$

Number of cards = 40 – 6 = 34

Multiples of 7 from 7 to 40 = 7, 14, 21, 28, 35

$\therefore$ Number of favourable outcomes = 5

So, probability of getting a card with a multiple of 7 = $\frac{5}{34}$

22. (*b*) $\frac{1}{2}$

23. (*a*) $\frac{3}{4}$

Possible outcomes = {HHH, HHT, HTH, THH, TTH, THT, HTT, TTT}

Total possible outcomes = 8,

There are two cases of the same result, *i.e.* {HHH, TTT}

Number of outcomes in which the game is lost = 8 – 2 = 6

$\therefore$ Probability of losing the game = $\frac{6}{8} = \frac{3}{4}$

24. (*a*) $\frac{1}{5}$

25. (*c*) $\frac{23}{52}$

Total number of possible outcomes = 52 – 3 = 49

No. of favourable outcomes = 26 – 3 = 23

$\therefore$ Required probability = $\frac{23}{52}$

26. (*c*) $\frac{3}{49}$ **27.** (*b*) $\frac{3}{4}$

28. (*c*) $\frac{1}{10}$ **29.** (*d*) $\frac{1}{200}$

30. (*d*) 8

$\frac{p}{12} + \frac{1}{3} = 1 \Rightarrow \frac{p}{12} = 1 - \frac{1}{3} = \frac{2}{3}$, $\therefore p = 8$

31. (*d*) $\frac{4}{5}$

Good bulbs = 25 – 5 = 20

P(good bulb) = $\frac{20}{25} = \frac{4}{5}$

32. (*a*) $\frac{5}{7}$

Total number of possible outcomes = 7

No. of favourable outcomes to $x^2 \le 4$ are $(-1)^2 = 1$, $0^2 = 0$, $1^2 = 1$, $(-2)^2 = 4$ and $(2)^2 = 4$

$\therefore$ Favourable outcomes = 5

$\therefore$ Required probability = $\frac{5}{7}$

33. (*c*) $\frac{5}{26}$

34. (*d*) 45

Let the number of black balls in the bag be n.

$\therefore$ Total number of balls are $15 + n$

Prob(Black ball) = 3 × Prob(White ball)

$\Rightarrow \frac{n}{15+n} = 3 \times \frac{15}{15+n} \Rightarrow n = 45$

35. (*c*) 24

Let number of red balls in the jar = x

number of blue balls in the jar = y

$\therefore$ Total number of balls in the jar = $x + y + 10$

Probability of selecting red ball = $\frac{1}{4}$

$\Rightarrow \frac{x}{x+y+10} = \frac{1}{4} \Rightarrow 4x = x + y + 10$

$\Rightarrow 3x - y = 10$ ...(*i*)

Also $\frac{1}{3} = \frac{y}{x+y+10}$

$\Rightarrow x + y + 10 = 3y$

$\Rightarrow x = 2y - 10$ ...(*ii*)

From (*i*) and (*ii*), we have

$3(2y - 10) - y = 10 \Rightarrow 6y - 30 - y = 10$

$\Rightarrow 5y = 40 \Rightarrow y = 8$

Putting $y = 8$ in (*ii*), we get

$x = 2 \times 8 - 10 = 16 - 10 = 6$

$\Rightarrow x = 6$

Hence, total number of balls in the jar = 6 + 8 + 10 = 24

36. (*b*) 50

Let R = getting a red ball
B = getting a black ball
W = getting a white ball

Now, P(R) + P(B) + P(W) = 1

$$P(R) + \frac{3}{10} + \frac{2}{5} = 1$$

$$\Rightarrow \quad P(R) = 1 - \left(\frac{3}{10} + \frac{2}{5}\right)$$

$$= 1 - \frac{7}{10} = \frac{3}{10}$$

Let x and y be the white and red balls respectively.

Then, $\frac{x}{x+y+20} = \frac{3}{10}$

$\Rightarrow \quad 10x - 3x - 3y = 60$

$\Rightarrow \quad 7x - 3y = 60 \quad ...(i)$

Again, $\frac{y}{x+y+20} = \frac{3}{10}$

$\Rightarrow \quad 10y - 3x - 3y = 60$

$\Rightarrow \quad 7y - 3x = 60 \quad ...(ii)$

On solving eqn (*i*) and (*ii*), $x = 15$ and $y = 15$.

So, total number of balls in the bag

$= 15 + 15 + 20 = 50$

37. (*a*) $\frac{3}{8}$

x can be 1, 4, 9 or 16 and y can be 1, 2, 3 or 4

Total number of cases of xy are 16.

Number of cases when xy is more than 16 are $(9 \times 2), (9 \times 3), (9 \times 4), (16 \times 2), (16 \times 3), (16 \times 4)$, *i.e.*, 6 cases.

P(value of xy more than 16) $= \frac{6}{16} = \frac{3}{8}$.

B. Assertion-Reason Type Questions

1. (*b*) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

2. (*b*) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

Case Study Based Questions

I. 1. (*a*) $\frac{1}{2}$ **2.** (*c*) 0 **3.** (*c*) $\frac{1}{3}$

4. (*a*) 1 **5.** (*d*)

II. 1. (*b*) $\frac{5}{36}$ **2.** (*d*) 0 **3.** (*a*) 1

4. (*c*) $\frac{1}{6}$ **5.** (*d*) $\frac{5}{18}$

Experts' Opinion

Questions based on following types are very important for Exams. So, students are advised to revise them thoroughly.

1. Problems based on tossing a coin.
2. Problems based on throwing a die.
3. Problems based on playing cards.
4. Problems based on selecting of an object from bag/box.

IMPORTANT FORMULAE

- $P(E) = \dfrac{\text{No. of outcomes favourable to E}}{\text{No. of all possible outcomes of the experiment}}$
- For any event E, P (E) + P ($\overline{E}$) = 1, where $\overline{E}$ stands for 'not E'.

COMMON ERRORS

Errors	Corrections
(*i*) Interpreting incorrectly that all the experiments are random experiment.	(*i*) An experiment whose outcome is known is not a random experiment.
(*ii*) Writing incorrectly the possible outcomes when a coin is tossed one by one or two coins are tossed together, say (HH, HT, TT).	(*ii*) Take care of the order of occurrence. Here, (HH, HT, TH, TT).
(*iii*) Using negative values and a number greater than one for probability.	(*iii*) The probability of an event lies between 0 and 1 (both 0 and 1 inclusive). So, a negative value and a number greater than 1 cannot be used for probability.

QUICK REVISION NOTES

- An experiment which has a number of possible outcomes is known as a random experiment.
- The theoretical probability or classical probability of an event E, written as P(E) is defined as

$$P(E) = \frac{\text{No. of outcomes favourable to E}}{\text{No. of all possible outcomes of the experiment}}$$

  where, we assume that the outcomes of the experiment are *equally likely*.
- The probability of a *sure event* (or a certain event) is 1.
- The probability of an event E is a number P(E) such that $0 \le P(E) \le 1$
- An event having only one outcome is called an *elementary event*. The sum of the probabilities of all the elementary events of an experiment is 1.
- For any event E, $P(E) + P(\overline{E}) = 1$, where $\overline{E}$ stands for 'not E'. E and $\overline{E}$ are called *complementary events*.
- When each outcome of a random experiment is likely to occur as the other, then they are termed as equally likely outcomes.