Probability

Exercise 31A

Q. 1. A coin is tossed once. Find the probability of getting a tail.

Answer : We know that

Probability of occurrence of an event

$$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$$

Total outcomes of the coin are tails and heads

Hence the total no.of outcomes are 2 (i.e. heads and tails)

And the desired output is tail. Hence no.of desired outcomes = 1

Therefore, the probability of getting a tail is

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

Conclusion: Probability of getting a tail when a coin is flipped is 0.5 or $\frac{1}{2}$

Q. 2 A. A die is thrown. Find the probability of

getting a 5

Answer : We know that,

Probability of occurrence of an event

$$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$$

Total outcomes are 1, 2, 3, 4, 5, 6, and the desired outcome is 5

Therefore, total no.of outcomes are 6, and total no.of desired outcomes are 1

$$\text{Probability of getting 5} = \frac{1}{6}$$

Conclusion: Probability of getting 5 when die is thrown is $\frac{1}{6}$

Q. 2 B. A die is thrown. Find the probability of

getting a 2 or a 3

Answer : We know that,

Probability of occurrence of an event

$$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$$

Total outcomes are 1, 2, 3, 4, 5, 6, and the desired outcomes are 2, 3

Therefore, total no.of outcomes are 6, and total no.of desired outcomes are 2

Probability of getting a 2 or 3

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

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

Conclusion: Probability of getting 2 or 3 when a die is thrown is $\frac{1}{3}$

Q. 2 C. A die is thrown. Find the probability of

getting an odd number

Answer : We know that,

Probability of occurrence of an event

$$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$$

As 1, 3, 5 are odd numbers up to 6, so the desired outcomes are 1, 3, 5, and total outcomes are 1, 2, 3, 4, 5, 6

Therefore, total no.of outcomes are 6, and total no.of desired outcomes are 3

Probability of getting an odd number

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

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

Conclusion: Probability of getting an odd number when a die is thrown is $\frac{1}{2}$

Q. 2 D. A die is thrown. Find the probability of

getting a prime number

Answer : We know that,

Probability of occurrence of an event

$$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$$

As 2, 3, 5 are prime numbers up to 6, so the desired outcomes are 2, 3, 5, and total outcomes are 1, 2, 3, 4, 5, 6

Therefore, total no.of outcomes are 6, and total no.of desired outcomes are 3

Probability of getting a prime number

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

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

Conclusion: Probability of getting a prime number when a die is thrown is $\frac{1}{2}$

Q. 2 E. A die is thrown. Find the probability of

getting a multiple of 3

Answer : We know that,

Probability of occurrence of an event

$$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$$

As 3, 6 are multiples up to 6, so the desired outcomes are 3, 6, and total outcomes are 1, 2, 3, 4, 5, 6

Therefore, total no.of outcomes are 6, and total no.of desired outcomes are 2

Probability of getting multiple of 3

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

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

Conclusion: Probability of getting multiple of 3 when die is thrown is $\frac{1}{3}$

Q. 2 F. A die is thrown. Find the probability of

getting a number between 3 and 6

Answer : We know that,

Probability of occurrence of an event

$$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$$

As 4, 5 are two numbers between 3 and, so the desired outcomes are 3, 6, and total outcomes are 1, 2, 3, 4, 5, 6

Therefore, total no.of outcomes are 6, and total no.of desired outcomes are 2

Probability of getting a number between 3 and 6

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

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

Conclusion: Probability of getting a number between 3 and 6 when a die is thrown is $\frac{1}{3}$

Q. 3. In a single throw of two dice, find the probability of

(i) getting a sum less than 6
(ii) getting a doublet of odd numbers
(iii) getting the sum as a prime number

Answer : (i) We know that,

Probability of occurrence of an event

$$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$$

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)

Total no.of outcomes are 36

In that only (1, 1), (1, 2), (1, 3), (1, 4), (2, 1), (2, 2), (2, 3), (3, 1), (3, 2), (4, 1) are our desired outputs as there sum is less than 6

Therefore no.of desired outcomes are 10

Therefore, the probability of getting a sum less than 6

$= \frac{10}{36}$

$= \frac{5}{18}$

Conclusion: Probability of getting a sum less than 6, when two dice are rolled is $\frac{5}{18}$

(ii) We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

In (a, b) if a=b then it is called a doublet

Total doublets are (1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)

In (a, b) if a=b and if a, b both are odd then it is called a doublet

Odd doublets are (1, 1), (3, 3), (5, 5)

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)

Total no.of outcomes are 36 and desired outcomes are 3

Therefore, probability of getting doublet of odd numbers

$= \frac{3}{36}$

$= \frac{1}{12}$

Conclusion: Probability of getting doublet of odd numbers, when two dice are rolled is $\frac{1}{12}$

(iii) We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

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)

Total no.of outcomes are 36

Desired outputs are (1, 1), (1, 2), (1, 4), (1, 6), (2, 1), (2, 3), (2, 5), (3, 2), (3, 4), (4, 1), (4, 3), (5, 2), (5, 6), (6, 1), (6, 5)

Total no.of desired outputs are 15

Therefore, probability of getting the sum as a prime number

$= \frac{15}{36}$

$= \frac{5}{12}$

Conclusion: Probability of getting the sum as a prime number, when two dice are rolled is $\frac{5}{12}$

Q. 4 A. In a single throw of two dice, find

P (an odd number on the first die and a 6 on the second)

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Total 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)

Desired outcomes are (1, 6), (3, 6), (5, 6)

Total no.of outcomes are 36 and desired outcomes are 3

Therefore, probability of getting odd on the first die and 6 on the second die

$= \frac{3}{36}$

$= \frac{1}{12}$

Conclusion: Probability of getting odd on the first die and 6 on the second die, when two dice are rolled is $\frac{1}{12}$

Q. 4 B. In a single throw of two dice, find

P (a number greater than 3 on each die)

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Total 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)

Desired outcomes are (4, 4), (4, 5), (4, 6), (5, 4), (5, 5), (5, 6), (6, 4), (6, 5), (6, 6)

Total no.of outcomes are 36 and desired outcomes are 9

Therefore, probability of getting number greater than 3 on each die

$= \frac{9}{36}$

$= \frac{1}{4}$

Conclusion: Probability of getting a number greater than 3 on each die, when two dice are rolled is $\frac{1}{4}$

Q. 4 C. In a single throw of two dice, find

P (a total of 10)

Answer : We know that,

Probability of occurrence of an event $= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Total 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)

Desired outcomes are (4, 6), (5, 5), (6, 4)

Total no.of outcomes are 36 and desired outcomes are 3

Therefore, the probability of getting a total of 10

$= \frac{3}{36}$

$= \frac{1}{12}$

Conclusion: Probability of getting total sum 10, when two dice are rolled is $\frac{1}{12}$

Q. 4 D. In a single throw of two dice, find

P (a total greater than 8)

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Total 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)

Desired outcomes are (3, 6), (4, 5), (4, 6), (5, 4), (5, 5), (5, 6), (6, 3), (6, 4), (6, 5), (6, 6)

Total no.of outcomes are 36 and desired outcomes are 10

Therefore, probability of getting total greater than 8 $= \frac{10}{36}$

$= \frac{5}{18}$

Conclusion: Probability of getting total greater than 8, when two dice are rolled is $\frac{5}{18}$

Q. 4 E. In a single throw of two dice, find

P (a total of 9 or 11)

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Total 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)

Desired outcomes are (3, 6), (4, 5), (5, 4), (6, 3), (6, 5) , (5, 6)

Total no.of outcomes are 36 and desired outcomes are 6

Therefore, probability of getting total equal to 9 or 11 $= \frac{6}{36}$

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

Conclusion: Probability of getting total equal to 9 or 11, when two dice are rolled is $\frac{1}{6}$

Q. 5. A bag contains 4 white and 5 black balls. A ball is drawn at random from the bag. Find the probability that the ball is drawn is white.

Answer : We know that,

Probability of occurrence of an event

$$= \frac{Total\ no.of\ Desired\ outcomes}{Total\ no.of\ outcomes}$$

By permutation and combination, total no.of ways to pick r objects from given n objects is ${}^nC_r$

Now, total no.of ways to pick a ball from 9 balls is ${}^9c_1 = 9$

Our desired output is to pick a white ball. So, no.of ways to pick a white ball from 4 white balls (because the white ball can be picked from only white balls) is ${}^4c_1 = 4$

Therefore, the probability of picking a white ball $= \frac{4}{9}$

Conclusion: Probability of picking a white ball from 4 white balls and 5 white balls is $\frac{4}{9}$

Q. 6 A. An urn contains 9 red, 7 white, and 4 black balls. A ball is drawn at random. Find the probability that the ball is drawn is

red

Answer : We know that

Probability of occurrence of an event

$$= \frac{Total\ no.of\ Desired\ outcomes}{Total\ no.of\ outcomes}$$

By permutation and combination, total no.of ways to pick r objects from given n objects is ^nC_r

Now, total no.of ways to pick a ball from 20 balls is $^{20}c_1 = 20$

Our desired output is to pick a red ball. So, no.of ways to pick a red ball from 9 red balls (because the red ball can be picked from only red balls) is $^9c_1 = 9$

Therefore, the probability of picking a red ball $= \frac{9}{20}$

Conclusion: Probability of picking a red ball from 9 red,

7 white and 4 black balls is $\frac{9}{20}$

Q. 6 B. An urn contains 9 red, 7 white, and 4 black balls. A ball is drawn at random. Find the probability that the ball is drawn is

white

Answer : We know that,

Probability of occurrence of an event

$$= \frac{Total\ no.of\ Desired\ outcomes}{Total\ no.of\ outcomes}$$

By permutation and combination, total no.of ways to pick r objects from given n objects is ^nC_r

Now, total no.of ways to pick a ball from 20 balls is $^{20}c_1 = 20$

Our desired output is to pick a white ball. So, no.of ways to pick a white ball from 7 white balls(because the white ball can be picked from only white balls) is $^7c_1 = 7$

Therefore, the probability of picking a white ball $= \frac{7}{20}$

Conclusion: Probability of picking a white ball from 9 red,

7 white and 4 black balls is $\frac{7}{20}$

Q. 6 C. An urn contains 9 red, 7 white, and 4 black balls. A ball is drawn at random. Find the probability that the ball is drawn is

red or white

Answer : We know that,

Probability of occurrence of an event

$$= \frac{Total\ no.of\ Desired\ outcomes}{Total\ no.of\ outcomes}$$

By permutation and combination, total no.of ways to pick r objects from given n objects is ${}^{n}C_{r}$

Now, total no.of ways to pick a ball from 20 balls is ${}^{20}c_{1} = 20$

Our desired output is to pick a white or red ball. So, no.of ways to pick a white or red ball from 16 balls(because there are a total of 16 balls which are either red or white) is ${}^{16}c_{1} = 16$

Therefore, the probability of picking a white or red ball $= \frac{16}{20}$

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

Conclusion: Probability of picking a white or red ball from 9 red, 7 white, and 4 black balls is $\frac{4}{5}$

Q. 6 D. An urn contains 9 red, 7 white, and 4 black balls. A ball is drawn at random. Find the probability that the ball is drawn is

white or black

Answer : We know that,

Probability of occurrence of an event

$$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$$

By permutation and combination, total no.of ways to pick r objects from given n objects is ${}^{n}C_{r}$

Now, total no.of ways to pick a ball from 20 balls is ${}^{20}c_{1} = 20$

Our desired output is to pick a white or red ball. So, no.of ways to pick a white or red ball from 16 balls(because there are a total of 16 balls which are either red or white) is $^{16}c_1 = 16$

Therefore, the probability of picking a white or black ball $= \frac{11}{20}$

$$= \frac{11}{20}$$

Conclusion: Probability of picking a white or black ball from 9 red, 7 white, and 4 black balls is $\frac{11}{20}$

Q. 6 E. An urn contains 9 red, 7 white, and 4 black balls. A ball is drawn at random. Find the probability that the ball is drawn is

not white

Answer : We know that,

Probability of occurrence of an event

$$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$$

By permutation and combination, total no.of ways to pick r objects from given n objects is ^nC_r

Now, total no.of ways to pick a ball from 20 balls is $^{20}c_1 = 20$

Our desired output is to pick a black or red ball(not white). So, no.of ways to pick a black or red ball from 13 balls (because there are a total of 13 balls which are either red or black) is $^{13}c_1 = 13$

Therefore, the probability of not picking a white ball $= \frac{13}{20}$

Conclusion: Probability of not picking a white ball from 9 red, 7 white, and 4 black balls is $\frac{13}{20}$

Q. 7. In a lottery, there are 10 prizes and 25 blanks. Find the probability of getting a prize.

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Total no.of outcomes = 10+25 = 35

Desired outcomes are prizes. Total no.of desired outcomes = 10

Therefore, the probability of getting a prize $= \frac{10}{35}$

$= \frac{2}{7}$

Conclusion: Probability of getting a prize is $\frac{2}{7}$

Q. 8 If there are two children in a family, find the probability that there is at least one boy in the family

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Let B be Boy and G be Girl

Total possible outcomes are BB, BG, GB, GG

Our desired outcome is at least one boy. So, BB, BG, GB are desired outputs.

Total no.of outcomes are 4, and the desired outcomes are 3

Therefore, the probability of at least one boy $= \frac{3}{4}$

Conclusion: Probability of at least one boy is $\frac{3}{4}$

Q. 9 A Three unbiased coins are tossed once. Find the probability of getting exactly 2 tails

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Let T be tails and H be heads

Total possible outcomes = TTT, TTH, THT, HTT, THH, HTH, HHT, HHH

Desired outcomes are exactly two tails. So, desired outputs are TTH, THT, HTT

Total no.of outcomes are 8 and desired outcomes are 3

Therefore, the probability of getting exactly 2 tails $= \frac{3}{8}$

Conclusion: Probability of getting exactly two tails is $\frac{3}{8}$

Q. 9 B. Three unbiased coins are tossed once. Find the probability of getting exactly one tail

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Let T be tails and H be heads

Total possible outcomes = TTT, TTH, THT, HTT, THH, HTH, HHT, HHH

Desired outcomes are exactly one tail. So, desired outputs are THH, HTH, HHT

Total no.of outcomes are 8 and desired outcomes are 3

Therefore, the probability of getting exactly one tail $= \frac{3}{8}$

Conclusion: Probability of getting exactly one tail is $\frac{3}{8}$

Q. 9 C. Three unbiased coins are tossed once. Find the probability of getting at most 2 tails

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Let T be tails and H be heads

Total possible outcomes = TTT, TTH, THT, HTT, THH, HTH, HHT, HHH

Desired outcomes are at most two tails. So, desired outputs are THH, HTH, HHT, TTH, THT, HTT, HHH

Total no.of outcomes are 8 and desired outcomes are 7

Therefore, the probability of getting at most 2 tails $= \frac{7}{8}$

Conclusion: Probability of getting at most two tails is $\frac{7}{8}$

Q. 9 D. Three unbiased coins are tossed once. Find the probability of getting at least 2 tails

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Let T be tails and H be heads

Total possible outcomes = TTT, TTH, THT, HTT, THH, HTH, HHT, HHH

Desired outcomes are at least two tails. So, the desired outputs are

TTH, THT, HTT, TTT

Total no.of outcomes are 8 and desired outcomes are 4

Therefore, the probability of getting at least 2 tails $= \frac{4}{8}$

$= \frac{1}{2}$

Conclusion: Probability of getting at least two tails is $\frac{1}{2}$

Q. 9 E. Three unbiased coins are tossed once. Find the probability of getting at most 2 tails or at least 2 heads

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Let T be tails and H be heads

Total possible outcomes = TTT, TTH, THT, HTT, THH, HTH, HHT, HHH

Desired outcomes are at least two heads or at most two tails. So, desired outputs are TTH, THT, HTT, THH, HTH, HHT, HHH

Total no.of outcomes are 8 and desired outcomes are 7

Probability of getting at most 2 tails or at least 2 heads $= \frac{7}{8}$

Conclusion: Probability of getting at least two heads or at most two tails is $\frac{7}{8}$

Q. 10. In a single throw of two dice, determine the probability of not getting the same number on the two dice.

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Total 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)

Desired outcomes are all outcomes except (1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)

Total no.of outcomes are 36 and desired outcomes are 30

probability of not getting same number $= \frac{30}{36}$

$= \frac{5}{6}$

Conclusion: Probability of not getting the same number on the two dice is $\frac{5}{6}$

Q. 11. If a letter is chosen at random from the English alphabet, find the probability that the letter is chosen is

(i) a vowel
(ii) a consonant

Answer : (i) We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Total possible outcomes are alphabets from a to z

Desired outcomes are a, e, i, o, u

Total no.of outcomes are 26 and desired outputs are 5

Therefore, the probability of picking a vowel

$= \frac{5}{26}$

Conclusion: Probability of choosing a vowel is $\frac{5}{26}$

(ii) We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Total possible outcomes are all alphabets from a to z

Desired outcomes are all alphabets except a, e, i, o, u

Total no.of outcomes are 26 and desired outputs are 21

Therefore, the probability of picking a consonant

$= \frac{21}{26}$

Conclusion: Probability of choosing a consonant is $\frac{21}{26}$

Q. 12. A card is drawn at random from a well-shuffled pack of 52 cards. What is the probability that the card bears a number greater than 3 and less than 10?

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Total no.of outcomes are 52

Desired output is a number greater than 3 and less than 10.

There will be four sets of each card naming A, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K. So, there will be a total of 24 cards between 3 and 10

Therefore, the probability of picking card between 3 and 10 $= \frac{24}{52}$

$= \frac{6}{13}$

Conclusion: Probability of picking a card between 3 and 10 is $\frac{6}{13}$

Q. 13. Tickets numbered from 1 to 12 are mixed up together, and then a ticket is withdrawn at random. Find the probability that the ticket has a number which is a multiple of 2 or 3.

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Total no.of outcomes are 12

Desired output is picking a number which is multiple of 2 or 3. So, desire outputs are 2, 3, 4, 6, 8, 9, 10, 12. Total no.of desired outputs are 8

Therefore, the probability of getting a number which is multiple of 2 or 3

$= \frac{8}{12}$

$= \frac{2}{3}$

Conclusion: Probability of picking a ticket which is multiple of 2 or 3 is $\frac{2}{3}$

Q. 14. What is the probability that an ordinary year has 53 Tuesdays?

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

An ordinary year has 365 days i.e. it has 52 weeks + 1 day. So, there will be 52 Tuesdays for sure(because every week has 1 Tuesday)

So, we want another Tuesday that to from that 1 day left(as there is only one Tuesday left after 52 weeks)

This one day can be, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday.Of these total 7 outcomes, the desired outcome is 1, i.e. Tuesday

Therefore, the probability of getting 52 Tuesdays in an ordinary year

$= \frac{1}{7}$

Conclusion: Probability of getting 53 Tuesdays in an ordinary year is $\frac{1}{7}$

Q. 15. What is the probability that a leap year has 53 Sundays?

Answer : We know that,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

A leap has 366 days i.e. 52 weeks + 2 days. So, there will be 52 Sundays for sure (because every week has one Sunday)

So, we want another Sunday from the remaining two days.

The two days may be Sunday, Monday or Monday, Tuesday or Tuesday, Wednesday or Wednesday, Thursday or Thursday, Friday or Friday, Saturday or Saturday, Sunday

So, total outcomes are 7 and desired the outcomes are 2(Sunday, Monday or Saturday, Sunday)

Therefore, the probability of getting 53 Sundays in a leap year

$= \frac{2}{7}$

Conclusion: Probability of getting 53 Sundays in a leap year is $\frac{2}{7}$

Q. 16. What is the probability that in a group of two people, both will have the same birthday, assuming that there are 365 days in a year and no one has his/her birthday on 29th February?

Answer : We know that,

Probability of occurring = 1 - the probability of not occurring

Let's calculate for the probability of not occurring, i.e. probability such that both of them don't have a birthday on the same day. For suppose the first person has a birthday on a particular day then the other person can have a birthday in the remaining 364 days

Probability of not having the same birthday

$= \frac{364}{365}$

Probability of having same birthday = 1 – probability of not having the same

Birthday

$= 1 - \frac{364}{365}$

$= \frac{1}{365}$

Conclusion: Probability of two persons having the same birthday is $\frac{1}{365}$

Q. 17. Which of the following cannot be the probability of occurrence of an event?

(i) 0 **(ii)** $\frac{-3}{4}$

(iii) $\frac{3}{4}$ **(iv)** $\frac{4}{3}$

Answer : (ii) and (iv) can't be the probability of occurrence of an event. So, (ii) and (iv) are the answers to our question.

Explanation: We know that,

$0 \leq \text{probability} \leq 1$ i.e. probability can vary from 0 to 1(both are inclusive)

So, (i) 0 can be possible as $0 \leq \text{probability} \leq 1$

(ii) $-\frac{3}{4}$ is not possible as it is less than 0

(iii) $\frac{3}{4}$ is possible as $0 \leq \text{probabilty} \leq 1$

(iv) $\frac{4}{3}$ is not possible as it is greater than 1

Conclusion: $\frac{4}{3}$ and $-\frac{3}{4}$ are the probabilities that cannot occur.

Q. 18. If 7/10 is the probability of occurrence of an event, what is the probability that it does not occur?

Answer : We know that,

Probability of occurring = 1 - the probability of not occurring

Given the probability of occurrence

$= \frac{7}{10}$

Therefore, the probability of not occurrence

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

$= \frac{3}{10}$

Conclusion: Probability of not occurrence is $\frac{3}{10}$

Q. 19. The odds in favor of the occurrence of an event are 8 : 13. Find the probability that the event will occur.

Answer : We know that,

If odds in favor of the occurrence an event are a:b, then the probability of an event to occur is $\frac{a}{a+b}$, which indirectly came from

Probability of the occurrence of an event

$$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$$

Where, Total no.of desired outcomes = a, and total no.of outcomes = a+b

Given a = 8, b= 13

The probability that the event occurs $= \frac{8}{8+13}$

$$= \frac{8}{21}$$

Conclusion: Probability that the event occurs is $\frac{8}{21}$

Q. 20. If the odds against the occurrence of an event be 4 : 7, find the probability of the occurrence of the event.

Answer : We know that,
If odds in favor of the occurrence an event are a:b, then the probability of an event to occur is $\frac{a}{a+b}$, similarly, if odds are not in the favor of the occurrence an event are a:b, then the probability of not occurrence of the event

is $\frac{a}{a+b}$

We also know that,

Probability of occurring = 1 - the probability of not occurring

$$= 1 - \frac{a}{a+b}$$

$$= \frac{b}{a+b}$$

Given a = 4 and b = 7

Probability of occurrence

$= \frac{7}{4+7}$

$= \frac{7}{11}$

Conclusion: Probability that the event occurs is $\frac{7}{11}$

Q. 21. If 5/14 Is the probability of occurrence of an event, find

(i) the odds in favor of its occurrence
(ii) the odds against its occurrence

Answer : (i) We know that,

If odds in favor of the occurrence an event are a:b, then the probability of an event to occur is $\frac{a}{a+b}$

Given, probability $= \frac{5}{14}$

We know, probability $= \frac{a}{a+b}$. So, $\frac{a}{a+b} = \frac{5}{14}$

a = 5 and a+b = 14 i.e. b = 9

odds in favor of its occurrence = a:b

= 5:9

Conclusion: Odds in favor of its occurrence is 5:9

(ii) As we solved in part (i), a = 5 and b = 9

As we know, odds against its occurrence is b:a

= 9:5

Conclusion: Odds against its occurrence is 9:5

Q. 17. Which of the following cannot be the probability of occurrence of an event?

(i) 0 (ii) $\frac{-3}{4}$

(iii) $\frac{3}{4}$ **(iv)** $\frac{4}{3}$

Answer : (ii) and (iv) can't be the probability of occurrence of an event. So, (ii) and (iv) are the answers to our question.

Explanation: We know that,

$0 \leq \text{probability} \leq 1$ i.e. probability can vary from 0 to 1(both are inclusive)

So, (i) 0 can be possible as $0 \leq \text{probability} \leq 1$

(ii) $-\frac{3}{4}$ is not possible as it is less than 0

(iii) $\frac{3}{4}$ is possible as $0 \leq \text{probabilty} \leq 1$

(iv) $\frac{4}{3}$ is not possible as it is greater than 1

Conclusion: $\frac{4}{3}$ and $-\frac{3}{4}$ are the probabilities that cannot occur.

Q. 18. If 7/10 is the probability of occurrence of an event, what is the probability that it does not occur?

Answer : We know that,

Probability of occurring = 1 - the probability of not occurring

Given the probability of occurrence $= \frac{7}{10}$

Therefore, the probability of not occurrence $= 1 - \frac{7}{10}$

$= \frac{3}{10}$

Conclusion: Probability of not occurrence is $\frac{3}{10}$

Q. 19. The odds in favor of the occurrence of an event are 8 : 13. Find the probability that the event will occur.

Answer : We know that,

If odds in favor of the occurrence an event are a:b, then the probability of an event to occur is $\frac{a}{a+b}$, which indirectly came from

Probability of the occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Where, Total no.of desired outcomes = a, and total no.of outcomes = a+b

Given a = 8, b= 13

The probability that the event occurs

$= \frac{8}{8+13}$

$= \frac{8}{21}$

Conclusion: Probability that the event occurs is $\frac{8}{21}$

Q. 20. If the odds against the occurrence of an event be 4 : 7, find the probability of the occurrence of the event.

Answer : We know that,

If odds in favor of the occurrence an event are a:b, then the probability of an event to occur is $\frac{a}{a+b}$, similarly, if odds are not in the favor of the occurrence an event are a:b, then the probability of not occurrence of the event is $\frac{a}{a+b}$

We also know that,

Probability of occurring = 1 - the probability of not occurring

$$= 1 - \frac{a}{a + b}$$

$$= \frac{b}{a + b}$$

Given a = 4 and b = 7

Probability of occurrence $= \frac{7}{4+7}$

$$= \frac{7}{11}$$

Conclusion: Probability that the event occurs is $\frac{7}{11}$

Q. 21. If 5/14 Is the probability of occurrence of an event, find

(i) the odds in favor of its occurrence
(ii) the odds against its occurrence

Answer : (i) We know that,

If odds in favor of the occurrence an event are a:b, then the probability of an event to occur is $\frac{a}{a+b}$

Given, probability

$$= \frac{5}{14}$$

We know, probability $= \frac{a}{a+b}$. So, $\frac{a}{a+b} = \frac{5}{14}$

a = 5 and a+b = 14 i.e. b = 9

odds in favor of its occurrence = a:b

= 5:9

Conclusion: Odds in favor of its occurrence is 5:9

(ii) As we solved in part (i), a = 5 and b = 9

As we know, odds against its occurrence is b:a

= 9:5

Conclusion: Odds against its occurrence is 9:5

Q. 22. Two dice are thrown. Find

(i) the odds in favor of getting the sum 6
(ii) the odds against getting the sum 7

Answer : Total 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)

Total cases where sum will be 6 is (1, 5), (2, 4), (3, 3), (4, 2), (5, 1) i.e. 5

Probability of getting sum 6 $= \frac{5}{36}$

We know that, If odds in favor of the occurrence an event are a:b, then the probability of an event to occur is $\frac{a}{a+b}$

Now we got $\frac{a}{a+b} = \frac{5}{36}$

So, a = 5 and a+b = 36 i.e. b = 31

Therefore odds in the favor of getting the sum as 6 is 5:31

Conclusion: Odds in favor of getting the sum as 6 is 5:31

(ii) Total 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)

Total cases where sum will be 7 is (1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1) i.e. 6

Probability of getting sum 6 $= \frac{6}{36}$

$= \frac{1}{6}$

We know that,

If odds in favor of the occurrence an event are a:b, then the probability of an event to occur is $\frac{a}{a+b}$

Now we got $\frac{a}{a+b} = \frac{1}{6}$

So, a = 1 and a+b = 6 i.e. b = 5

Therefore odds in the favor of getting the sum as 7 is 1:5

Odds against getting the sum as 7 is b:a i.e. 5:1

Conclusion: Odds against getting the sum as 7 is 5:1

Q. 23. A combination lock on a suitcase has 3 wheels, each labeled with nine digits from 1 to 9. If an opening combination is a particular sequence of three digits with no repeats, what is the probability of a person guessing the right combination?

Answer : As repetition is not allowed total no.of cases possible is

9×8×7(because if one of the numbers occupies a wheel, then the other wheel cannot be occupied by this number, i.e. next wheel have 1 less case than the previous wheel and so on)

Therefore, total cases = 504

Desired output is the correct combination of a single 3 digit number.

Therefore, the total no.of desired outcomes are 1

We know that,

Probability of occurrence of an event

$$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$$

Therefore, the probability of correct combination

$$= \frac{1}{504}$$

Conclusion: Probability of guessing right combination is $\frac{1}{504}$

Q. 24. In a lottery, a person chooses six different numbers at random from 1 to 20. If these six numbers match with the six numbers already fixed by the lottery committee, he wins the prize. What is the probability of winning the prize in the game?

Answer : All numbers are different (given in question), this will be the same as picking r different objects from n objects which is ${}^{n}c_{r}$

Here, n= 20 and r = 6(as we have to pick 6 different objects from 20 objects)

Now we shall calculate the value of ${}^{20}C_{6} = \frac{(20)!}{(20-6)!\times(6)!}$ as ${}^{n}C_{r} = \frac{(n)!}{(n-r)!\times(r)!}$

i.e. ${}^{20}C_{6} = 38760$

Therefore, 38760 cases are possible, and in that only one them has prize, i.e. total no.of desired outcome is 1

As we know,

Probability of occurrence of an event

$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Therefore, the probability of winning a prize is

$= \frac{1}{38760}$

Conclusion: Probability of winning the prize in the game

is $\frac{1}{38760}$

Q. 25. In a single throw of three dice, find the probability of getting

(i) a total of 5
(ii) a total of at most 5

Answer : Total no.of cases will be 6 x 6 x 6 = 216(because each die can have values from 1 to 6)

Desired outcomes are those whose sum up to 5. Desired outcomes are (1, 1, 3), (1, 3, 1), (1, 2, 2), (2, 1, 2), (2, 2, 1), (3, 1, 1) i.e. total of 6 cases

As we know,

Probability of occurrence of an event $= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$

Therefore, the probability of outcome whose sum is 5

$= \frac{6}{216}$

$= \frac{1}{36}$

Conclusion: Probability of getting a total of 5 when three dice are thrown is $\frac{1}{36}$

(ii) Total no.of cases will be 6 x 6 x 6 = 216(because each die can have values from 1 to 6)

Desired outcomes are those whose sum up to 5. Desired outcomes are (1, 1, 3), (1, 3, 1), (1, 2, 2), (2, 1, 2), (2, 2, 1), (3, 1, 1) (1, 1, 1), (1, 1, 2), (1, 2, 1), (2, 1, 1), i.e. total of 10 cases

As we know,

Probability of occurrence of an event

$$= \frac{\text{Total no.of Desired outcomes}}{\text{Total no.of outcomes}}$$

Therefore, the probability of outcome whose sum is at most 5

$$= \frac{10}{216}$$

$$= \frac{5}{108}$$

Conclusion: Probability of getting total of at most 5 when three dice are thrown is $\frac{5}{108}$

Exercise 31B

Q. 1. If A and B are two events associated with a random experiment for which P(A) = 0.60, P(A or B) = 0.85 and P(A and B) = 0.42, find P(B).

Answer : Given : P(A) = 0.60, P(A or B) = 0.85 and P(A and B) = 0.42

To find : P(B)

Formula used : P(A or B) = P(A) + P(B) - P(A and B)

Substituting in the above formula we get,

0.85 = 0.60 + P(B) – 0.42

0.85 = 0.18 + P(B)

0.85 – 0.18 = P(B)

0.67 = P(B)

P(B) = 0.67

Q. 2. Let A and B be two events associated with a random experiment for which P(A) = 0.4, P(B) = 0.5 and P(A or B) = 0.6. Find P(A and B).

Answer : Given : P(A) = 0.4, P(A or B) = 0.6 and P(B) = 0.5

To find : P(A and B)

Formula used : P(A or B) = P(A) + P(B) - P(A and B)

Substituting in the above formula we get,

0.6 = 0.4 + 0.5 – P(A and B)

0.6 = 0.9 - P(A and B)

P(A and B) = 0.9 – 0.6

P(A and B) = 0.3

P(A and B) = 0.3

Q. 3 In a random experiment, let A and B be events such that P(A or B) = 0.7, P(A and B) = 0.3 and $P(\bar{A})$ = 0.4. Find P(B).

Answer : Given : P($\bar{A}$) = 0.4, P(A or B) = 0.7 and P(A and B) = 0.3

To find : P(B)

Formula used : P(A) = 1 – P($\bar{A}$)

P(A or B) = P(A) + P(B) - P(A and B)

We have P($\bar{A}$) = 0.4

P(A) = 1 – 0.4 = 0.6

We get P(A) = 0.6

Substituting in the above formula we get,

0.7 = 0.6 + P(B) – 0.3

0.7 = 0.3 + P(B)

0.7 – 0.3 = P(B)

0.4 = P(B)

P(B) = 0.4

Q. 4. If A and B are two events associated with a random experiment such that P(A) = 0.25, P(B) = 0.4 and P(A or B) = 0.5, find the values of

(i) P(A and B)

(ii) $P\left(A \text{ and } \bar{B}\right)$

Answer : (i) Given : P(A) = 0.25, P(A or B) = 0.5 and P(B) = 0.4

To find : P(A and B)

Formula used : P(A or B) = P(A) + P(B) - P(A and B)

Substituting in the above formula we get,

0.5 = 0.25 + 0.4 – P(A and B)

0.5 = 0.65 - P(A and B)

P(A and B) = 0.65 – 0.5

P(A and B) = 0.15

P(A and B) = 0.15

(ii) Given : P(A) = 0.25, P(A and B) = 0.15 (from part (i))

To find : P(A and $\bar{B}$)

Formula used : P(A and $\bar{B}$) = P(A) – P(A and B)

Substituting in the above formula we get,

P(A and $\bar{B}$) = 0.25 – 0.15

P(A and $\bar{B}$) = 0.10

P(A and $\bar{B}$) = 0.10

Q. 5. If A and B be two events associated with a random experiment such that P(A) = 0.3, P(B) = 0.2 and P(A ∩ B) = 0.1, find

(i) $P\left(\bar{A} \cap B\right)$

(ii) $P\left(A \cap \bar{B}\right)$

Answer : (i) Given : P(A) = 0.3, P(B) = 0.2 , P(A ∩ B) = 0.1

To find : $P(\bar{A} \cap B)$

Formula used : $P(\bar{A} \cap B)$ = P(B) - P(A ∩ B)

Substituting in the above formula we get,

$P(\bar{A} \cap B)$ = 0.2 – 0.1

$P(\bar{A} \cap B)$ = 0.1

$P(\bar{A} \cap B)$ = 0.1

(ii) Given : P(A) = 0.3, P(B) = 0.2 , P(A ∩ B) = 0.1

To find : $P(A \cap \bar{B})$

Formula used : $P(A \cap \bar{B})$ = P(A) - P(A ∩ B)

Substituting in the above formula we get,

$P(A \cap \bar{B})$ = 0.3 – 0.1

$P(A \cap \bar{B})$ = 0.2

$P(A \cap \bar{B})$ = 0.2

Q. 6. If A and B are two mutually exclusive events such that P(A) = (1/2) and P(B) = (1/3), find P(A or B).

Answer : Given : A and B are mutually exclusive events

P(A) = $\frac{1}{2}$, P(B) = $\frac{1}{3}$

To find : P(A or B)

Formula used : P(A or B) = P(A) + P(B) - P(A and B)

For mutually exclusive events A and B, P(A and B) = 0

Substituting in the above formula we get,

P(A or B) = $\frac{1}{2}$ + $\frac{1}{3}$ – 0

P(A or B) = $\frac{5}{6}$

P(A or B) = $\frac{5}{6}$

Q. 7. Let A and B be two mutually exclusive events of a random experiment such that P(not A) = 0.65 and P(A or B) = 0.65, find P(B).

Answer : Given : A and B are mutually exclusive events

P(not A) = P($\bar{A}$) = 0.65 , P(A or B) = 0.65

To find : P(B)

Formula used : P(A) = 1 – P($\bar{A}$)

P(A or B) = P(A) + P(B) - P(A and B)

For mutually exclusive events A and B, P(A and B) = 0

P(A) = 1 – P(not A)

P(A) = 1 – 0.65

P(A) = 0.35

Substituting in the above formula we get,

0.65 = 0.35 + P(B)

P(B) = 0.65 – 0.35

P(B) = 0.30

P(B) = 0.30

Q. 8. A, B, C are three mutually exclusive and exhaustive events associated with a random experiment.

If P(B) = (3/2) P(A) and P(C) = (1/2) P(B), find P(A).

Answer : Given : A,B,C are mutually exclusive events and exhaustive events

P(B) = (3/2) P(A) and P(C) = (1/2) P(B)

To find : P(A)

Formula used : P(A) + P(B) + P(C) = 1

For mutually exclusive events A,B,and C , P(A and B) = P(B and C) = P(A and C)= 0

Let P(A) = x , P(B) = (3/2) P(A) = $\frac{3}{2}$x , P(C) = (1/2) P(B) = $\frac{1}{2} \times \frac{3}{2}$ x = $\frac{3}{4}$x

x + $\frac{3}{2}$ x + $\frac{3}{4}$ x = 1

$\frac{13}{4}$ x = 1

x = $\frac{4}{13}$

P(A) = x = $\frac{4}{13}$

P(A) = $\frac{4}{13}$

Q. 9. The probability that a company executive will travel by plane is (2/5) and that he will travel by train is (1/3). Find the probability of his travelling by plane or train.

Answer : let A denote the event that a company executive will travel by plane and B denote the event of him travelling by train

Given : P(A) = $\frac{2}{5}$, P(B) = $\frac{1}{3}$

To find : Probability of a company executive will be travelling by plane or train=P(A or B)

Formula used : P(A or B) = P(A) + P(B) - P(A and B)

Probability of a company executive will be travelling in both plane and train =P(A and B)= 0

(as he cannot be travelling by plane and train at the same time)

P(A or B) = $\frac{2}{5}$ + $\frac{1}{3}$ – 0

P(A or B) = $\frac{6+5}{15} = \frac{11}{15}$

P(A or B)= $\frac{11}{15}$

Probability of a company executive will be travelling by plane or train= P(A or B) = $\frac{11}{15}$

Q. 10. From a well-shuffled pack of 52 cards, a card is drawn at random. Find the probability of its being a king or a queen

Answer : let A denote the event that the card drawn is king and B denote the event that card drawn is queen.

In a pack of 52 cards, there are 4 king cards and 4 queen cards

Given : P(A) = $\frac{4}{52}$, P(B) = $\frac{4}{52}$

To find : Probability that card drawn is king or queen = P(A or B)

The formula used : Probability =

$\frac{\text{favourable number of outcomes}}{\text{total number of outcomes}}$

P(A or B) = P(A) + P(B) - P(A and B)

P(A) = $\frac{4}{52}$ (as favourable number of outcomes = 4 and total number of outcomes = 52)

P(B) = $\frac{4}{52}$ (as favourable number of outcomes = 4 and total number of outcomes = 52)

Probability that card drawn is king or queen = P(A and B)= 0

(as a card cannot be both king and queen in the same time)

P(A or B) = $\frac{4}{52} + \frac{4}{52} - 0$

P(A or B) = $\frac{4+4}{52} = \frac{8}{52} = \frac{2}{13}$

P(A or B)= $\frac{2}{13}$

Probability of a card drawn is king or queen = P(A or B) = $\frac{2}{13}$

Q. 11. From a well-shuffled pack of cards, a card is drawn at random. Find the probability of its being either a queen or a heart.

Answer : let A denote the event that the card drawn is queen and B denote the event that card drawn is the heart.

In a pack of 52 cards, there are 4 queen cards and 13 heart cards

Given : P(A) = $\frac{4}{52}$, P(B) = $\frac{13}{52}$

To find : Probability that card drawn is either a queen or heart = P(A or B)

The formula used : Probability =

$\frac{\text{favourable number of outcomes}}{\text{total number of outcomes}}$

P(A or B) = P(A) + P(B) - P(A and B)

P(A) = $\frac{4}{52}$ (as favourable number of outcomes = 4 and total number of outcomes = 52)

P(B) = $\frac{13}{52}$ (as favourable number of outcomes = 13 and total number of outcomes = 52)

Probability that card drawn is both queen and heart = P(A and B)= 1

(as there is one card which is both queen and heart i.e queen of hearts)

P(A or B) = $\frac{4}{52} + \frac{13}{52} - 1$

P(A or B) = $\frac{4+13-1}{52} = \frac{16}{52} = \frac{4}{13}$

P(A or B)= $\frac{4}{13}$

Probability of a card drawn is either a queen or heart = P(A or B) = $\frac{4}{13}$

Q. 12. A card is drawn at random from a well-shuffled deck of 52 cards. Find the probability of its being a spade or a king.

Answer : let A denote the event that the card drawn is spade and B denote the event that card drawn is king.

In a pack of 52 cards, there are 13 spade cards and 4 king cards

Given : P(A) = $\frac{13}{52}$, P(B) = $\frac{4}{52}$

To find : Probability that card drawn is either a queen or heart = P(A or B)

The formula used : Probability =

$\frac{\text{favourable number of outcomes}}{\text{total number of outcomes}}$

P(A or B) = P(A) + P(B) - P(A and B)

P(A) = $\frac{13}{52}$ (as favourable number of outcomes = 13 and the total number of outcomes = 52)

P(B) = $\frac{4}{52}$ (as favourable number of outcomes = 4 and the total number of outcomes = 52)

The probability that card is drawn is both spade and king = P(A and B)= 1

(as there is one card which is both spade and king i.e. king of spades)

P(A or B) =$\frac{13}{52} + \frac{4}{52} - 1$

P(A or B) = $\frac{13+4-1}{52} = \frac{16}{52} = \frac{4}{13}$

P(A or B)= $\frac{4}{13}$

Probability of a card drawn is either a spade or king = P(A or B) = $\frac{4}{13}$

Q. 13. A number is chosen from the numbers 1 to 100. Find the probability of its being divisible by 4 or 6.

Answer : let A denote the event that the number is divisible by 4 and B denote the event that the number is divisible by 4.

To find : Probability that the number is both divisible by 4 or 6 = P(A or B)

The formula used : Probability =

$\frac{\text{favourable number of outcomes}}{\text{total number of outcomes}}$

P(A or B) = P(A) + P(B) - P(A and B)

Numbers from 1 to 100 divisible by 4 are 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76, 80, 84, 88, 92, 96, 100.

There are 25 numbers from 1 to 100 divisible by 4

Favourable number of outcomes = 25

Total number of outcomes = 100 as there are 100 numbers from 1 to 100

P(A) = $\frac{25}{100}$

Numbers from 1 to 100 divisible by 6 are 6,12,18,24,30,36,42,48,54,60,66,72,78,84,90,96

There are 16 numbers from 1 to 100 divisible by 6

Favourable number of outcomes = 16

Total number of outcomes = 100 as there are 100 numbers from 1 to 100

P(B) = $\frac{16}{100}$

Numbers from 1 to 100 divisible by both 4 and 6 are

12,24,36,48,60,72,84,96

There are 8 numbers from 1 to 100 divisible by both 4 and 6

Favourable number of outcomes = 8

P(A and B) = $\frac{8}{100}$

P(A or B) = P(A) + P(B) - P(A and B)

P(A or B) = $\frac{25}{100} + \frac{16}{100} - \frac{8}{100}$

P(A or B) = $\frac{25+16-8}{100} = \frac{33}{100}$

P(A or B) $= \frac{33}{100}$

The probability that the number is both divisible by 4 or 6 = P(A or B) $= \frac{33}{100}$

Q. 14. A die is thrown twice. What is the probability that at least one of the two throws comes up with the number 4?

Answer : Given : A die is thrown twice

To find : Probability that at least one of the two throws comes up with the number 4

The formula used : Probability = $\frac{\text{favourable number of outcomes}}{\text{total number of outcomes}}$

A die is numbered from 1 to 6

When a die is thrown twice, total number of outcomes = 6^2 = 36

Favourable outcomes =

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

Favourable number of outcomes = 11

Probability that at least one of the two throws comes up with the number 4 = $\frac{11}{36}$

The probability that at least one of the two throws comes up with the number 4 = $\frac{11}{36}$

Q. 15. Two dice are tossed once. Find the probability of getting an even number on the first die or a total of 8.

Answer : Given : two dice are tossed once

To find : Probability of getting an even number on the first die or a total 8.

The formula used : Probability = $\frac{\text{favourable number of outcomes}}{\text{total number of outcomes}}$

P(A or B) = P(A) + P(B) - P(A and B)

A die is numbered from 1 to 6

When two dice are tossed once, total number of outcomes = 6^2 = 36

Let A denote the event of getting an even number on the first die and B denote the event of getting a total of 8

For getting an even number on the first die

Favourable outcomes =

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

Favourable number of outcomes = 18

Probability of getting an even number on the first die = P(A) = $\frac{18}{36}$

For getting a total of 8

Favourable outcomes =

{ (2,6) , (4,4) , (6,2) ,(5,3) , (3,5) }

Favourable number of outcomes = 5

Probability of getting a total of 8 = P(A) = $\frac{5}{36}$

For getting an even number on the first die and a total of 8

Favourable outcomes = {(2,6) , (4,4) , (6,2)}

Probability of getting an even number on the first die and a total of 8 = P(A and B) = $\frac{3}{36}$

P(A or B) = P(A) + P(B) - P(A and B)

P(A or B) = $\frac{18}{36} + \frac{5}{36} - \frac{3}{36}$

P(A or B) = $\frac{18+5-3}{36} = \frac{20}{36} = \frac{5}{9}$

Probability of getting an even number on the first die or a total 8 = $\frac{5}{9}$

Q. 16. Two dice are thrown together. What is the probability that the sum of the numbers on the two faces is neither divisible by 3 nor by 4.

Answer : Given: Two dice are thrown together.

Sample Space:

(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)

To Find: P(sum of faces neither divisible by 3 nor by 4)

Sum = {2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12}

Sum neither divisible by 3 nor 4 = {2, 5, 7, 10, 11}

$$P = \frac{number\ of\ favourable\ outcomes}{total\ possible\ outcomes}$$

P(sum of faces neither divisible by 3 nor by 4) $= \frac{5}{11}$

Hence, probability is $\frac{5}{11}$.

Q. 17. In class, 30% of the students offered mathematics 20% offered chemistry and 10% offered both. If a student is selected at random, find the probability that he has offered mathematics or chemistry.

Answer : Given: Math students = 30%

Chemistry Students = 20%

Math & Chemistry both = 10%

To Find: P(Math or Chemistry)

Now, P(Math) $= 30\% = \frac{30}{100} = 0.30$

P(Chemistry) $= 20\% = \frac{20}{100} = 0.20$

P(Math ∩ Chemistry) $= 10\% = \frac{10}{100} = 0.10$

We know that,

P(A ∪ B) = P(A) + P(B) – P(A ∩ B)

Therefore,

P(Math ∪ Chemistry) = 0.30 + 0.20 – 0.10 = 0.40

Hence, number of students studying math or chemistry are 40%.

Q. 18. The probability that Hemant passes in English is (2/3), and the probability that he passes in Hindi is (5/9). If the probability of his passing both the subjects is (2/5), find the probability that he will pass in at least one of these subjects.

Answer : let A denot the event that Hemant passes in english and B denote the event that hemant passes in hindi .

Given : P(A) = $\frac{2}{3}$, P(B) = $\frac{5}{9}$,P(A and B) = $\frac{2}{5}$

To find : Probability that he will pass in at least one of these subjects. = P(A or B)

Formula used : P(A or B) = P(A) + P(B) - P(A and B)

P(A or B) = $\frac{2}{3} + \frac{5}{9} - \frac{2}{5}$

P(A or B) = $\frac{30 + 25 - 18}{45} = \frac{37}{45}$

P(A or B) = $\frac{37}{45}$

The probability that he will pass in at least one of these subjects. = P(A or B) = $\frac{37}{45}$

Q. 19. The probability that a person will get an electrification contract ia (2/5) and the probability that he will not get a plumbing contract is (4/7). If the probability of getting at least one contract is (2/3), what is the probability that he will get both?

Answer : Let A denote the event that a person will get electrification contract and B denote the event that the person will get a plumbing contract

Given : P(A) = $\frac{2}{5}$, P(not B) = P($\bar{B}$) = $\frac{4}{7}$, P(A or B) = $\frac{2}{3}$

To find: Probability that he will get both electrification and plumbing contract = P(A and B)

Formula used : P(B) = 1 – P($\bar{B}$)

P(A or B) = P(A) + P(B) - P(A and B)

P(B) = 1 - $\frac{4}{7} = \frac{3}{7}$

P(B) = $\frac{3}{7}$

Probability of getting at least one contract = $\frac{2}{3}$

$\frac{2}{3} = \frac{2}{5} + \frac{3}{7} -$ P(A and B)

$\frac{2}{3} = \frac{14+15}{35} -$ P(A and B)

P(A and B) $= \frac{29}{35} - \frac{2}{3} = \frac{87-70}{105} = \frac{17}{105}$

P(A and B) $= \frac{17}{105}$

The probability that he will get both electrification and plumbing contract = $\frac{17}{105}$

Q. 20. The probability that a patient visiting a denist will have a tooth extracted is 0.06, the probability that he will have a cavity filled is 0.2, and the probability that he will have a tooth extracted or a cavity filled is 0.23.What is the probability that he will have a tooth extracted as well as a cavity filled?

Answer : Let A denote the event that a patient visiting a denist will have a tooth extracted and B denote the event that a patient will have a cavity filled

Given : P(A) = 0.06 , P(B) = 0.2 , P(A or B) = 0.23

To find: Probability that he will have a tooth extracted and a cavity filled= P(A and B)

Formula used : P(A or B) = P(A) + P(B) - P(A and B)

Probability that he will have a tooth extracted or a cavity filled = 0.23

0.23 = 0.06 + 0.2 $-$ P(A and B)

0.23 = 0.26 $-$ P(A and B)

P(A and B) = 0.26 – 0.23 = 0.03

P(A and B) = 0.03

Probability that he will have a tooth extracted and a cavity filled=P(A and B) = 0.03

Q. 21. In a town of 6000 people, 1200 are over 50 years old, and 2000 are females. It is known that 30% of the females are over 50 years. What is the probability that a randomly chosen individual from the town is either female or over 50 years?

Answer : let A denote the event that the chosen individual is female and B denote the event that the chosen individual is over 50 years old.

Given : Town consists of 6000 people, 1200 are over 50 years old, and 2000 are females

To find : Probability that a randomly chosen individual from the town is either female or over 50 years = P(A or B)

The formula used : Probability =

$$\frac{\text{favourable number of outcomes}}{\text{total number of outcomes}}$$

P(A or B) = P(A) + P(B) - P(A and B)

For the event A ,

There are 2000 females present in a town of 6000 people

Favourable number of outcomes = 2000

Total number of outcomes = 6000

P(A) = $\frac{2000}{6000}$ = $\frac{1}{3}$

For the event B,

There are 1200 are over 50 years of age in a town of 6000 people

Favourable number of outcomes = 1200

Total number of outcomes = 6000

P(A) = $\frac{1200}{6000}$ = $\frac{1}{5}$

30% of the females are over 50 years

For the event A and B,

$\frac{30}{100} \times 2000 = 600$ females are over 50 years of age

Favourable number of outcomes = 600

P(A and B) = $\frac{600}{6000}$ = $\frac{1}{10}$

P(A or B) = P(A) + P(B) - P(A and B)

P(A or B) = $\frac{1}{3} + \frac{1}{5} - \frac{1}{10}$

P(A or B) = $\frac{10 + 6 - 3}{30} = \frac{13}{30}$

P(A or B) = $\frac{13}{30}$

The probability that a randomly chosen individual from the town is either female or over 50 years = P(A or B) = $\frac{13}{30}$