Exercise 14.1 Page: 214

1. Complete the statements:

(i) Probability of event E + Probability of event “not E” = _____

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

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

(iv) The sum of the probabilities of all the elementary events of an experiment is _____.

(v) The probability of an event is greater than or equal to _____ and less than or equal to _____.

Answer:

(i) 1

(ii) 0, impossible event

(iii) 1, sure or certain event

(iv) 1

(v) 0, 1

2. Which of the following experiments have equally likely outcomes? Explain.

(i) A driver attempts to start a car. The car starts or does not start.

(ii) A player attempts to shoot a basketball. She/he shoots or misses the shot.

(iii) A trial is made to answer a true-false question. The answer is right or wrong.

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

Answer:

(i) In the experiment, “A driver attempts to start a car. The car starts or does not start”, we are not justified to assume that each outcome is as likely to occur as the other. Thus, the experiment has no equally likely outcomes.

(ii) In the experiment, “A player attempts to shoot a basketball. She/he shoots or misses the shot”, we are not justified to assume that each outcome is as likely to occur as the other. Thus, the experiment has no equally likely outcomes.

(iii) In the experiment “A trial is made to answer a true-false question. The answer is right or wrong.” We know, in advance, that the result can lead in one of the two possible ways – either right or wrong. We can reasonably assume that each outcome, right or wrong, is likely to occur as the other. Thus, the outcomes right or wrong are equally likely.

(iv) In the experiment, “A baby is born, It is a boy or a girl”. We know, in advance that the outcome can lead in one of the two possible outcomes – either a boy or a girl. We are justified to assume that each outcome, boy or girl, is likely to occur as the other. Thus, the outcomes boy or girl are equally likely.

3. Why is tossing a coin considered to be a fair way of deciding which team should get the ball at the beginning of a football game?

Answer: The tossing of a coin is considered to be a fair way of deciding which team should get the ball at the beginning of a football game as we know that the tossing of the coin only land in one of two possible ways – either head up or tail up. It can reasonably be assumed that each outcome, head or tail, is as likely to occur as the other, i.e., the outcomes head and tail are equally likely. So the result of the tossing of a coin is completely unpredictable.

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

(A) 2/3

(B) -1.5

(C) 15%

(D) 0.7

Answer:

(B) Since the probability of an event E is a number P(E) such that

$0 \leq P(E) \leq 1$

(B) -1.5 cannot be the probability of an event.

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

Answer.

Since P(E) + P (not E) = 1

so, P (not E) = 1 – P(E) = 1 – 0.05 = 0.95

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

(i) an orange flavoured candy?

(ii) a lemon flavoured candy?

Answer:

(i) Consider the event related to the experiment of taking out of an orange flavoured candy from a bag containing only lemon flavoured candies. Since no outcome gives an orange flavoured candy, therefore, it is an impossible event so its probability is 0.

(ii) Consider the event of taking a lemon flavoured candy out of a bag containing only lemon flavoured candies. This event is a certain event so its probability 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?

Answer.

Let E be the event of having the same birthday

Given, P(E) = 0.992

But P(E) + P(not E) = 1

P(not E) = 1 – P(E) = 1 – 0.992 = 0.008

8. A bag contains 3 red balls and 5 black balls. A ball is drawn at random from the bag. What is the probability that the ball drawn is:

(i) red?

(ii) not red?

Answer:

There are 3 + 5 = 8 balls in a bag. Out of these 8 balls, one can be chosen in 8 ways.

so, Total number of elementary events = 8

(i) Since the bag contains 3 red balls, therefore, one red ball can be drawn in 3 ways.

so, Favourable number of elementary events = 3

Hence P (getting a red ball) = 3/8

(ii) Since the bag contains 5 black balls along with 3 red balls, therefore one black (not red) ball can be drawn in 5 ways.

so, Favourable number of elementary events = 5

Hence P (getting a black ball) = 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?

Answer:

Total number of marbles in the box = 5 + 8 + 4 = 17

so, Total number of elementary events = 17

(i) There are 5 red marbles in the box.

Favourable number of elementary events = 5

so, P (getting a red marble) = 5/17 = 0.29

(ii) There are 8 white marbles in the box.

Favourable number of elementary events = 8

So, P (getting a white marble) = 8/17 = 0.47

(iii) Total number of green marble = 4

P (green marble) = 4/17 = 0.23

∴ P (not green) = 1-P(green ball) = 1-(4/7) = 0.77

10. A piggy bank contains hundred 50 p coins, fifty Re. 1 coins, twenty Rs. 2coins and ten Rs. 5 coins. If it is equally likely that of the coins will fall out when the bank is turned upside down, what is the probability that the coin:

(i) will be a 50 p coin?

(ii) will not be a Rs.5 coin?

Answer:

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

So, Total number of elementary events = 180

(i) Total number of 50 p coin = 100

P (50 p coin) = 100/180 = 5/9 = 0.55

(ii)Total number of ₹5 coin = 10

P (₹5 coin) = 10/180 = 1/18 = 0.055

∴ P (not ₹5 coin) = 1-P (₹5 coin) = 1-0.055 = 0.945

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 fishes and 8 female fishes (see figure). What is the probability that the fish taken out is a male fish?

Fig. 15.4

Answer:

Total number of fish in the tank = 5 + 8 = 13

∴ Total number of elementary events = 13

There are 5 male fishes in the tank.

∴ Favourable number of elementary events = 5

Hence, P (taking out a male fish) = 5/13 = 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 figure) and these are equally likely outcomes. What is the probability that it will point at:

Fig. 15.5

(i) 8?

(ii) an odd number?

(iii) a number greater than 2?

(iv) a number less than 9?

Answer:

Out of 8 numbers, an arrow can point any of the numbers in 8 ways.

∴ Total number of favourable outcomes = 8

(i) Favourable number of outcomes = 1

Hence, P (arrow points at 8) = ⅛ = 0.125

(ii) Favourable number of outcomes = 4

Hence, P (arrow points at an odd number) = 4/8 = ½ = 0.5

(iii) Favourable number of outcomes = 6

Hence, P (arrow points at a number > 2) = 6/8 = ¾ = 0.75

(iv) Favourable number of outcomes = 8

Hence, P (arrow points at a number < 9) = 8/8 =1

13. A dice is thrown once. Find the probability of getting:

(i) a prime number.

(ii) a number lying between 2 and 6.

(iii) an odd number.

Answer:

Total number of favourable outcomes of throwing a dice = 6

(i) On a dice, the prime numbers are 2, 3 and 5.

Therefore, favourable outcomes = 3

Hence P (getting a prime number) = 3/6 = ½ = 0.5

(ii) On a dice, the number lying between 2 and 6 are 3, 4, 5.

Therefore, favourable outcomes = 3

Hence P (getting a number lying between 2 and 6) = 3/6 = ½ = 0.5

(iii) On a dice, the odd numbers are 1, 3 and 5.

Therefore, favourable outcomes = 3

Hence P (getting an odd number) = 3/6 = ½ = 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.

Answer:

Total number of favourable outcomes = 52

(i) There are two suits of red cards, i.e., diamond and heart. Each suit contains one king.

∴ Favourable outcomes = 1

Hence, P (a king of red colour) = 2/52 = 1/26 = 0.038

(ii) There are 12 face cards in a pack.

So, Favourable outcomes = 12

Hence, P (a face card) = 12/52 = 3/13 = 0.23

(iii) There are two suits of red cards, i.e., diamond and heart. Each suit contains 3 face cards.

So, Favourable outcomes = 6

Hence, P (a red face card) = 6/52 = 3/26 = 0.11

(iv) There are only one jack of heart.

So, Favourable outcome = 1

Hence, P (the jack of hearts) = 1/52 = 0.019

(v) There are 13 cards of spade.

So, Favourable outcomes = 13

Hence, P (a spade) = 13/52 = ¼ = 0.25

(vi) There is only one queen of diamonds.

So, Favourable outcome = 1

Hence, P (the queen of diamonds) = 1/52 = 0.019

15. Five cards – then ten, jack, queen, king and ace of diamonds, are well-shuffled with their face downwards. One card is then picked up at random.

(i) What is the probability that the card is the queen?

(ii) If the queen is drawn and put aside, what is the probability that the second card picked up is (a) an ace? (b) a queen?

Answer:

Total number of favourable outcomes = 5

(i) There is only one queen.

Favourable outcome = 1

Hence, P (the queen) = ⅕ = 0.2

(ii) In this situation, total number of favourable outcomes = 4

(a) Favourable outcome = 1

Hence, P (an ace) = ¼ = 0.25

(b) There is no card as queen.

So, Favourable outcome = 0

Hence, P (the queen) = 0/4 = 0

16. 12 defective pens are accidently mixed with 132 good ones. It is not possible to just look at a pen and tell whether or not it is defective. One pen is taken out at random from this lot. Determine the probability that the pen taken out is a good one.

Answer:

Total number of favourable outcomes = 132 + 12 = 144

Number of favourable outcomes = 132

Hence, P (getting a good pen) = 132/144 = 11/12 = 0.916

17. (i) A lot of 20 bulbs contains 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?

Answer:

(i) Total number of favourable outcomes = 20

Number of favourable outcomes = 4

Hence P (getting a defective bulb) = 4/20 = ⅕ = 0.2

(ii) Now total number of favourable outcomes = 20 – 1 = 19

Number of favouroable outcomes = 19 – 4 = 15

Hence P (getting a non-defective bulb) = 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.

Answer:

Total number of favourable outcomes = 90

(i) Number of two-digit numbers from 1 to 90 are 90 – 9 = 81

So, Favourable outcomes = 81

Hence, P (getting a disc bearing a two-digit number) = 81/90 = 9/10 = 0.9

(ii) From 1 to 90, the perfect squares are 1, 4, 9, 16, 25, 36, 49, 64 and 81.

so, Favourable outcomes = 9

Hence P (getting a perfect square) = 9/90 = 1/10 = 0.1

(iii) The numbers divisible by 5 from 1 to 90 are 18.

So, Favourable outcomes = 18

Hence P (getting a number divisible by 5) = 18/90 = ⅕ = 0.2

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?

(ii) D?

Answer:

Total number of favourable outcomes = 6

(i) Number of favourable outcomes = 2

Hence P (getting a letter A) = 2/6 = ⅓ = 0.33

(ii) Number of favourable outcomes = 1

Hence P (getting a letter D) = ⅙ = 0.166

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

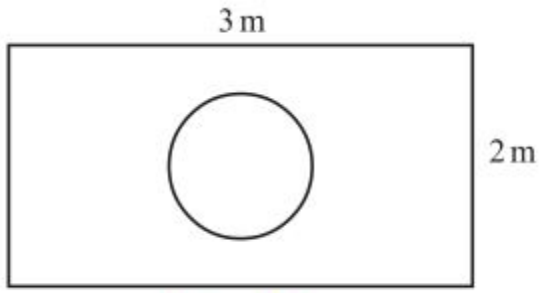

Fig. 15.6

Answer:

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First, calculate the area of the rectangle and the area of the circle. Here, the area of the rectangle is the possible outcome and the area of the circle will be the favourable outcome.

So, the area of the rectangle = (3×2) m^2 = 6 m^2

and,

The area of the circle = πr^2 = $\pi(½)^2$ m^2 = π/4 m^2 = 0.78

∴ The probability that die will land inside the circle = [(π/4)/6] = π/24 or, 0.78/6 = 0.13

21. A lot consists of 144 ball pens of which 20 are defective and the others are good. Nuri will buy a pen if it is good, but will not buy if it is defective. The

shopkeeper draws one pen at random and gives it to her. What is the probability that:

(i) she will buy it?

(ii) she will not buy it?

Answer:

Total number of favourable outcomes = 144

(i) Number of non-defective pens = 144 – 20 = 124

So, Number of favourable outcomes = 124

Hence P (she will buy) = P (a non-defective pen) = 124/144 = 31/36 = 0.86

(ii) Number of favourable outcomes = 20

Hence P (she will not buy) = P (a defective pen) = 20/144 = 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 1/11 . Do you agree with this argument? Justify your answer.

Answer:

Total favourable outcomes of throwing two dice 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)

Total number of favourable outcomes = 36

(i) It is given that to get the sum as 2, the probability is 1/36 as the only possible outcomes = (1,1)

For getting the sum as 3, the possible events (or outcomes) = E (sum 3) = (1,2) and (2,1)

So, P(sum 3) = 2/36

Similarly,

E (sum 4) = (1,3), (3,1), and (2,2)

So, P (sum 4) = 3/36

E (sum 5) = (1,4), (4,1), (2,3), and (3,2)

So, P (sum 5) = 4/36

E (sum 6) = (1,5), (5,1), (2,4), (4,2), and (3,3)

So, P (sum 6) = 5/36

E (sum 7) = (1,6), (6,1), (5,2), (2,5), (4,3), and (3,4)

So, P (sum 7) = 6/36

E (sum 8) = (2,6), (6,2), (3,5), (5,3), and (4,4)

So, P (sum 8) = 5/36

E (sum 9) = (3,6), (6,3), (4,5), and (5,4)

So, P (sum 9) = 4/36

E (sum 10) = (4,6), (6,4), and (5,5)

So, P (sum 10) = 3/36

E (sum 11) = (5,6), and (6,5)

So, P (sum 11) = 2/36

E (sum 12) = (6,6)

So, P (sum 12) = 1/36

So, the table will be as:

Event: Sum on 2 dice	2	3	4	5	6	7	8	9	10	11	12
Probability	1/36	2/36	3/36	4/36	5/36	6/36	5/36	4/36	3/36	2/36	1/36

(ii) I do not agree with the argument given here. Justification has already been given in part (i).

23. A game consists of tossing a one rupee coin 3 times and noting its outcome each time. Hanif wins if all the tosses give the same result, i.e., three heads or three tails and loses otherwise. Calculate the probability that Hanif will lose the game.

Answer:

The outcomes associated with the experiment in which a coin is tossed thrice:

HHH, HHT, HTH, THH, TTH, HTT, THT, TTT

Therefore, Total number of favourable outcomes = 8

Number of favourable outcomes = 6

Hence required probability = 6/8 = ¾ = 0.75

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?

Answer:

(i) The outcomes associated with the experiment in which a dice is thrown is twice:

(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 favourable outcomes = 36

Now consider the following events:

Consider the following events.

A = 5 comes in first throw,

B = 5 comes in second throw

P(A) = 6/36,

P(B) = 6/36 and

P(not B) = 5/6

So, P(not A) = 1-(6/36) = 5/6

∴ The required probability = (5/6)×(5/6) = 25/36

(ii)Number of events when 5 comes at least once = 11

∴ The required probability = 11/36

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

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

Answer:

(i) Incorrect: We can classify the outcomes like this but they are not then, 'equally likely'. Reason is that 'one of each' can result in two ways – from a head on first coin and tail on the second coin or from a tail on the first coin and head on the second coin. This makes it twice as likely as two heads (or two tails).

(ii) Correct: The two outcomes considered in the question are equally likely.