Likelihood of an Event Occurring

29

By studying this lesson you will be able to

- identify the events that definitely occur, the events that definitely do not occur and the event that occur randomly and
- describe the outcomes of an experiment.

29.1 Events

Let us consider the following events.

1. A stone which is lifted and released, falling downwards
2. The sun rising from the West
3. A tossed coin landing heads up
4. The next page turned in a Mathematics book being a whole numbered page
5. The cricketer getting out in the next ball
6. Appearance of the moon on a new-moon day
7. The sun rising tomorrow
8. Rain occurring this afternoon
9. A heavy stone floating on water
10. A train leaving at the scheduled time

Now let us divide these events into the following three types; the events that definitely occur, the events that definitely do not occur and the events which we cannot be certain will occur or not.

We know that the events 1, 4 and 7 will definitely occur. We also know that the events 2, 6 and 9 will definitely not occur. If we consider event 3, we cannot say for certain that a tossed coin will land heads up. Likewise it is not certain whether the events 5, 8 and 10 will occur or not.

So, the events we come across are of three types. They are, events that definitely occur, events that definitely do not occur and events that we cannot be certain will occur or not. The events which we cannot be certain will occur or not are called **random events**.

Activity 1

Write 2 examples each of random events, events that definitely occur and events that definitely do not occur.

Discuss your answers with the others in the class.

Exercise 29.1

(1) Write down whether each of the events given below, is an event which definitely occurs, an event which definitely does not occur or a random event.

(a) Of the two competing football teams *A* and *B*, team *A* winning the game

(b) When a red regular cube is tossed, the side that lands up being red

(c) A ball taken out of a bag which contains only 5 white balls, being a black ball

(d) The next passenger getting down from a bus being a woman

(e) When a regular cube with each of its six sides marked with one of 1, 2, 3, 4, 5 and 6 is rolled, the side with 5 turning up

(f) A stone thrown at a Mango tree with fruits, hitting a Mango

(g) A piece of wood placed on water, floating

(h) The youngest participant in a 100 m race for those under thirteen winning the race

(i) Chathuri being a student who obtains more than 75 marks for Mathematics in the grade 7 year end examination

(2) In a school having 700 students, a prefect is chosen by the votes of all the students. Aravinda and Suranga have been proposed for this position.

(i) Find the least number of votes that Aravinda must get if he is to become the prefect.

(ii) Will a prefect always be elected through this method?

(3) The faces of a die are numbered 1, 2, 3, 4, 5 and 6. The die is rolled once. Write down whether each of the events given below is an event which will definitely occur, an event which will definitely not occur or a random event.
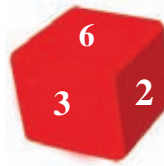
 (i) Obtaining 8
 (ii) Obtaining an even number
(iii) Obtaining 4
(iv) Obtaining a number which is less than 7

29.2 Experiments and Outcomes

The event, "the first commuter getting down from the bus is a woman" is a random event. This is because the first commuter getting down from the bus can be either a woman or a man. Before someone gets down from the bus, we cannot be certain which of these two events will occur. The experiment here is "observing whether the first commuter getting down from the bus is a woman or a man". The outcome will be either "the commuter is a woman" or "the commuter is a man".

For the event of "a stone which is lifted and released falling downwards" the relevant experiment is "observing a stone which is lifted and released". The outcome is "the stone falling downwards".

Furthermore, in experiments such as observing whether the sun rises from the East and observing whether a stone lifted and released falls downwards, the outcomes are definitely known before the experiment is conducted.

Let us consider the event of "a tossed coin landing tails up". In this case we cannot be certain whether heads or tails will land up. So the event is a random event. Here, the experiment is "observing the side that lands up when a coin is tossed". The outcome will be either "heads landing up" or "tails landing up".

Let us consider the event of "rain occurring this afternoon". This is a random event. The experiment is "observing whether it rains this afternoon". The outcome will be either "raining this afternoon" or "not raining this afternoon".

Example 1

The faces of a die are numbered 1, 2, 3, 4, 5 and 6. The die is rolled once and the number on the face that turns upward is observed. Write the set of outcomes of this experiment.

getting 1, getting 2, getting 3, getting 4, getting 5 and getting 6.
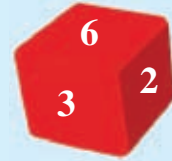
Exercise 29.2

(1) Write down the experiments and corresponding outcomes for each of the events in a, b, c, d and e under Exercise 29.1 (1).

29.3 The likelihood of obtaining each of the possible outcomes of an experiment

Let us examine the nature of each of the experiments given below.

➤ The faces of a regular die are numbered 1, 2, 3, 4, 5 and 6. The die is rolled once and the number on the face that turns upward is observed.

The outcomes of this experiment are getting 1, getting 2, getting 3, getting 4, getting 5 and getting 6. If each of these outcomes is equally likely to occur, then the die used in this experiment is called a "fair die" or an "unbiased die".

➤ A coin is tossed once and the side that lands up is observed.

The outcomes of this experiment are getting head and getting tail. If either one of these outcomes is equally likely to occur, then the coin used in this experiment is called "a fair coin "or an "unbiased coin"

➤ A coin with one side made of aluminum and the other side of copper, where the quantities of aluminum and copper used are equal, is tossed once and the side that lands up is observed.

The outcomes of this experiment are "the aluminum side lands up" and "the copper side lands up". Since the density of copper is more than the density of aluminum, the likelihood of the aluminum side landing up is greater than the likelihood of the copper side landing up. Therefore this is not a fair coin.

➤ A coconut shell similar to the one in the figure is tossed once and the side that lands up is observed.

The outcomes of this experiment are "the shell lands up and "the shell lands down. Although there are only two outcomes, the likelihood of landing with the shell up is greater than the likelihood of landing with the shell down. Therefore, the coconut shell is not an unbiased object.

➤ The faces of a regular tetrahedron are numbered 1, 2, 3 and 4. The tetrahedron is rolled once and the number on the face that turns downward is observed.

The outcomes of this experiment are getting 1, getting 2, getting 3 and getting 4. If each of these is equally likely to occur, then this regular tetrahedron is a fair one.
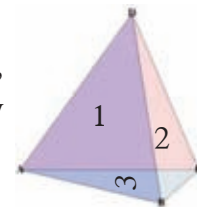
➤ The faces of a cuboid are numbered 1, 2, 3, 4, 5 and 6. The cuboid is rolled once and the number on the face that turns upward is observed.

The outcomes of this experiment are getting 1, getting 2, getting 3, getting 4, getting 5 and
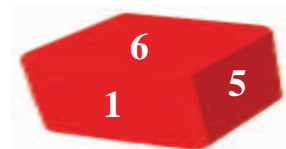
getting 6. The areas of the faces of the cuboid are not the same. It is more likely for the cuboid to land with a face having the greatest area downwards. Therefore, of the six outcomes, certain events are more likely to occur than the others. So the cuboid is not a "fair object".

If each of the outcomes of an experiment is equally likely to occur, then the object used in the experiment is called a fair or an unbiased object.

Exercise 29.3

(1) For each experiment below, write the set of outcomes and write down whether the experiment is carried out using a biased object or an unbiased object.

   (i) The top in the figure, with its faces marked from 0 to 9 is spun and the face that touches the ground when it stops spinning is observed.

   (ii) The figure shows a circular disc divided into 8 equal parts. The parts are numbered 1 to 8. One end of the indicator is fixed to the center and the other end is rotated. The number of the portion where the indicator stops is observed.
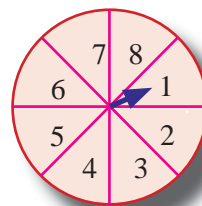
(2) Consider the figure below. Each circular disc is made to rotate around its centre. When the discs stop rotating, the colour indicated by the arrow head is observed. Explain whether each of the discs used in this experiment is fair or not.
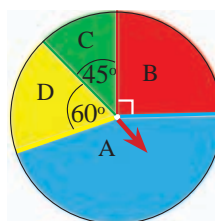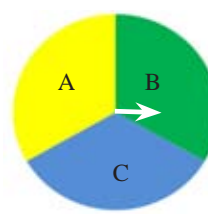
Figure 1   Figure 2

(3) Write two examples of experiments which are done using fair objects.

Summary

- The events which occur in our environment fall into one of the following three types. The events which definitely occur, the events which definitely do not occur and random events.
- The events that can occur in an experiment are called the outcomes of the experiment.
- If an experiment is carried out using an object, the object is considered to be an unbiased object (fair object) if all the outcomes of the experiment are equally likely and it is considered to be a biased object if the outcomes are not equally likely.