Probability

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) $\text{Probability of an event E} + \text{Probability of the event 'not E'} = 1.$

(ii) The probability of an event that cannot happen is 0. Such an event is called an impossible event.

(iii) The probability of an event that is certain to happen is 1. Such an event is called a 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.

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 Solution: a true-false question. The Solution: is right or wrong.

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

Solution:

(i) The car may or may not start depending on different conditions such as fuel, etc., thus this statement does not have equally likely outcomes.

(ii) Even though the player may fire or miss the shot, this statement does not have equally likely outcomes.

(iii) This statement has equally likely outcomes because the solution is either correct or incorrect.

(iv) Because it is known that a newborn baby can be either a boy or a girl, this statement likewise has equally likely outcomes.

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:

The tossing of a coin is a fair technique of deciding because there are only two possible outcomes: head or tail. Tossing is unexpected and regarded as entirely unbiased because these two results are equally likely outcomes.

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

(A) $\frac{2}{3}$

(B) -1.5

(C) 15%

(D) $\mathbf{0.7}$

Solution:

The probability of any event (E) always lies between 0 and 1 i.e. 0 ≤ P(E) ≤ 1. So, from the above options, option (B) -1.5 cannot be the probability of an event.

Any event's probability (E) is always between 0 and 1, i.e. $0 \leq \mathrm{P(E)} \leq 1$. Option (B) -1.5 cannot represent the probability of an event, based on the given options.

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

Solution:

According to the question, it is given that $\mathrm{P(E)} = 0.05$

As we know that the sum of two complementary events are 1.

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

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

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

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

As a result, the probability of 'not E' is 0.95 .

6. A bag contains lemon flavored candies only. Malini takes out one candy without looking into the bag. What is the probability that she takes out

(i) an orange flavored candy?

(ii) a lemon flavored candy?

Solution:

(i) There is no way to take out orange-flavored candy from a bag that simply contains lemon-flavored candy. As a result, the chance of removing orange-flavored sweets is zero.

(ii) As the bag only contains lemon-flavored candy, she will only take out lemon-flavored candy each time. As a result, the event is certain, and the probability of having lemon-flavored candy is 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:

Let E be the event in which two students can share the same birthday.

It is given that the probability of two students not having the same birthday in a group of 3 students is 0.992 i.e. $\mathrm{P(E)} = 0.992$

As we know, that the total of two complementary events is 1.

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

We will find out the probability of not happening of event by substituting the given values in the above equation.

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

$$\mathrm{P(not\ E)} = 1 - 0.992 = 0.008$$

As a result, the probability that the 2 students have the same birthday is 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:

According to question, a bag contains

$$\text{Number of red balls in a bag} = 3$$

$$\text{Number of black balls in a bag} = 5$$

$$\text{Total number of balls} = 3 + 5 = 8$$

$$\text{Probability of drawing red ball} = \frac{\text{Number of possible outcomes}}{\text{Total number of favorable outcomes}}$$

(i)

$$\text{Probability of drawing red balls } P(R) = \frac{\text{no. of red balls}}{\text{total no. of balls}} = \frac{3}{8}$$

(ii)

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

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:

According to the question,

$$\text{No. of red balls in a box} = 5$$

$$\text{No. of white balls in a box} = 8$$

$$\text{No. of green balls in a box} = 4$$

$$\text{Total no. of red balls} = 5 + 8 + 4 = 17$$

Using the formula, calculate the probability of getting red, white, and green marble.

$$P(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$$

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

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

(iii) $\text{Probability of drawing a ball which is green} = \frac{4}{17} = 0.23$

$\text{Probability of drawing a ball which is not green} = 1 - 0.23 = 0.77$

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:

According to the question, we are given

$$\text{Number of 50p coins} = 100$$

$$\text{Number of ₹1 coins} = 50$$

$$\text{Number of ₹2 coins} = 20$$

$$\text{Number of ₹5 coins} = 10$$

So, the total number of coins $= 100 + 50 + 20 + 10 = 180$

Using the formula, calculate the probability of getting red, white, and green marble.

$$\text{P(E)} = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

(i) $\text{Probability of drawing 50p coin} = \frac{100}{180} = 0.55$

(ii) $\text{Probability of getting a ₹5 coin} = \frac{10}{180} = \frac{1}{18} = 0.055$

$$\text{Probability of not getting a ₹5 coin} = 1 - \frac{1}{18} = \frac{17}{18} = 0.945$$

11. Gopi buys fish from a shop for his aquarium. The shopkeeper takes out one fish at random from a tank containing 5 male fish and 8 female fish (see Fig. 15.4). What is the probability that the fish taken out is a male fish?

Fig. 15.4

Solution:

According to the question, we have

$$\text{Number of male fish} = 5$$

$$\text{Number of female fish} = 8$$

So, the total number of fishes $= 5 + 8 = 13$

$$P(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$$

$$\text{Probability that the fish taken out is a male fish} = \frac{\text{Number of male fish}}{\text{Total number of fishes}} = \frac{5}{13} = 0.38$$

As a result, the chances of the fish being a male are 0.38.

12. A game of chance consists of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8 (see Fig. 15.5), and these are equally likely outcomes. What is the probability that it will point at

(i) 8?

(ii) an odd number?

(iii) a number greater than 2?

(iv) a number less than 9?

Fig. 15.5

Solution:

The total number of possible outcomes is 8.

$$\text{Probability of getting 8} = \frac{\text{Probability of getting 8}}{\text{Total number of outcomes}}$$

(i) $\text{Probability of getting 8} = \frac{1}{8} = 0.125$

(ii) $\text{Total number of odd numbers} = 1, 3, 5, 7 = 4$

$$\text{Probability of getting odd number} = \frac{\text{Total number of odd number}}{\text{Total number of outcomes}}$$

$$\text{Probability of getting odd number} = \frac{4}{8} = \frac{1}{2} = 0.5$$

(iii) Total numbers greater than 2 are $3, 4, 5, 6, 7, 8 = 6$

$$\text{Probability of getting numbers greater than 2} = \frac{\text{Number greater than 2}}{\text{Total number of outcomes}}$$

$$\text{Probability of getting numbers greater than 2} = \frac{6}{8} = \frac{3}{4} = 0.75$$

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

$$\text{Probability of getting numbers less than 9} = \frac{\text{Number greater than 9}}{\text{Total number of outcomes}} = \frac{8}{8} = 1$$

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.

Solution:

Total number of possible events when a dice is thrown $1,2,3,4,5,6 = 6$

Total numbers of prime numbers on dice are $1,3 \text{ and } 5 = 3$

Formula used: $P(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$

(i)

$$\text{Probability of getting a prime numbers} = \frac{\text{Number of prime numbers}}{\text{Total number of outcome}}$$

$$\text{Probability of getting a prime numbers} = \frac{3}{6} = 0.5$$

(ii) Number lying between 2 and 6 are 3 i.e. 3,4,5.

$$\text{Probability of getting a number lying between 2 and 6} = \frac{\text{Number lying between 2 and 6}}{\text{Total number of outcomes}}$$

$$= \frac{3}{6} = 0.5$$

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

$$\text{Probability of getting a odd number} = \frac{\text{Number of odd numbers}}{\text{Total number of outcomes}} = \frac{3}{6} = 0.5$$

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:

A well-shuffled deck has a total of 52 cards.

$\text{Number of spade cards} = 13$

$\text{Number of heart cards} = 13$

Number of diamond cards $= 13$

Number of clud cards $= 13$

Total number of Kings $= 4$

Total number of queens $= 4$

Total number of jacks $= 4$

Number of face cards $= 12$

Formula used: $P(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$

(i)

$$\text{Probability of getting a king of red colour} = \frac{\text{Number of red colour king}}{\text{Total number of outcomes}} = \frac{2}{52} = \frac{1}{26} = 0.038$$

(ii)

$$\text{Probability of getting a face card} = \frac{\text{Number of face cards}}{\text{Total number of outcomes}} = \frac{12}{52} = \frac{3}{13} = 0.23$$

(iii)

$$\text{Probability of getting a red face card} = \frac{\text{Number of red face card}}{\text{Total number of outcomes}} = \frac{6}{52} = \frac{3}{26} = 0.11$$

(iv)

$$\text{Probability of getting the jack of hearts} = \frac{\text{Number of jack of hearts}}{\text{Total number of outcomes}} = \frac{1}{52} = 0.019$$

(v) Probability of getting a spade card $= \frac{\text{Number of spade card}}{\text{Total number of outcomes}} = \frac{13}{52} = \frac{1}{4} = 0.25$

(vi)

Probability of getting the queen of diamonds $= \frac{\text{Number of possible outcomes}}{\text{Total number of favorable outcomes}} = \frac{1}{52} = 0.019$

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:

We are given,

$\text{Total numbers of cards} = 5$

Formula used: $P(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$

(i)

$$\text{Numbers of queen card} = 1$$

$$P\text{ (picking a queen)} = \frac{1}{5} = 0.2$$

(ii) If the queen is chosen and set aside, the ten, jack, king, and ace of diamonds are the only cards left.

(a) Total numbers of ace $= 1$

$$\text{P (picking an ace)} = \frac{1}{4} = 0.25$$

(b) Total numbers of queen $= 0$

$$\text{P (picking a queen)} = \frac{0}{4} = 0$$

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:

In this question, we have

$$\text{Number of defective pens} = 12$$

$$\text{Number of good pens} = 132$$

$$\text{Numbers of pens} = \text{Numbers of defective pens} + \text{Numbers of good pens}$$

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

$$\text{Probability that the pen taken out is a good one} = \frac{\text{Number of possible outcomes}}{\text{Total number of favorable outcomes}}$$

$$\text{P(picking a good pen)} = \frac{132}{144} = \frac{11}{12} = 0.916$$

As a result, the probability that the pen taken out is good is 0.916.

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)

$$\text{Number of defective bulbs} = 4$$

$$\text{Total number of bulbs} = 20$$

$$\text{Probability of obtaining a defective bulb} = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}} = \frac{4}{20} = \frac{1}{5} = 0.2$$

(ii) Since one non-defective bulb is already drawn, the total number of bulbs remaining is 19.

So, the total number of events (or outcomes) $= 19$

The total number of non-defective bulbs $= 19 - 4 = 15$

$$\text{Probability that the bulb is not defective} = \frac{15}{19} = 0.789$$

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:

According to the question, there are a total 90 numbers of discs in a box.

Formula used: $\mathrm{P(E)} = \dfrac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$

(i) Total number of two-digit numbers between $1 \text{ to } 90 = 90 - 9 = 81$

$$\text{Probability of getting a two} - \text{digit number} = \frac{\text{Number of possible outcomes}}{\text{Total number of favorable outcomes}}$$

$$\text{P(getting a 2} - \text{digit number)} = \frac{81}{90} = \frac{9}{10} = 0.9$$

(ii) Total number of perfect square numbers $= 9\ (1, 4, 9, 16, 25, 36, 49, 64 \text{ and } 81)$

$$\text{Probability of getting a perfect square number} = \frac{\text{Number of possible outcomes}}{\text{Total number of favorable outcomes}}$$

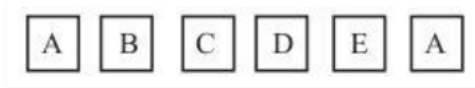
$$\text{P(getting a perfect square number)} = \frac{9}{90} = \frac{1}{10} = 0.1$$

(iii) Total numbers which are divisible by 5 $=$
$18\ (5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85 \text{ and } 90)$

$$\text{Probability of getting a number divisible by 5} = \frac{\text{Number of possible outcomes}}{\text{Total number of favorable outcomes}}$$

$$\text{P(getting a number divisible by 5)} = \frac{18}{90} = \frac{1}{5} = 0.2$$

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



The die is thrown once. What is the probability of getting

(i) A?

(ii) D?

Solution:

The total number of events $= 6$

Formula used: $P(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$

(i) Total number of faces with A $= 2$

$P\text{ (getting A)} = \frac{2}{6} = \frac{1}{3} = 0.33$

(ii) Total number of faces with D $= 1$

$P\text{ (getting D)} = \frac{1}{6} = 0.166$

20. Suppose you drop a die at random on the rectangular region shown in Fig. 15.6. What is the probability that it will land inside the circle with diameter 1m?

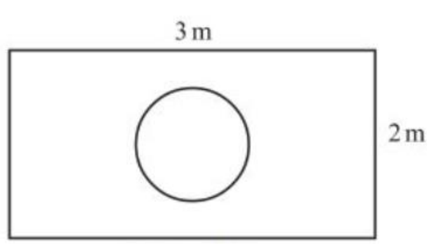


Fig. 15.6

Solution:

To begin, calculate the area of the rectangle and the circle. The possible outcome is the area of the rectangle, whereas the favorable outcome is the area of the circle.

So,

$$\text{Area of the rectangular region} = \text{L} \times \text{B} = (3 \times 2)\text{m}^2 = 6\ \text{m}^2$$

$$\text{Area of circular region} = \pi r^2 = \pi\left(\frac{1}{2}\right)^2 = \frac{\pi}{4}$$

Calculate the probability of landing inside the circle.

$$\text{Probability that it will land inside the circle} = \frac{\text{Number of possible outcomes}}{\text{Number of favorable outcomes}}$$

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

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

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

As a result, it has a 0.13 percent chance of landing inside the circle.

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:

$$\text{Total number of ball pens} = 144$$

$$\text{Number of defective ball pens} = 20$$

$$\text{Number of good ball pens} = 144 - 20 = 124$$

Formula used: $\mathrm{P(E)} = \dfrac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$

(i) $\text{Probability that she will buy it} = \dfrac{\text{Number of possible outcomes}}{\text{Number of favorable outcomes}}$

$$\text{P (buying)} = \frac{124}{144} = \frac{31}{36} = 0.86$$

(ii) $\text{Probability that she will not buy it} = \dfrac{\text{Number of possible outcomes}}{\text{Number of favorable outcomes}}$

$$\text{P (not buying)} = \frac{20}{144} = \frac{5}{36} = 0.138$$

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 of 1/11. Do you agree with this argument? Justify your Solution.

Solution:

If two dice are thrown, the following outcomes are possible:

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

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

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

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

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

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

Thus, the total numbers of events: $6 \times 6 = 36$

The number of possible outcomes to get the sum as $2 = (1,1)$

The number of possible outcomes to get the sum as $3 = (2,1), (1,2)$

The number of possible outcomes to get the sum as $4 = (2,2), (1,3), (3,1)$

The number of possible outcomes to get the sum as $5 = (3,2), (2,3), (4,1), (1,4)$

The number of possible outcomes to get the sum as $6 = (5,1), (1,5), (3,3), (4,2), (2,4)$

The number of possible outcomes to get the sum as $7 = (4,3), (3,4), (6,1), (1,6), (5,2), (2,5)$

The number of possible outcomes to get the sum as $8 = (4,4), (6,2), (2,6), (5,3), (3,5)$

The number of possible outcomes to get the sum as $9 = (5,4), (4,5), (6,3), (3,6)$

The number of possible outcomes to get the sum as $10 = (5,5), (6,4), (4,6)$

The number of possible outcomes to get the sum as $11 = (6,5), (5,6)$

The number of possible outcomes to get the sum as $12 = (6,6)$

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) The argument is incorrect because it is already stated in part(i) that there are 36 possible outcomes, not 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:

The total numbers of possible outcomes are $=$ $(\text{HHH}, \text{HHT}, \text{HTH}, \text{THH}, \text{TTH}, \text{HTT}, \text{THT}, \text{TTT}) = 8$

Number of possible outcomes to get three heads or three tails $= 2$

$$\text{Probability that Hanif will win the game} = \frac{\text{Number of possible outcomes}}{\text{Total number of favorable outcomes}}$$

$$\text{P(winning the game)} = \frac{2}{8} = \frac{1}{2}$$

$$\text{Probability that Hanif will win the game} = 1 - \frac{1}{4}$$

$$\text{P(losing the game)} = \frac{3}{4} = 0.75$$

As a result, Hanif has a 0.75 percent chance of losing the game.

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:

The following outcomes are:

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

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

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

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

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

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

Hence, the total number of outcome $= 6 \times 6 = 36$

(i) The number of possible outcomes when 5 will come up either time $=$ $(5,1), (5,2), (5,3), (5,4), (5,5), (5,6), (1,5), (2,5), (3,5), (4,5), (6,5) = 11$

$$\text{Probability that 5 will come up either time} = \frac{\text{Number of possible outcomes}}{\text{Total number of favorable outcome}} = \frac{11}{36}$$

$$\text{Probability that 5 will not come up either time} = 1 - \frac{11}{36} = \frac{25}{36}$$

(ii) Number of possible outcomes when 5 will come up at-least once $= 5 + 6 = 11$

$$\text{Probability that 5 will come up at} - \text{least once} = \frac{\text{Number of possible outcomes}}{\text{Total number of favorable outcome}} = \frac{11}{36}$$

As a result, the required probability is $\frac{11}{36}$.

25. Which of the following arguments are correct and which are not correct? Give reasons for your Solution

(i) If two coins are tossed simultaneously there are three possible outcomes—two heads, two tails or one of each. Therefore, for each of these outcomes, the probability is 1/3

(ii) If a die is thrown, there are two possible outcomes—an odd number or an even number. Therefore, the probability of getting an odd number is 1/2

Solution:

(i) When two coins are tossed at the same time,

The total numbers of possible outcomes are $(\mathrm{H}, \mathrm{H}), (\mathrm{T}, \mathrm{T}), (\mathrm{H}, \mathrm{T}), (\mathrm{T}, \mathrm{H}) = 4$

$\text{Number of possible outcomes for two heads} = (\mathrm{H}, \mathrm{H}) = 1$

$\text{Number of possible outcomes for two tails} = (\mathrm{T}, \mathrm{T}) = 1$

$\text{Number of possible outcomes for one of each} = (\mathrm{H}, \mathrm{T}), (\mathrm{T}, \mathrm{H}) = 2$

Thus,

$\text{P (getting two heads)} = \frac{1}{4}$

$\text{P (getting two tails)} = \frac{1}{4}$

$\text{P (getting one of each)} = \frac{2}{4} = \frac{1}{4}$

As a result, this statement is incorrect because the probability of each of the outcome is not $\frac{1}{4}$

.

(ii) The total numbers of possible outcomes when a dice is thrown $= (1,2,3,4,5,6)$

Number of possible outcomes for odd number $= (1,3,5) = 3$

Number of possible outcomes for even number $= (2,4,6) = 3$

Thus, P (getting odd number) $= \frac{3}{6} = \frac{1}{2}$

As a result, this statement is valid because both outcomes are equally possible.

Exercise: 15.2

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?

Solution:

Because there are five days and each of them can go to the store in five different ways, the total number of possible outcomes $= 5 \times 5 = 25$

(i) The number of possible events that both will visit the shop on the same day $=$ $(T, T), (W, W), (TH, TH), (F, F), (S, S) = 5$

P (both visiting on the same day) $= \frac{5}{25} = \frac{1}{5}$

(ii) The number of possible events that both will visit the shop on consecutive days $=$ $(T, W), (W, TH), (TH, F), (F, S), (W, T), (TH, W), (F, TH), (S, F) = 8$

P (both visiting on the consecutive days) $= \frac{8}{25}$

(iii) The number of possible events that both will visit the shop on the different days $=$
$(T, W), (W, TH), (TH, F), (F, S), (W, T), (TH, W), (F, TH), (S, F) = 8$

$$P\text{ (both visiting on the different day)} = 1 - \frac{5}{25} = \frac{20}{25} = \frac{4}{5}$$

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 first throw (columns); Number in second throw (rows)

+	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 table will look like this:

+	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

The total number of possible events $6 \times 6 = 36$

(i) When the sum is even, there are 18 possible outcomes.

$$\text{Probability that the total score is even} = \frac{\text{Number of possible outcomes}}{\text{Total number of outcomes}}$$

$$\text{P(Even)} = \frac{18}{36} = \frac{1}{2}$$

(ii) When the sum is six, there are 4 possible outcomes.

$$\text{Probability of getting the sum 6} = \frac{\text{Number of possible outcomes}}{\text{Total number of outcomes}}$$

$$\text{P(Sum is 6)} = \frac{4}{36} = \frac{1}{9}$$

(iii) When the sum is at least 6(greater than 5), there are 15 possible outcomes.

$$\text{Probability of getting the sum is at least 6} = \frac{\text{Number of possible outcomes}}{\text{Total number of outcomes}}$$

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

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:

According to the question, there are 5 red balls in a bag.

Let us assume that the number of blue balls is x.

As a result, the total number of balls is $x + 5$.

$$\text{P(E)} = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$$

$$\text{P (drawing a blue ball)} = \frac{x}{x+5} ——- (1)$$

Similarly,

P (drawing a red ball) $= \frac{5}{x+5}$ ——- (2)

From equation (1) and (2), we get

$x = 10$

Therefore, the total number of blue balls is 10.

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:

According to the question, it is given that,

$$\text{Total number of black balls} = x$$

$$\text{Total number of balls} = 12$$

Formula used:

$$P(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}}$$

P (getting black balls) $= \frac{x}{12}$ ———————(1)

If six more black balls are added to the box, the probability of drawing a black ball is now doubled.

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

Number of black balls $= x + 6$

$$\text{P (getting black balls)} = \frac{x+6}{18} ———————(2)$$

Given this, the probabilities of drawing a black ball are now two times higher as they were previously.

$2 \times \text{Probability of drawing black ball before} = \text{Probability of drawing black ball}$

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

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

$3x = x + 6$

$3x - x = 6$

$2\,x = 6$

$x = 6$

As a result, the number of black balls is 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 ⅔. Find the number of blue balls in the jar.

Solution:

According to the question, there are 24 marbles in a jar.

Let x be the number of green marbles and $24 - x$ be the number of blue marbles.

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

$\frac{\text{Number of possible outcomes}}{\text{Total number of outcomes}} = \frac{2}{3}$

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

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

$x = 16$

Thus, the number of green marbles is16.

As a result, the total number of blue marbles is $24 - x = 24 - 26 = 8$