

Theoretical Probability — Class 10

The classical formula, the one condition it needs, and the four facts that come free with it.

$P(E)$ = number of outcomes favourable to E / number of all possible outcomes · valid only when outcomes are **equally likely**

The formula, and the condition it rests on

Theoretical (classical) probability of an event E is the fraction of all possible outcomes that count as E. You do not perform the experiment — you list the outcomes, count, and divide. The definition is **Laplace's (1795)**, and the CBSE syllabus names it in exactly those words: *classical definition of probability*.

The formula holds **only when the individual outcomes are equally likely** — a fair coin, a fair die, a well-shuffled deck, a bag drawn from without looking. A bag of 4 red balls and 1 blue ball does **not** make "red" and "blue" equally likely; there the five *balls* are the equally likely outcomes, not the two colours. **Check equal likelihood before you write the fraction.**

The sample space. The list of every possible outcome. Write it down before you count anything — in the exam it is where the method mark sits, and it is the only thing you can recount later.

Five facts that come free with the formula

Idea	In symbols	What it gives you
Range of a probability	$0 \leq P(E) \leq 1$	Favourable can never exceed total, nor be negative. So 1.5, -0.2 and $8/3$ are never probabilities — if you get one, recount.
Impossible event	$P(E) = 0$	An 8 on a normal die: 0 favourable out of 6, so $P = 0$.
Sure (certain) event	$P(E) = 1$	A number below 7 on a die: all 6 faces qualify, so $P = 1$.
Elementary events	sum = 1	An event with exactly one outcome. For a die, $6 \times (1/6) = 1$ — a fast check that your separate probabilities are right.
Complement	$P(\text{not } E) = 1 - P(E)$	Often the shortest route. $P(\text{ace}) = 4/52 = 1/13$, so $P(\text{not an ace}) = 12/13$ without counting 48 cards.

Where this sits in NCERT and CBSE

NCERT. Probability is **Chapter 14**, the last chapter of the rationalised textbook. One teaching section — *Probability — A Theoretical Approach*, the whole of this page — and **one exercise, Exercise 14.1, 25 questions**. Mind the numbering: the theory is **Section 14.2** but the questions are **Exercise 14.1**. A book offering an "Exercise 14.2" here, or numbering this Chapter 15, is a pre-2023 edition.

CBSE. Unit VII **Statistics & Probability is 11 marks of 80**, shared with Statistics — CBSE sets weightage by unit, never by chapter.

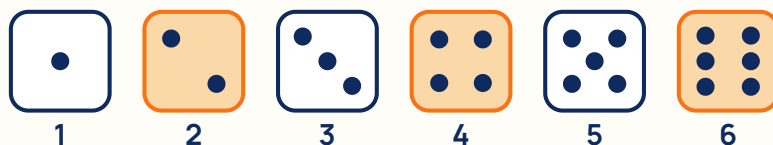
The syllabus gives this chapter one line, verbatim: "*Classical definition of probability. Simple problems on finding the probability of an event.*" Use it as a limit. If a solution reaches for conditional probability, permutations or combinations, it has left the Class 10 syllabus.

Key takeaways

- **$P(E)$ = favourable outcomes / total outcomes** — only when the outcomes are **equally likely**.
- **Write the sample space down.** Almost every lost mark in this chapter is a miscount, not a formula error.
- **$0 \leq P(E) \leq 1$** always: impossible event **0**, sure event **1**.
- All **elementary events sum to 1** — use it as a self-check.
- **$P(\text{not } E) = 1 - P(E)$** — reach for it whenever "at least" or "not" appears.
- Show **total = ...**, **favourable = ...** before the fraction. A bare answer has nowhere to earn the method mark.

Three NCERT questions, worked end to end

All from Exercise 14.1 — the only exercise this chapter has.



One throw of a fair die: **six** equally likely outcomes. Shaded = the three even faces, so $P(\text{even}) = 3/6 = 1/2$.

NCERT Ex 14.1 Q13

A die is thrown once. Find the probability of getting a prime number.

Step 1 — write the sample space. $S = \{1, 2, 3, 4, 5, 6\}$, so **total outcomes = 6**, equally likely because the die is fair.

Step 2 — name the favourable outcomes. The primes in S are 2, 3, 5 (1 is not prime; 4 and 6 are composite), so **favourable outcomes = 3**.

Step 3 — apply the formula, then reduce. $P(\text{prime}) = 3/6 = 1/2$.

Check: the complement $\{1, 4, 6\}$ is also 3 outcomes, so the two add to 1. ✓ The odd faces $\{1, 3, 5\}$ give $1/2$ as well — a different event, the same answer, which is why you name the outcomes instead of guessing.

NCERT Ex 14.1 Q5

If $P(E) = 0.05$, what is the probability of ‘not E’?

Step 1. An event and its complement always satisfy $P(E) + P(\text{not } E) = 1$.

Step 2. $P(\text{not } E) = 1 - 0.05 = 0.95$.

Write Step 1. There is nothing to count here, so quoting the complement rule *is* the working.

NCERT Ex 14.1 Q4

Which of the following cannot be the probability of an event? (A) $2/3$ (B) -1.5 (C) 15% (D) 0.7

Test each against $0 \leq P(E) \leq 1$: (A) $2/3 \approx 0.67$ in range; (B) -1.5 is **negative**; (C) $15\% = 0.15$, in range; (D) 0.7, in range.

Answer: (B). A count of favourable outcomes cannot be negative, so no probability can be.

The trap is (C). Students reject 15% because it “is not a fraction”. A probability may be written as a fraction, a decimal or a percentage — only its *value* has to lie between 0 and 1.

WHERE THE MARKS GO

No sample space written. The count is the method mark; a lone fraction cannot earn it.

Total counted wrongly. The commonest single error in the chapter — and every mark after it follows the wrong denominator.

The wrong event solved. “At least one”, “not” and “between” each change the favourable list.

Answer out of range or unreduced. Above 1 or below 0 means recount — never write it down.

NOW TRY THESE TWO

1 (Ex 14.1 Q8). A bag contains 3 red balls and 5 black balls. One ball is drawn at random. Find $P(\text{red})$ and $P(\text{not red})$.

2 (Ex 14.1 Q6). A bag contains lemon-flavoured candies only. Malini takes out one candy without looking. What is the probability that it is (i) orange-flavoured, (ii) lemon-flavoured?

Answers. 1: total = 8, favourable = 3, so $P(\text{red}) = 3/8$ and $P(\text{not red}) = 1 - 3/8 = 5/8$. 2: (i) an **impossible** event, $P = 0$; (ii) a **sure** event, $P = 1$.

Turn a chapter you understand into marks you keep

- **Chapter 1 free** — start on examfront today at no cost.
- **Mistake identification** — names the miscount or the misread event, not just “wrong”.
- **Anytime tests** — practise Probability the moment you finish this page.
- **Weekly tests** — keep the counting habit sharp across all 14 chapters.
- **Mock tests before the exam** — the full 80-mark paper under real timing.

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