

Comprehensive Notes
of
Central Board of Secondary Education

Class IX

Mathematics
(Ganita Manjari)

Chapter - 7 (Introduction to Probability)

by

lumens

Randomness

Meaning of Randomness

An event is called random when its outcome cannot be predicted with certainty before it happens.

Examples

- Tossing a coin
- Rolling a dice
- Picking a card from a deck
- Choosing a student randomly from a class

In all these cases, we know the possible outcomes, but we do not know exactly which outcome will occur.

Random Experiment

A random experiment is an action or process that produces one outcome from many possible outcomes.

Examples of Random Experiments

Experiment	Possible Outcomes
Tossing a coin	Head (H), Tail (T)
Rolling a die	1, 2, 3, 4, 5, 6
Picking a colored ball	Red, Blue, Green etc.

The Probability Scale

Probability tells us how likely an event is to happen.

The probability scale ranges from 0 to 1.

Probability	Meaning
0	Impossible event
Between 0 and 1	Event may happen
1	Certain event

Probability Scale Diagram:

0 ----- 1/2 ----- 1

Impossible Even Chance Certain

Examples:

Event	Probability
Sun rising tomorrow	1
Rolling a 7 on a normal die	0
Getting Head in coin toss	1/2

Measuring Probability Objectively

Probability can be measured in two ways:

1. Using evidence from experience
2. Using theoretical methods

Using Evidence from Experience:

This method uses actual observations or experiments.

It is also called Experimental Probability.

Formula

$$\text{Experimental Probability} = \frac{\text{Number of times event occurs}}{\text{Total number of trials}}$$

Solved Example 1

A coin is tossed 40 times. Heads appear 22 times.

Find the probability of getting a Head.

Solution

Number of Heads = 22

Total tosses = 40

$$P(H) = \frac{22}{40}$$
$$P(H) = \frac{11}{20}$$

Answer

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

Solved Example 2

A die is rolled 60 times. Number 4 appears 8 times.

Find the experimental probability of getting 4.

Solution

$$P(4) = \frac{8}{60}$$

$$P(4) = \frac{2}{15}$$

Answer

$$\frac{2}{15}$$

Using Theoretical Methods:

Theoretical probability is based on reasoning and known possible outcomes.

Formula

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

Solved Example 1

Find the probability of getting an even number when a die is rolled.

Solution

Sample space:

$$S = \{1,2,3,4,5,6\}$$

Even numbers:

$$E = \{2,4,6\}$$

Number of favourable outcomes = 3

Total outcomes = 6

$$P(E) = \frac{3}{6}$$
$$P(E) = \frac{1}{2}$$

Answer

$$\boxed{\frac{1}{2}}$$

Solved Example 2

Find the probability of drawing a king from a deck of 52 cards.

Solution

Number of kings = 4

Total cards = 52

$$P(\text{King}) = \frac{4}{52}$$

$$P(\text{King}) = \frac{1}{13}$$

Answer

$$\frac{1}{13}$$

Experimental Probability

Experimental probability is found by actually performing an experiment.

Steps

1. Perform the experiment
2. Record outcomes
3. Count favourable outcomes
4. Use the formula

Example:

A spinner is spun 50 times.

Red appears 18 times.

Find the probability of landing on red.

Solution

$$P(\text{Red}) = \frac{18}{50}$$

$$P(\text{Red}) = \frac{9}{25}$$

Answer

$$\boxed{\frac{9}{25}}$$

Performing Observations or Experiments

Observations help us estimate probabilities in real life.

Examples

- Weather forecasting
- Cricket match analysis
- Election predictions
- Traffic studies

Scientists collect data repeatedly and estimate probability from observations.

Theoretical Probability

Theoretical probability assumes all outcomes are equally likely.

Important Conditions

- Outcomes must be equally likely.
- Total outcomes must be known.

Example

Probability of getting a vowel from the word “MATHS”.

Letters = M, A, T, H, S

Vowels = A

$$P(\text{Vowel}) = \frac{1}{5}$$

Analysing Statistical Data Using Probability

Probability helps in interpreting data and making predictions.

Applications

- Weather reports
- Insurance companies
- Medical studies
- Sports analysis

Example:

In a survey of 200 students:

- 120 like cricket

Probability that a student likes cricket:

$$P(\text{Cricket}) = \frac{120}{200}$$
$$P(\text{Cricket}) = \frac{3}{5}$$

Elements of Probability

Main elements:

1. Experiment
 2. Outcome
 3. Sample Space
 4. Event
-

Sample Space:

The set of all possible outcomes is called the sample space.

It is represented by S .

Examples

Example 1: Coin Toss

$$S = \{H, T\}$$

Example 2: Rolling a Die

$$S = \{1, 2, 3, 4, 5, 6\}$$

Example 3: Two Coin Tosses

$$S = \{HH, HT, TH, TT\}$$

Events

An event is a collection of favourable outcomes.

Examples

Example 1

Event of getting an even number on a die:

$$E = \{2,4,6\}$$

Example 2

Event of getting at least one Head in two tosses:

$$E = \{HH, HT, TH\}$$

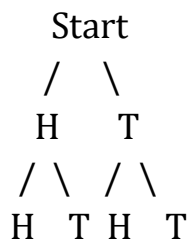
Sample Spaces and Events Together

Experiment	Sample Space	Event
Tossing coin	{H,T}	Getting H = {H}
Rolling die	{1,2,3,4,5,6}	Odd numbers = {1,3,5}
Two coins	{HH,HT,TH,TT}	One Head = {HT,TH}

Tree Diagrams

Tree diagrams help show all possible outcomes systematically.

Example: Tossing Two Coins



Outcomes:

$$\{HH, HT, TH, TT\}$$

Example: Coin and Die

Coin \rightarrow H or T

Die \rightarrow 1 to 6

Total outcomes:

$$(H, 1), (H, 2) \dots (T, 6)$$

Total outcomes = 12

Solved Examples on Tree Diagrams

Example

A coin is tossed twice.

Find probability of getting exactly one Head.

Solution

Sample space:

$$S = \{HH, HT, TH, TT\}$$

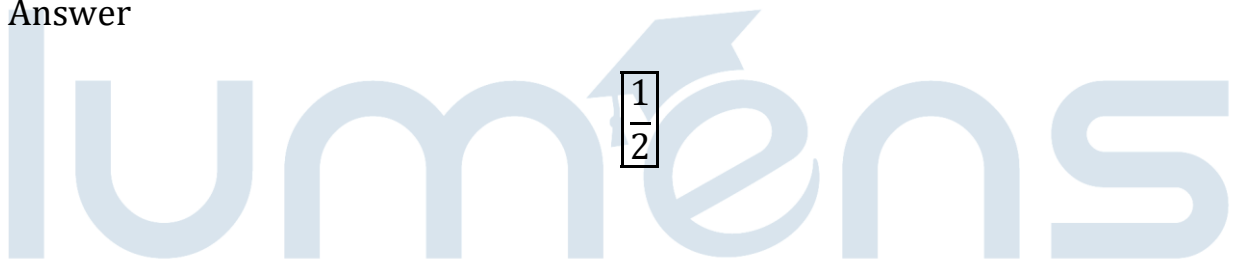
Exactly one Head:

$$E = \{HT, TH\}$$

$$P(E) = \frac{2}{4}$$

$$P(E) = \frac{1}{2}$$

Answer



Important Properties of Probability

1. Probability lies between 0 and 1

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

2. Probability of impossible event:

$$P(E) = 0$$

3. Probability of certain event:

$$P(E) = 1$$

Practice Worksheet

Section A — MCQs

1. Probability of an impossible event is:

- a) 1
- b) 0
- c) $1/2$
- d) 2

2. A die has how many outcomes?

- a) 2
- b) 4
- c) 6
- d) 8

3. Sample space of a coin toss is:

- a) {1,2}
- b) {H,T}
- c) {H}
- d) {T}

4. Probability always lies between:

- a) 0 and 10
- b) 1 and 100
- c) 0 and 1
- d) -1 and 1

5. Experimental probability is based on:

- a) Guessing
- b) Experiments

- c) Luck
- d) Prediction

6. Probability of getting Head in a fair coin toss:

- a) 0
- b) 1
- c) $1/2$
- d) 2

7. Event of getting odd number on die:

- a) {2,4,6}
- b) {1,3,5}
- c) {1,2,3}
- d) {4,5,6}

8. Which is a random experiment?

- a) Measuring height
- b) Tossing a coin
- c) Writing a book
- d) Drawing a line

9. Probability of getting 7 on a die:

- a) 1
- b) $1/6$
- c) 0
- d) 7

10. Number of kings in deck:

- a) 2
- b) 4

- c) 6
- d) 8

11. Total cards in deck:

- a) 26
- b) 40
- c) 52
- d) 56

12. Event means:

- a) Experiment
- b) Favourable outcomes
- c) Guess
- d) Trial

13. Probability of certain event:

- a) 0
- b) 1
- c) 2
- d) $1/2$

14. Outcomes of two coin tosses:

- a) 2
- b) 3
- c) 4
- d) 6

15. Tree diagrams help to:

- a) Draw circles
- b) Show outcomes

- c) Add numbers
- d) Solve equations

16. Experimental probability uses:

- a) Data
- b) Formulas only
- c) Imagination
- d) Assumptions

17. Theoretical probability assumes outcomes are:

- a) Unequal
- b) Impossible
- c) Equally likely
- d) Randomly chosen

18. Which is not a probability?

- a) $1/2$
- b) 0
- c) 1
- d) 5

19. Probability of vowel from "CAT":

- a) $1/3$
- b) $2/3$
- c) 0
- d) 1

20. Probability of getting even number on die:
- $1/3$
 - $1/2$
 - $2/3$
 - 1
-

Section B — Fill in the Blanks

- Probability of a certain event is _____.
 - The set of all possible outcomes is called _____.
 - Tossing a coin is a _____ experiment.
 - Probability of impossible event is _____.
 - The probability scale ranges from _____ to _____.
 - The set $\{1,2,3,4,5,6\}$ is sample space of a _____.
 - Experimental probability is based on _____.
 - An event is a set of _____ outcomes.
 - Tree diagrams help show all possible _____.
 - Theoretical probability assumes outcomes are equally _____.
-

Section C — True/False

- Probability can be greater than 1.
- Rolling a die is a random experiment.
- Experimental probability uses observations.
- Sample space means favourable outcomes only.
- Probability of impossible event is 0.

6. A coin has two possible outcomes.
 7. Tree diagrams help organise outcomes.
 8. Event and sample space are same.
 9. Probability of certain event is 1.
 10. Theoretical probability uses reasoning.
-

Section D — Other Questions

Short Answer Questions

1. Define probability.
 2. What is a sample space?
 3. Define event with example.
 4. What is experimental probability?
 5. What is theoretical probability?
-

Solve the Following

1. Find probability of getting odd number on die.
2. A coin is tossed 30 times. Heads appear 12 times. Find experimental probability of Head.
3. Write sample space for:
 - Tossing two coins
 - Rolling one die
4. Draw tree diagram for two coin tosses.
5. A bag contains 5 red balls and 3 blue balls. Find probability of selecting:

- a red ball
 - a blue ball
-

Answer Key

MCQ Answers

1-b	8-b	15-b
2-c	9-c	16-a
3-b	10-b	17-c
4-c	11-c	18-d
5-b	12-b	19-a
6-c	13-b	20-b
7-b	14-c	

Fill in the Blanks Answers

1. 1
 2. Sample Space
 3. Random
 4. 0
 5. 0, 1
 6. Die
 7. Experiments
 8. Favourable
 9. Outcomes
 10. Likely
-

True/False Answers

- | | |
|----------|----------|
| 1. False | 6. True |
| 2. True | 7. True |
| 3. True | 8. False |
| 4. False | 9. True |
| 5. True | 10. True |
-

End of Chapter

lumenS