Chapter 14: Probability Notes for Class 10

What is Probability?

Definition: The theoretical probability of an event E is:

P(E) = Number of outcomes favourable to E / Number of all possible outcomes
This formula assumes all outcomes are equally likely.

Experimental vs Theoretical Probability

Feature	Experimental Probability	Theoretical Probability
Based on	Actual trials or observations	Logical assumptions and reasoning
Formula	Favourable trials ÷ Total trials	Favourable outcomes ÷ Total outcomes
Requires	Repeated experiments	Equally likely outcomes
Also Called	Empirical Probability	Classical Probability

As the number of trials increases, experimental probability gets closer and closer to theoretical probability.

Key Terms of Probability

Term	Meaning	Example

Experiment	An action with well-defined outcomes.	Tossing a coin, throwing a die
Outcome	A possible result of one trial.	Getting **Head (H)** on a coin toss
Sample Space (S)	The set of all possible outcomes of an experiment.	S = {H, T}) for a coin toss
Event (E)	A specific outcome or a set of outcomes of interest.	Getting an even number on a die
Elementary Event	An event that contains exactly one outcome.	Getting **3** on a die
Favourable Outcomes	Outcomes that satisfy the given event condition.	For the event 'getting an even number': {2, 4, 6}

Sum of Elementary Events
The sum of probabilities of all elementary events of an experiment always equals 1.
Example: For a die: $P(1) + P(2) + P(3) + P(4) + P(5) + P(6) = 1/6 \times 6 = 1$

Types of Events in Probability

- Impossible Event: $P(E) = 0$
  e.g., rolling 8 on a die
- Sure/Certain Event: $P(E) = 1$
  e.g., rolling <7 on a die
- For any event E: $0 \leq P(E) \leq 1$
- Complementary Event (Not E) : $P(\bar{E}) = 1 - P(E)$

Complementary Events Explained

If event E is ‘getting a head’, then $\bar{E}$ (complement, read as ‘E-bar’) is ‘not getting a head’ = ‘getting a tail’. They are complementary because together the events cover all possibilities.

Complementary Events Formula

$$P(E) + P(\bar{E}) = 1 \implies P(\bar{E}) = 1 - P(E)$$

Two Dice Problems

When two dice are thrown, the total number of outcomes = $6 \times 6 = 36$. Each ordered pair (a, b) represents a unique outcome where $a \neq b$ position-wise, so $(1, 4) \neq (4, 1)$.

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

Event	Favourable Outcomes	Probability
Sum = 8	(2,6), (3,5), (4,4), (5,3), (6,2) → 5 outcomes	5/36
Sum = 13	None (Impossible event)	0
Sum ≤ 12	All 36 possible outcomes (Sure event)	1

Sum = 7	(1,6), (2,5), (3,4), (4,3), (5,2), (6,1) → 6 outcomes	6/36 = 1/6
Sum = 2	(1,1) → 1 outcome	1/36
Sum = 12	(6,6) → 1 outcome	1/36

Understanding Playing Cards

A standard deck has 52 cards.

- ♠ Spades
  Black - 13 cards
- ♥ Hearts
  Red - 13 cards
- ♦ Diamonds
  Red - 13 cards
- ♣ Clubs
  Black - 13 cards

Card Type	Count	Details
Total Cards	52	4 suits × 13 cards each
Red Cards (♥ + ♦)	26	Hearts and Diamonds
Black Cards (♠ + ♣)	26	Spades and Clubs
Aces	4	One Ace in each suit
Face Cards (K, Q, J)	12	3 face cards × 4 suits
Number Cards (2–10)	36	9 number cards × 4 suits
Kings of Red Suits	2	King of Hearts and King of Diamonds

Previous Year Board Questions

Question 1: A bag contains 6 red, 4 white and 8 blue balls. A ball is drawn at random. Find the probability that the ball drawn is (i) blue, (ii) not red.
Solution: Total = 18
Blue balls = 8
Red balls = 6
White balls = 4
(i) P(blue) = 8/18 = 4/9
(ii) P(not red) = 12/18 = 2/3

Question 2: Cards marked 2 to 101 are placed in a box and one is drawn at random. Find the probability that the number on the card is (i) a perfect square, (ii) divisible by 7.
Solution: Total = 100
(i) Perfect squares: 4, 9, 16, 25, 36, 49, 64, 81 and 100
There are 9 perfect squares
P(a perfect square) = 9/100
(ii) Divisible by 7 (7, 14, ... 98)
There are 14 numbers divisible by 7
P(divisible by 7) = 14/100 = 7/50

Question 3: A die is thrown twice. What is the probability that (i) 5 will not come up either time? (ii) 5 will come up at least once?
Solution: Total = 36
Outcomes where 5 appears: (5,1), (5,2)...(5,6), (1,5)...(6,5) minus double-count
Therefore 11 outcomes
(i) P(5 not at all) = 25/36
(ii) P(5 at least once) = 11/36

Question 4: A number x is selected at random from the numbers 1, 2, 3 and 4. Another number y is selected at random from 1, 2, 3 and 4. Find the probability that the product of x and y is less than 9.
Solution: Total pairs = 16

Products ≥ 9: (3,3)=9, (3,4)=12, (4,3)=12, (4,4)=16
Total 4 favourable outcomes
P(xy < 9) = 12/16 = 3/4

All Formulas at a Glance

Formula	Expression	Notes
Theoretical Probability	$P(E) = n(E)/n(S)$	(n(E)) = number of favourable outcomes, (n(S)) = total number of outcomes
Range of Probability	$(0 \leq P(E) \leq 1)$	Probability always lies between 0 and 1
Complementary Event	$P(\bar{E}) = 1 - P(E)$	A useful shortcut when finding the probability of 'not' an event
Sum of All Elementary Events	$\sum P(E_i)=1$	The probabilities of all possible outcomes add up to 1
Impossible Event	$P(E)=0$	No favourable outcomes exist
Sure (Certain) Event	$P(E)=1$	Every outcome is favourable
Two Dice: Total Outcomes	$6 \times 6 = 36$	All 36 outcomes are equally likely
Two Coins: Total Outcomes	$2 \times 2 = 4$	Sample space = ({HH, HT, TH, TT})