Chapter 15 - Probability

Excercise 15A

Solution 1

(i) The probability of an impossible event is **zero**.

(ii) The probability of a sure event is **one**.

(iii) For any event E, P(E) + P(not E)= **one** .

(iv) The probability of a possible but not a sure event lies between **zero** and **one**.

(v) The sum of probabilities of all the outcomes of an experiment is **one**.

Solution 2

When a coin is tossed the outcomes are:

$\{H, T\}$

So, the number of outcomes = 2

$$P(\text{getting a tail}) = \frac{1}{2}$$

Solution 3

When two coins are tossed the outcomes are:
{HH, HT, TH, TT}
Total number of outomes = 4

(i) $P(\text{getting exactly 1 head}) = \frac{2}{4} = \frac{1}{2}$

(ii) $P(\text{getting atmost 1 head}) = \frac{3}{4}$

(iii) $P(\text{getting atleast 1 head}) = \frac{3}{4}$

Solution 4

In a throw of a dice, all possible outcomes are 1, 2, 3, 4, 5, 6

Total number of possible outcomes = 6

(i)Let E be event of getting even number

Then, the favorable outcomes are 2, 4, 6

Number of favorable outcomes= 3

$\therefore$ P(getting a even number)= P(E) = $\frac{3}{6} = \frac{1}{2}$

(ii)Let R be the number less than 5

Then, the favorable outcomes are 1, 2, 3, 4

Number of favorable outcomes = 4

$\therefore$ P(getting a number less than 5)= P(R) = $\frac{4}{6} = \frac{2}{3}$

(iii)Let M be the event of getting a number greater than 2

Then, the favorable outcomes are 3, 4, 5, 6

Number of favorableoutcomes = 4

$\therefore$ P(getting a number greater than 2)= P(M) $= \frac{4}{6} = \frac{2}{3}$

(iv)Let N be the number lying between 3 and 6

Then the favorable outcomes are 4, 5

Number of favorable outcomes = 2

$\therefore$ P(getting a number 3 and 6)= P(N) = $\frac{2}{6} = \frac{1}{3}$

(v)Let G be event of getting a number other than 3

Then the favorable outcomes are 1, 2, 4, 5, 6

Number of favorable outcomes = 5

$\therefore$ P(getting a number other than 5)=P(G) = $\frac{5}{6}$

(vi)Let T be event of getting a number 5

Then the favorable outcome is 5

Number of favorable outcomes = 1

$\therefore$ P(getting a number 5)=P(T) $= \frac{1}{6}$

Solution 5

There are 26 letters in the English alphabet.

Total number of outomes = 26

The vowels are A, E, I, O and U

So, there are 26 – 5 = 21 consonants

P(getting a consonant) = $\frac{21}{26}$

Solution 6

Since there are 6 letters on the die,
the total number of outomes = 26

(i) The number of times A appears = 3

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

(ii) The number of times D appears = 1

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

Solution 7

Total number of bulbs = 200

Number of defective bulbs = 16

(i)Let E_1 be the event of getting a defective bulb

Total number of defective bulbs = 16

$\therefore$ P(getting defective bulbs) = P(E_1) = $\frac{16}{200} = \frac{2}{25}$

(ii)Let E_2 be the event of "getting non - defective bulb"

$\therefore$ P(getting non defective bulb) = $P(E_2) = 1 - \frac{16}{200} = \frac{184}{200} = \frac{23}{25}$

Solution 8

Let E be an event of winning the game, then E' will be losing it.

$P(E) + P(E') = 1$

$\Rightarrow 0.7 + P(E') = 1$

$\Rightarrow P(E') = 0.3$

Hence, the probability of losing the game is 0.3.

Solution 9

There are 35 students in a class of whom 20 are boys and 15 are girls.

(i) $P(\text{choosing a boy}) = \frac{20}{35} = \frac{4}{7}$

(ii) $P(\text{choosing a girl}) = \frac{15}{35} = \frac{3}{7}$

Solution 10

The number of prizes = 10

The number of blanks = 25

So, the total number of tickets = 10 + 25 = 35

$P(\text{getting a prize}) = \frac{10}{35} = \frac{2}{7}$

Solution 11

Total number of tickets sold = 250

Number of prizes = 5

Let E be the event getting a prize

Number of favorable outcomes = 5

$\therefore$ P(getting a prize) = $P(E) = \frac{5}{250} = \frac{1}{50}$

Solution 12

Total number of outcomes = 17

(i) The odd number numbers on the cards are

1, 3, 5 ,7, 9, 11, 13, 15 and 17

So, there are 9 possible outcomes.

P(getting an odd number)

$= \frac{9}{17}$

(ii) The numbers divisible by 5 are:

5, 10 and 15

So, there are 3 possible outcomes.

P(getting a number divisible by 5)

$= \frac{3}{17}$

Solution 13

Total number of outcomes = 8

The factors of 8 are 1, 2, 4 and 8.

So, there are 4 possible outcomes.

P(getting a factor of 8)

$= \frac{4}{8} = \frac{1}{2}$

Note : The answer given in the text in incorrect.

The correct answer is as shown above.

Solution 14

The number of outcomes is:

$\{GGG, BGG, GBG, GGB, BBG, BGB, GBB, BBB\}$

Total number of outcomes = 8

The possible outcomes of having at least one boy are:

$\{BGG, GBG, GGB, BBG, BGB, GBB, BBB\}$

So, there are 7 possible outcomes.

P(getting at least one boy)

$= \frac{7}{8}$

Solution 15

The bag has 4 white balls, 5 red balls, 2 blacks balls and 4 green balls.

So, total number of balls in the bag = $4+5+2+4=15$

(i) The number of black balls = 2

P(getting a black ball)

$= \frac{2}{15}$

(ii) The number of green balls = 4

So, there are $15-4=11$ non-green balls

P(getting a non-green ball)

$= \frac{11}{15}$

(iii) The number of red and white balls = $5+4=9$

P(getting a red or white ball)

$= \frac{9}{15} = \frac{3}{5}$

(iv) The number of red and green balls = $5+4=9$

So, there are $15-9=6$ balls which are neither red nor green.

P(getting a ball which is neither red nor green)

$= \frac{6}{15} = \frac{2}{5}$

Solution 16

There are 52 cards in the pack.

(i) There are 2 red kings

P(getting a red king)

$$= \frac{2}{52} = \frac{1}{26}$$

(ii) There are 4 queens and 4 jacks

So, there are 8 possible outcomes.

P(getting a queen or jack)

$$= \frac{8}{52} = \frac{2}{13}$$

Solution 17

There are 26 red cards containing a 2 queensand 2 more black queens are there in a pack of cards

$\therefore$ P(getting a red card or a queen) $= \dfrac{28}{52} = \dfrac{7}{13}$

$\therefore$ P(getting neither a red card nor a queen) = $\left(1 - \dfrac{7}{13}\right) = \dfrac{6}{13}$

Solution 18

There are 52 cards in the pack.

(i) There are 6 red face cards.

P(getting a red face card)

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

(ii) There are 2 black kings

P(getting a black king)

$$= \frac{2}{52} = \frac{1}{26}$$

Solution 19

If two dice are rolled together, the 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)
So, there are 36 outcomes.
(i) The following outcomes have an even number on each dice.
(2,2), (2,4), (2,6), (4,2), (4,4), (4,6), (6,2), (6,4), (6,6)
So, there are 9 possible outcomes.
P(getting even numbers on each dice)
$= \frac{9}{36} = \frac{1}{4}$
(ii) The following outcomes give the sum 5.
(1,4), (4,1), (2,3), (3,2)
So, there are 4 possible outcomes.
P(getting a sum of 5)
$= \frac{4}{36} = \frac{1}{9}$

Solution 20

If two dice are rolled together, the 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)
So, there are 36 outcomes.
The following outcomes will give sum of numbers
on the two dice to be 10:
(2,5), (5,2) and (5,5)
So, there are 3 possible outcomes.
P(getting numbers whose sum is 10)
$= \frac{3}{36} = \frac{1}{12}$

Solution 21

If two dice are rolled together, the 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)

So, there are 36 outcomes.

The following outcomes will give sum of numbers on their tops to be less than 7.

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

So, there are 15 possible outcomes.

P(getting numbers whose sum of the tops to be less than 7)

$= \frac{15}{36} = \frac{5}{12}$

Solution 22

If two dice are rolled together, the 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)

So, there are 36 outcomes.

The following outcomes will give the product to be a perfect square.

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

So, there are 8 possible outcomes.

P(getting numbers whose product is a perfect square)

$$= \frac{8}{36} = \frac{2}{9}$$

Solution 23

If two dice are rolled together, the 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)

So, there are 36 outcomes.

The following outcomes will give the product 12.

(2,6), (6,2), (3,4), (4,3)

So, there are 4 possible outcomes.

$$P(\text{getting numbers whose product is } 12) = \frac{4}{36} = \frac{1}{9}$$

Solution 24

There are 46 cards in total.

(i) The primes less than 10 are 5 and 7.

$$P(\text{getting a prime less than } 10) = \frac{2}{46} = \frac{1}{23}$$

(ii) The perfect squares are 9, 16, 25, 36 and 49.

So, there are 5 possible outcomes.

$$P(\text{getting a perfect square}) = \frac{5}{46}$$

Solution 25

Spinning arrow may come to rest at one of the 12 numbers

$\therefore$ total number of outcomes = 12 (i)Probability that it will point at 6 = $\frac{1}{12}$

(ii)Even numbers are 2, 4, 6, 8, 10 and 12. There are 6 numbers.

$\therefore$ Probability that it points at even numbers = $\frac{6}{12} = \frac{1}{2}$

(iii)The prime numbers are 2,3 5, 7 and 11. There are 5 prime numbers.

$\therefore$ Probability that it points at prime number = $\frac{5}{12}$

(iv)There are 2 numbers divisible by 5. These are 5 and 10.

$\therefore$ Probability that a number is a multiple of 5 = $\frac{2}{12} = \frac{1}{6}$

Solution 26

There are 12 defective pens, which are accidentally mixed with 132 good ones.

So, there are total $12 + 132 = 144$ pens

$$P(\text{that the pen taken out is good}) = \frac{132}{144} = \frac{11}{12}$$

Solution 27

Total number of ballpoint pens = 144

There are 20 defective pens, so there are

144 – 20 = 124 good pens.

(i) P(that she will buy it) = $\frac{124}{144} = \frac{31}{36}$

(ii) P(that she will not buy it) = $\frac{20}{144} = \frac{5}{36}$

Solution 28

(i) Total number of discs = 90

The two-digit numbers would be 10, 11, 12, ...90.

So, there are 81 two-digit numbers.

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

(ii) The perfect squares from 1 to 90 are

1, 4, 9, 16, 25, 36, 49, 64 and 81.

So, there are 9 perfect squares.

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

(iii) The numbers divisible by 5 are

5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85 and 90.

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

Solution 29

(i) Total number of bulbs = 20

There are 4 defective bulbs.

P(getting a defective bulb) = $\frac{4}{20} = \frac{1}{5}$

(ii) Given that the bulb drawn in (i) is not defective and not replaced.

So, there are 4 defective bulbs left from a total of 19 bulbs.

$\Rightarrow$ there are 15 non-defective bulbs

P(getting a non-defective bulb) = $\frac{15}{19}$

Solution 30

(i) P(that she takes out an orange-flavoured candy) = 0

(Since there are no orange-flavoured candies in the bag)

(ii) P(that she takes out a lemon-flavoured candy) = 1

(Since there are only lemon-flavoured candies in the bag)

Solution 31

Total number of students = 40

(i) The number of girls = 25

P(that the name written is a girl) = $\frac{25}{40} = \frac{5}{8}$

(ii) The number of boys = 15

P(that the name written is a boy) = $\frac{15}{40} = \frac{3}{8}$

Solution 32

Total number of all possible outcomes = 52 (i)P(getting an ace) = $\frac{4}{52} = \frac{1}{13}$

(ii)P(getting a '4' of spades) = $\frac{1}{52}$

(iii)P(a '9' of a black suit) = $\frac{2}{52} = \frac{1}{26}$

(iv)P(getting a red king) = $\frac{2}{52} = \frac{1}{26}$

Solution 33

Total numbers of cards = 52

(i)There are 4 queen cards in a pack of cards

$\therefore$ Probability of getting a queen card = $\frac{4}{52} = \frac{1}{13}$

(ii)There are 13 cards of diamond in a pack of cards

$\therefore$ probability ofgetting a diamond card = $\frac{13}{52} = \frac{1}{4}$

(iii)In a pack of cards there are 4 kings and 4 aces

Number of such cards = 4 + 4 = 8

Probability of getting either a king or an ace = $\frac{8}{52} = \frac{2}{13}$

(iv)There are two red aces in a pack of cards

$\therefore$ probability of getting a red ace = $\frac{2}{52} = \frac{1}{26}$

Solution 34

We know that there are 52 cards in all.

Total number of outomes = 52

(i) The number of red kings = 2

P(getting a king of red suit) = $\frac{2}{52} = \frac{1}{26}$

(ii) The number of face cards = 12

P(getting a face card) = $\frac{12}{52} = \frac{3}{13}$

(iii) The number of red face cards = 6

P(getting a red face card) = $\frac{6}{52} = \frac{3}{26}$

(iv) The number of queens of black suit = 2

P(getting a queen of black suit) = $\frac{2}{52} = \frac{1}{26}$

(v) The number of jack of hearts = 1

P(getting a jack of hearts) = $\frac{1}{52}$

(vi) The number of spade = 13

P(getting a spade) = $\frac{13}{52} = \frac{1}{4}$

Solution 35

Total number of cards = 52

(i)There are 13 cards of spade (including 1 ace) and 3 more ace cards are there in a pack of cards

$\therefore$ P(getting a card of spades or an ace) = $\frac{16}{52} = \frac{4}{13}$

(ii)There are 2 red kings in a pack of cards

$\therefore$ P(getting a red king) = $\frac{2}{52} = \frac{1}{26}$

(iii)There are 4 kings and 4 queens in a pack of cards

$\therefore$ P(getting either a king or a queen) = $\frac{8}{52} = \frac{2}{13}$

(iv)P(getting neither a king nor a queen) = $\left(1 - \frac{2}{13}\right) = \frac{11}{13}$

Excercise 15B

Solution 1

There are 25 cards in total.

(i) The numbers divisible by 2 are

2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22 and 24.

The numbers divisible by 3 are

3, 6, 9, 12, 15, 18, 21 and 24.

So, the total number of possible outcomes = 16

Note that 6, 12, 18 and 24 are twice.

However, we count these numbers only once.

$$P(\text{getting a number divisible by 2}) = \frac{16}{25}$$

(ii) The primes are 2, 3, 5, 7, 11, 13, 17, 19 and 23.

So, there are 9 possible outcomes.

$$P(\text{getting a prime}) = \frac{9}{25}$$

Solution 2

The numbers on the cards are

3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35 and 37.

So, there 18 cards.

The cards with primes are

3, 5, 7, 11, 13, 17, 19, 23, 29, 31 and 37.

So, there are 11 possible outcomes.

$$P(\text{getting a prime number}) = \frac{11}{18}$$

Solution 3

There 30 cards in the bag.

(i) The numbers divisible by 3 are

3, 6, 9, 12, 15, 18, 21, 24, 27 and 30.

So, the numbers not divisible by 3 are $30 - 10 = 20$

Thus, there are 20 possible outcomes.

$$\text{P(getting a number divisible by 3)} = \frac{20}{30} = \frac{2}{3}$$

(ii) The primes greater than 7 are

11, 13, 17, 19, 23 and 29.

So, there are 6 possible outcomes.

$$\text{P(getting a prime greater than 3)} = \frac{6}{30} = \frac{1}{5}$$

(iii) The perfect squares would be

1, 4, 9, 16 and 25.

So, there are 5 perfect squares, and hence 25 non-perfect squares.

$$\text{P(getting a perfect square)} = \frac{25}{30} = \frac{5}{6}$$

Solution 4

To find the number of cards in the bag, we use the general formula for an AP since the numbers on the cards are in AP.

Here, first term, $a = 1$, common difference $= d = 2$

Let n be the number of cards in the bag.

$a_n = a + (n - 1)d$

$\Rightarrow 35 = 1 + (n - 1)(2)$

$\Rightarrow 34 = 2n - 2$

$\Rightarrow n = 18$

So, there 18 cards in the bag.

(i) The primes less than 15 are 3, 5, 7, 11 and 13.

So, there are 6 possible outcomes.

$$P(\text{getting a prime less than } 15) = \frac{5}{18}$$

(ii) The number divisible by 3 and 5 is 15 and 30.

$$P(\text{getting a } 15 \text{ or } 30) = \frac{2}{18} = \frac{1}{9}$$

Solution 5

To find the number of cards in the bag, we use the general formula for an AP since the numbers on the cards are in AP.

Here, first term, $a = 6$, common difference $= d = 1$

Let n be the number of cards in the bag.

$a_n = a + (n - 1)d$

$\Rightarrow 70 = 6 + (n - 1)(1)$

$\Rightarrow 64 = n - 1$

$\Rightarrow n = 65$

So, there 65 cards in the bag.

(i) The one-digit numbered cards are 6, 7, 8 and 9.

So, there are 4 possible outcomes.

$$P(\text{getting a one-digit numbered card}) = \frac{4}{65}$$

(ii) The numbers divisible by 5 are

10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65 and 70.

$$P(\text{getting a number divisible by 5}) = \frac{13}{65} = \frac{1}{5}$$

(iii) The odd numbers less than 30 are

7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27 and 29.

$$P(\text{getting an odd number less than 30}) = \frac{12}{65}$$

(iv) There are 21 numbers from 50 to 70.

The composite numbers between 50 and 70 are

51, 52, 54, 55, 56, 57, 58, 60, 62, 63, 64, 65, 66, 68 ,69

P(getting a composite number between 50 and 70)

$$= \frac{15}{65} = \frac{3}{13}$$

Solution 6

To find the number of cards in the bag, we use the general formula for an AP since the numbers on the cards are in AP.

Here, first term, $a = 1$, common difference $= d = 2$

Let n be the number of cards in the bag.

$a_n = a + (n - 1)d$

$\Rightarrow 101 = 1 + (n - 1)(2)$

$\Rightarrow 100 = 2n - 2$

$\Rightarrow 102 = 2n$

$\Rightarrow n = 51$

So, there 51 cards in the bag.

(i) The numbers less than 19 are 1, 3, 5, 7, 9, 11, 13, 15 and 17.

So, there are 9 possible outcomes.

$$P(\text{getting a number less than } 19) = \frac{9}{51} = \frac{3}{17}$$

(ii) The primes less than 20 are 3, 5, 7, 11, 13, 17, 19.

So, there are 7 possible outcomes.

$$P(\text{getting a prime less than } 20) = \frac{7}{51}$$

Solution 7

Total number of tickets = 100

(i)Even numbers are 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100

Total number of even number = 50

P(getting a even number) = $\frac{50}{100} = \frac{1}{2}$

(ii)Numbers less than 16 are 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

Total number of numbers less than 16 is 14

P(getting a number less than 16) = $\frac{14}{100} = \frac{7}{50}$

(iii)Numbers which are perfect square are 4, 9, 16, 25, 36, 49, 64, 81, 100

Total number of perfect squares = 9

P(getting a perfect square) = $\frac{9}{100}$

(iv)Prime numbers less than 40 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37

Total number of prime numbers =12

P(getting a prime number less 40) = $\frac{12}{100} = \frac{3}{25}$

Solution 8

The total number of discs in the box are 80.
The numbers which are perfect squares are
1, 4, 9, 16, 25, 36, 49 and 64.
So, there are 8 possible outcomes.
P(getting a number which is a perfect square)

$$= \frac{8}{80}$$

$$= \frac{1}{10}$$

Solution 9

The total number of coins in the piggy bank

$= 100 + 70 + 50 + 30 = 250$

(i) There are seventy Re. 1 coins.

So, there are 70 possible outcomes.

P(getting a Re. 1 coin)

$= \frac{70}{250}$

$= \frac{7}{25}$

(ii) There are thirty Rs. 5 coins.

So, the number of coins that are not Rs. 5 coins are

$250 - 30 = 220$

So, there are 220 possible outcomes.

P(getting a coin that is not a Rs. 5 coin)

$= \frac{220}{250}$

$= \frac{22}{25}$

(iii) The number of 50-p coins are 100, and the number of Rs. 2 coins are 50.

So, there are $100 + 50 = 150$ possible outcomes.

P(getting a coin that will be 50-p or a Rs. 2 coin)

$= \frac{150}{250}$

$= \frac{3}{5}$

Solution 10

Let the total number of balls in the jar be x.

Since there are 10 orange balls in the jar,

P(getting an orange ball) = $\frac{10}{x}$

Since there are only three types of balls in the jar,

P(getting a red ball) + P(getting a blue ball) + P(getting an orange ball) = 1

$\Rightarrow \frac{1}{4} + \frac{1}{3} + \frac{10}{x} = 1$

$\Rightarrow \frac{3x + 4x + 120}{12x} = 1$

$\Rightarrow 3x + 4x + 120 = 12x$

$\Rightarrow 120 = 5x$

$\Rightarrow x = 24$

Hence, the total number of balls in the jar is 24.

Solution 11

Given that there are 18 balls in the bag.

(i) Since the number of red balls is given to be x,

there are $(18 - x)$ non-red balls.

$$P(\text{getting a non-red ball}) = \frac{18 - x}{18}$$

(ii) If two more red balls are put in the bag,

then there are $(18 + 2) = 20$ total number of balls.

So, the number of red balls in this case is $(x + 2)$.

According to the given condition,

$$P(\text{getting a red ball}) = \frac{9}{8} \times P(\text{getting a red ball in the first case})$$

$$\Rightarrow \frac{x+2}{20} = \frac{9}{8}\left(\frac{x}{18}\right)$$

$$\Rightarrow \frac{x+2}{20} = \frac{x}{16}$$

$$\Rightarrow 16x + 32 = 20x$$

$$\Rightarrow 4x = 32$$

$$\Rightarrow x = 8$$

So, the value of x is 8.

Solution 12

The total number of marbles in the jar is 24.
Let the number of blue marbles in the jar be x.

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

Since there are only two types of marbles in the jar,

$$P(\text{getting a blue marble}) + P(\text{getting a green marble}) = 1$$

$$\Rightarrow \frac{2}{3} + \frac{x}{24} = 1$$

$$\Rightarrow \frac{16 + 3x}{24} = 1$$

$$\Rightarrow 16 + 3x = 24$$

$$\Rightarrow 8 = 3x$$

$$\Rightarrow x = 4$$

Hence, the number of blue marbles in the jar is 4.

Solution 13

The total number of marbles in the jar is 54.
Let the number of white marbles in the jar be x.

$$P(\text{getting a white marble}) = \frac{x}{54}$$

Since there are only three types of marbles in the jar,

$$P(\text{getting a blue marble}) + P(\text{getting a green marble}) + P(\text{getting a white marble}) = 1$$

$$\Rightarrow \frac{1}{3} + \frac{4}{9} + \frac{x}{54} = 1$$

$$\Rightarrow \frac{1}{3} + \frac{4}{9} = 1 - \frac{x}{54}$$

$$\Rightarrow \frac{7}{9} = \frac{54 - x}{54}$$

$$\Rightarrow 42 = 54 - x$$

$$\Rightarrow x = 12$$

Hence, the number of white marbles in the jar is 12.

Solution 14

The total number of shirts is 100.

(i) Since Rohit accepts only shirts which are good,

so, there are 88 possible outcomes.

P(shirt is acceptable to Rohit)

$= \frac{88}{100}$

$= \frac{22}{25}$

(ii) Given that there are 88 shirts that are good, 8 that have minor defects.

This means there are 100 – 88 – 8 = 4 shirts with major defects.

Since Kamal only rejects shirts with major defects,

so, there are 96 possible outcomes.

P(shirt is acceptable to Kamal)

$= \frac{96}{100}$

$= \frac{24}{25}$

Solution 15

The total number of persons in the group is 12 out of which 3 are extremely patient, other 6 are extremely honest and 3 are extremely kind.

(i) P(selecting an extremely patient person)

$= \frac{3}{12}$

$= \frac{1}{4}$

(ii) There are 9 persons who are either extremely kind or extremely honest.

P(selecting an extremely kind or honest person)

$= \frac{9}{12}$

$= \frac{3}{4}$

Solution 16

Two dice are thrown simultaneously

Total number of outcomes = 6 6 = 36

(i)Favourable cases are: (1, 1), (1, 2), (1, 3), (1, 4), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 6) = 25.

$\therefore$ Probability that 5 will not come upon either die $= \frac{25}{36}$

(ii)Favourable cases are: (1, 5), (2, 5), (3, 5), (4, 5), (5, 5), (6, 5), (5, 1), (5, 2), (5, 3), (5, 4), (5, 6) = 11

Probability that 5 will come at least once $= \frac{11}{36}$

(iii)5 will come up on both dice in 1 case = (5,5)

$\therefore$ probability that 5 will come on both dice = $\frac{1}{36}$

Solution 17

If two dice are rolled together, the 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)
So, there are 36 outcomes.
The following outcomes will give the product
to be a perfect square.
(1, 1), (1,4), (2,2), (3,3), (4, 1), (4,4), (5,5), (6,6)
So, there are 8 possible outcomes.
P(getting numbers whose product is a perfect square)

$$= \frac{8}{36} = \frac{2}{9}$$

Solution 18

There are 11 letters in the word ASSOCIATION.

Total number of outomes = 11

The vowels are A, O and 1 appear twice each

So, there are 6 letters which are vowels in the given word.

So, there are $11 - 6 = 5$ consonants

(i) P(getting a vowel) = $\frac{6}{11}$

(ii) P(getting a consonant) = $\frac{5}{11}$

(iii) There are two S letters.

P(getting an S) = $\frac{2}{11}$

Solution 19

Given that there are 5 cards.

Total number of outomes = 5

(a) There is 1 queen.

P(getting a queen) = $\frac{1}{5}$

(b) Given that a queen is drawn and put aside.

So, there will be 4 cards from where the ace will be chosen.

(i) P(getting an ace) = $\frac{1}{4}$

(ii) Since the queen is kept aside, there is no queen left.

P(getting a queen) = 0

Solution 20

We know that there are 52 cards in a pack of cards.
Total number of outomes = 52
The number of red cards = 26
Out of these there are 2 red queens, and there are 2 more black queens.
So, the cards which are neither a red card nor a queen are $52 - (26 + 2) = 24$

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

Solution 21

There are 365 days in an ordinary year.
Total number of outomes = 365
Since in an ordinary year there are 52 weeks,
there will surely be 52 Mondays.
Now, $52 \times 7 = 364$ days
So, the last day could be any of the 7 days of the week.

$$\text{Thus, } P(\text{the last day is a Monday}) = \frac{1}{7}$$

Solution 22

There are 6 red face cards in every pack.
So, the remaining number of cards = 52 – 6 = 46
Total number of outomes = 46
(i) The remaining number of red cards = 26 – 6 = 20

P(getting a red card) = $\frac{20}{46} = \frac{10}{23}$

(ii) Since the red face cards are removed, the remaining number of black face cards = 6

P(getting a face card) = $\frac{6}{46} = \frac{3}{23}$

(iii) There are 13 dubs.

P(getting a card of dubs) = $\frac{13}{46}$

Note: The answer given in the text for the sub-part (iii) is incorrect.

Solution 23

There are 4 kings, 4 queens and 4 aces in every pack.
So, the remaining number of cards = 52 – 12 = 40
Total number of outomes = 40
(i) The remaining number of black face cards = 2

P(getting a black face card) = $\frac{2}{40} = \frac{1}{20}$

(ii) There are 26 red cards in the pack.
Out of these the 2 red kings, 2 red queens and the 2 red aces are removed.
So, there are 26 – 6 = 20 possible outcomes left.

P(getting a red card) = $\frac{20}{40} = \frac{1}{2}$

Solution 24

Since the one-rupee coin is tossed thrice, its outcomes are {HHH, HTT, THT, TTH, HHT, HTH, THH, TTT}.
So, there are 8 outcomes.

(i) P(getting three heads) = $\frac{1}{8}$

(ii) P(getting at least 2 tails) = $\frac{4}{8} = \frac{1}{2}$

Solution 25

There are 366 days in a leap year.
Total number of outomes = 366
Since in a leap year there are 52 weeks,
there will surely be 52 Sundays.
Now, $52 \times 7 = 364$ days
So, the last two days could be any of the following outcomes:
{(Saturday, Sunday), (Sunday, Monday)}

Thus, P(that there are 53 Sundays) = $\frac{2}{7}$

Excercise MCQ

Solution 1

Correct option: (c)
We know that, the probability of an event E will always lie between 0 and 1, where 0 is the probability of an impossible event and 1 is the probability of a sure event.

Solution 2

Correct option: (b)
Let E be the event.
So, the probability of the event happening will be P(E).
Thus, the probability of the event not happening will be P(E').
Given that, $P(E) = p$
We know that, $P(E) + P(E') = 1$
$\Rightarrow p + P(E') = 1$
$\Rightarrow P(E') = 1 - p$

Solution 3

Correct option: (b)
The probability of an impossible event is always 0.

Solution 4

Correct option: (c)
The probability of a sure event is always 1.

Solution 5

Correct option: (a)
We know that, the probability of an event E will always lie between 0 and 1.
Since $1.5 > 1$, it cannot be the probability of an event.

Solution 6

Correct option: (c)

The prime numbers from 1 to 30 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29.

So, there are 10 prime numbers between 1 and 30.

P(getting a prime number)

$$= \frac{\text{number of primes between 1 and 30}}{\text{Total}}$$

$$= \frac{10}{30}$$

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

Solution 7

Correct option: (c)

The selected numbers would be 4, 8, and 12.

So, there are 3 number.

P(number is a multiple of 4)

$$= \frac{\text{number of multiples of 4}}{\text{Total}}$$

$$= \frac{3}{15}$$

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

Solution 8

Correct option: (d)

The numbers on the card have to be perfect sqaures.

So, the numbers would be 9, 16, 25, 36, 49.

So, there are 5 numbers.

Total number of cards = $(50 - 6) + 1 = 44 + 1 = 45$

P(getting a perfect square)

$$= \frac{\text{number of perfect squares}}{\text{Total}}$$

$$= \frac{5}{45}$$

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

Solution 9

Correct option: (c)

The total number of discs = 90

The primes less than 23 are 2, 3, 5, 7, 11, 13, 17, 19.

So, there are 8 numbers.

P(getting a prime number less than 23)

$$= \frac{8}{90}$$

$$= \frac{4}{45}$$

Note : In the text, the option (c) is incorrect. It should be $\frac{4}{45}$ to go with the question asked.

Solution 10

Correct option: (d)
The total number of cards = 9
The primes numbers would be 2, 3, 5, 7, 11.
So, there are 5 numbers.
P(getting a prime number)
$= \frac{5}{9}$

Solution 11

Correct option: (b)
The total number of tickets = 40
The multiples of 7 between 1 and 40 are
7, 14, 21, 28 and 35.
So, there are 5 numbers.
P(getting a multiple of 7)
$= \frac{5}{40}$
$= \frac{1}{8}$

Solution 12

Correct option: (d)
We know that, the probability of an event E will always lie between 0 and 1.
Since $\frac{7}{6} > 1$, it cannot be the probability of an event.

Solution 13

Correct option: (c)
We know that, if E is an event, then $P(E) + P(E') = 1$.
Let E be the event where the game is won.
So, $0.4 + P(E') = 1$
$\Rightarrow P(E') = 1 - 0.4$
$\Rightarrow P(E') = 0.6$
So, the probability of losing the game is 0.6.

Solution 14

Correct option: (d)
An event that cannot occur is called an impossible event.
The probability of an impossible event is 0.

Solution 15

Correct option: (b)
The total number of tickets = 20
The multiples of 5 between 1 and 20 are
5, 10, 15 and 20.
So, there are 4 numbers.
P(getting a multiple of 5)
$= \frac{4}{20}$
$= \frac{1}{5}$

Solution 16

Correct option: (c)

The total number of tickets = 25

The multiples of 3 are 3, 6, 9, 12, 15, 18, 21, 24.

The multiples of 5 are 5, 10, 15, 20 and 25.

Since 15 is a multiple of 3 as well as 5, it is to be calculated only once.

So, there are 12 numbers.

P(getting a multiple of 3 or 5)

$= \frac{12}{25}$

Solution 17

Correct option: (d)

The total number of tickets = 10

The numbers less than 10 are 6, 7, 8 and 9.

So, there are 4 numbers.

P(getting a number less than 10)

$= \frac{4}{10}$

$= \frac{2}{5}$

Solution 18

Correct option: (a)
The numbers on a die are 1, 2, 3, 4, 5 and 6.
So, there are 6 numbers in total.
The even numbers on the die are 2, 4 and 6.
So, there are 3 numbers.
P(getting an even number)
$= \frac{3}{6}$
$= \frac{1}{2}$

Solution 19

Correct option: (d)
The numbers on a fair die are 1, 2, 3, 4, 5 and 6.
So, there are 6 numbers in total.
The numbers greater than 2 are 3, 4, 5 and 6.
So, there are 4 numbers.
P(getting a number greater than 2)
$= \frac{4}{6}$
$= \frac{2}{3}$

Solution 20

Correct option: (b)
The numbers on a die are 1, 2, 3, 4, 5 and 6.
So, there are 6 numbers in total.
The odd number on a die greater than 3 is 5.
So, there is only 1 number.
P(getting an odd number greater than 3)
$= \frac{1}{6}$

Solution 21

Correct option: (c)
The numbers on a die are 1, 2, 3, 4, 5 and 6.
So, there are 6 numbers in total.
The prime numbers on the die are 2, 3 and 5.
So, there are 3 numbers.
P(getting a prime number on the die)
$= \frac{3}{6}$
$= \frac{1}{2}$

Solution 22

Correct option: (c)

The numbers on each die are 1, 2, 3, 4, 5 and 6.

So, the total possibilities 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)

So, there are 36 numbers in total.

There are 6 possibilites when the two die have the same number (1,1), (2,2), (3,3), (4,4), (5,5), (6,6).

P(getting the same number on both the die)

$= \frac{6}{36}$

$= \frac{1}{6}$

Solution 23

Correct option: (d)

When two coins are tossed the outcomes are:

{HH, HT, TH, TT}

So, there are 4 numbers in total.

P(getting one head)

$= \frac{1}{4}$

Solution 24

Correct option: (b)

The numbers on each die are 1, 2, 3, 4, 5 and 6.

So, the total possibilities 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)

So, there are 36 numbers in total.

There are 6 possibilites when we obtain a doublet,
(1,1), (2,2), (3,3), (4,4), (5,5), (6,6).

P(getting a doublet)

$= \frac{6}{36}$

$= \frac{1}{6}$

Solution 25

Correct option: (d)

When two coins are tossed the simultaneously the outcomes are:

{HH, HT, TH, TT}

So, there are 4 outcomes.

Getting atmost one head means the possible outcomes are:

{HT, TH, TT}

So, there are 3 possible outcomes.

P(getting atmost one head)

$= \frac{3}{4}$

Solution 26

Correct option: (c)

When three coins are tossed the simultaneously the outcomes are:

{HHH, HHT, HTH, THH, THT, HTT, TTH and TTT}

So, there are 8 possible outcomes.

P(getting exactly two heads)

$= \frac{3}{8}$

Solution 27

Correct option: (b)

The number of prizes = 8

The number of blanks = 16

So, the total number of tickets = 8 + 16 = 24

P(getting a prize) $= \frac{8}{24} = \frac{1}{3}$

Solution 28

Correct option: (c)

The number of prizes = 6

The number of blanks = 24

So, the total number of tickets = 6 + 24 = 30

P(not getting a prize) $= \frac{24}{30} = \frac{4}{5}$

Solution 29

Correct option: (c)
The bag contains 3 blue, 2 white and 4 red marbles.
So, the total number of marbles = 3 + 2 + 4 = 9
Since the marbles cannot be white, it can blue or red.
The number of blue or red marbles = 3 + 4 = 7

P(getting a blue or red marble) = $\frac{7}{9}$

Solution 30

Correct option: (b)
The bag contains 4 red and 6 black balls.
So, the total number of balls = 4 + 6 = 10
The number of black balls = 6
P(getting a black ball)

$= \frac{6}{10}$

$= \frac{3}{5}$

Solution 31

Correct option: (c)
The bag contains 8 red, 2 black and 5 white balls.
So, the total number of balls = 8 + 2 + 5 = 15
Since the ball should not be black, it can be red or white.
The number of red and white balls = 13
P(getting a red and white ball)

$= \frac{13}{15}$

Solution 32

Correct option: (c)

The bag contains 3 white, 4 red and 5 black balls.

So, the total number of balls = 3 + 4 + 5 = 12

For the ball that is drawn to be neither black nor white, it should be red.

The number of red balls = 4

P(getting a red ball)

$= \frac{4}{12}$

$= \frac{1}{3}$

Solution 33

Correct option: (b)

The total number of cards = 52

The number of black kings = 2

P(getting a black king)

$= \frac{2}{52}$

$= \frac{1}{26}$

Solution 34

Correct option: (a)

The total number of cards = 52

The number of queens = 4

P(getting a queen)

$= \frac{4}{52}$

$= \frac{1}{13}$

Solution 35

Correct option: (c)

The total number of cards = 52

The number of face cards = 12

P(getting a face card)

$= \frac{12}{52}$

$= \frac{3}{13}$

Solution 36

Correct option: (b)

The total number of cards = 52

The number of black face cards = 6

P(getting a black face card)

$= \frac{6}{52}$

$= \frac{3}{26}$

Solution 37

Correct option: (c)

The total number of cards = 52

The number of 6 in the deck of cards = 4

P(getting a 6)

$= \frac{4}{52}$

$= \frac{1}{13}$