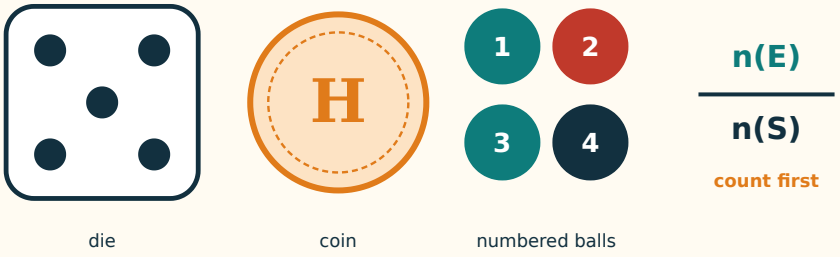
MATHS WITHOUT GUESSWORK

Probability

Understand the Outcomes.
Count Carefully.
Solve Independently.

A guided problem-solving workbook

CBSE Class 10 Mathematics · Syllabus session 2026–27



die coin numbered balls

Count the right outcomes first. The formula is the easy part.

Core topics: classical definition of probability · simple problems on finding the probability of an event

Original explanations, examples and questions. Not a substitute for the NCERT textbook or your teacher.

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Events and favourable outcomes

PREREQUISITE

Learning objective: Turn a sentence into an event and pick out exactly the outcomes that make it happen.

◆ MEANING	An **event** E is a description of what we are looking for. The outcomes that make the event happen are its **favourable outcomes**; their number is **n(E)**.
★ EVERYDAY EXAMPLE	"Our team wins the toss" is an event; it happens for one outcome (our call comes up).
➤ IN MATHEMATICS	Die, event "an even number": 1 **2** 3 **4** 5 **6** favourable 2, 4, 6, so n(E) = 3.
⚠ COMMON CONFUSION	"Favourable" does **not** mean "good for me". If the event is "getting a 1", then 1 is favourable even if 1 loses the game.
✎ QUICK PRACTICE	Die, event "a number less than 3": write the favourable outcomes.

⇄ SAME EXPERIMENT, DIFFERENT EVENT

One die, S = {1, 2, 3, 4, 5, 6}. The total stays 6; only the favourable outcomes change.

Event	Outcomes (teal = favourable)	n(E)	P(E)
an even number	1 **2** 3 **4** 5 **6**	3	$\frac{1}{2}$
the number 4	1 2 3 **4** 5 6	1	$\frac{1}{6}$
a prime number	1 **2** **3** 4 **5** 6	3	$\frac{1}{2}$
the number 8	1 2 3 4 5 6	0	0

◆ UNDERSTAND

An event with exactly **one** favourable outcome is an **elementary event** (e.g. "getting 4"). A die has six elementary events, each with probability 1/6, and they add up to 1.

✔ CHECK YOURSELF

C2. A die is thrown. List the favourable outcomes and n(E) for: (a) a number less than 3; (b) a multiple of 3; (c) a number greater than 6.

The formula, and the eight steps that come before it

CORE

Learning objective: Name the numerator and denominator of P(E) and follow a fixed order of steps.

➤ FORMULA WITHOUT GUESSWORK

$$P(E) = \frac{n(E)}{n(S)} = \frac{\text{number of outcomes favourable to E}}{\text{total number of equally likely outcomes}}$$

P(E): probability of event E · **n(E)**: how many outcomes make E happen (numerator) · **n(S)**: how many equally likely outcomes the experiment has (denominator)

1	Read the question carefully.	Underline the event words.
2	Identify the experiment and the event.	What is done once? What are we looking for?
3	Determine all possible outcomes.	List, tree or grid.
4	Identify which outcomes satisfy the event.	Test each outcome against the event.
5	Count the favourable outcomes: n(E).	Count once each.
6	Count the total equally likely outcomes: n(S).	Check with 2^k, 6 × 6, 52, etc.
7	Apply the formula and simplify.	Numerator = n(E), denominator = n(S).
8	Check that the answer lies between 0 and 1.	And that n(E) + n(not E) = n(S).

List, or count systematically?

Situation	Best tool	Example
Few outcomes (up to about 12)	write every outcome	die; two or three coins; coin + die
Two objects, 36 outcomes	6 × 6 grid	two dice; a die thrown twice
Many identical-type outcomes	count with a rule	numbers 1 to 90: two-digit numbers are 10 to 90, i.e. 90 − 9 = 81
Objects in groups	add the group sizes	bag with 4 red, 6 blue, 2 green: n(S) = 12
Cards	use the deck structure	4 suits × 13 ranks; 12 face cards

◆ UNDERSTAND

Four distinctions this chapter keeps testing: counting **objects** vs counting **colour names**; counting **favourable** vs **all** outcomes; counting each outcome **once** vs twice; a **complete** sample space vs one with a gap. Each worked example below highlights one of them.

Worked example 8: two dice and the 6 × 6 grid

CORE

Learning objective: Use the grid to count all 36 ordered outcomes and select the favourable ones.

WORKED EXAMPLE 8 **A blue die and a grey die are thrown together. Find P(sum is 8), P(sum is 13), P(sum is 12 or less), P(a doublet).**

WHAT IS ASKED?	Four probabilities, all about the pair of numbers.
WHAT IS GIVEN?	Two fair dice that can be told apart.
HOW DO I IDENTIFY THE OUTCOMES?	(blue, grey) ordered pairs in a 6 × 6 grid.
WHY IS THIS METHOD SUITABLE?	Each of the 36 pairs is equally likely; the sums 2 to 12 are not.

	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)

◆ **COUNT BEFORE YOU CALCULATE**

1 · THE EXPERIMENT	Two dice thrown together.
2 · ALL OUTCOMES · n(S)	the grid: 6 × 6 = 36 ordered pairs
3 · THE EVENT IN WORDS	the sum is 8
4 · FAVOURABLE · n(E)	(2, 6), (3, 5), (4, 4), (5, 3), (6, 2) → n(E) = 5

FORMULA WITHOUT GUESSWORK $P(E) = \frac{n(E)}{n(S)} = \frac{5}{36}$

Event	Favourable outcomes	n(E)	P(E)
the sum is 13	none	0	0/36 = 0
the sum is 12 or less	(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), …, (6, 6)	36	36/36 = 1
a doublet (same number on both)	(1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)	6	6/36 = 1/6

⚠ **COMMON TRAP**

Counting (2, 6) and (6, 2) as one outcome. They are different cells of the grid (blue 2, grey 6 vs blue 6, grey 2).

Final answer (board format): P(sum 8) = 5/36; P(sum 13) = 0 (impossible); P(sum ≤ 12) = 1 (certain); P(doublet) = 1/6.

✎ **YOUR TURN**

T7. Two dice are thrown. Find P(the sum is 10) and P(the product is 6).

✓ **WHY IS THIS FAVOURABLE?**

A doublet means the same number on both dice: the diagonal (1, 1), (2, 2), …, (6, 6): 6 cells. The largest possible sum is 6 + 6 = 12, so a sum of 13 has no cells (impossible) and "12 or less" is every cell (certain).

UNIT 1 · UNDERSTANDING THE QUESTION

Doubts 1 and 2: what am I supposed to count?

DOUBT 1 — *"How do I identify the event in a long question?"*

✗ WHY THIS CONFUSION HAPPENS	Questions wrap the event in a story; students count what is mentioned last or loudest.
◆ UNDERSTAND THE IDEA	The event is the condition the outcome must satisfy. Strip the story and write "E: ..." in a few words.
★ SPOT THE CLUE	Words after "probability that..." or "probability of getting...". Joining words: "both ... and", "or", "not".
➤ CHOOSE THE METHOD	Write the event in words, then test each outcome against it.
✎ SOLVED EXAMPLE	A number is picked at random from 1 to 30. n(S) = 30. Event: a multiple of both 2 and 3. Favourable: 6, 12, 18, 24, 30; n(E) = 5. P = 5/30 = **1/6**. "Both 2 and 3" means divisible by 6.
? WHY THIS STEP?	"Multiple of both 2 and 3" needs both tests passed; 4 passes one test only, so it is not favourable.
⚠ COMMON TRAP	Counting multiples of 2 and multiples of 3 separately (15 + 10) and adding: that is a different event, and it double-counts.
✎ YOUR TURN DB1	A number is chosen at random from 1 to 25. Find P(it is a multiple of both 3 and 4).
✓ CHECK YOURSELF	a multiple of both 3 and 4: **2/25** (2 out of 25) — only 12 and 24.

DOUBT 2 — *"Does "favourable" mean the result I want or like?"*

✗ WHY THIS CONFUSION HAPPENS	In everyday English, favourable means good for me.
◆ UNDERSTAND THE IDEA	In probability, favourable means **satisfies the event**, even if that result is bad for you.
★ SPOT THE CLUE	Read the event, not the story: "the probability that she does **not** win" makes losing outcomes favourable.
➤ CHOOSE THE METHOD	Favourable = outcomes making the stated event true.
✎ SOLVED EXAMPLE	A die is thrown once. n(S) = 6. Event: not getting a 6. Favourable: 1, 2, 3, 4, 5; n(E) = 5. P = 5/6. Rahul wants a 6, but the event asked is "not 6".
? WHY THIS STEP?	We count outcomes that make the *event* happen. Here that is 1, 2, 3, 4, 5.
⚠ COMMON TRAP	Answering 1/6 because "6 is the good outcome for Rahul".
✎ YOUR TURN DB2	Asha wins only if a dial numbered 1 to 8 stops at 8. Find P(Asha does not win).
✓ CHECK YOURSELF	not 8 (Asha does not win): **7/8** (7 out of 8)

If the question says… then identify… then do…

Learning objective: Translate the words of the question into a counting plan.

If the question says or shows…	What should I identify?	What should I do next?
A coin is tossed (once, twice, three times)	H/T for each toss, in order	List in order: 2, 4 or 8 outcomes
A die is rolled once	the six faces	Select the faces satisfying the condition
Two dice / a die thrown twice	ordered pairs (first, second)	Use the 6 × 6 grid; 36 outcomes
A coin and a die together	pairs (coin, die)	List 2 × 6 = 12 pairs
An object is selected from a bag or box	each object (not each colour)	Add group sizes for n(S); count qualifying objects
A card is drawn from a deck	suit, colour, rank; 52 cards	Count by structure: 13 per suit, 4 per rank, 12 face cards
Cards are removed first	the cards that remain	Rebuild n(S) and n(E) from what is left
A number condition (prime, square, multiple)	exactly which numbers qualify	List or count by rule; check boundaries
"Not" a particular event	outcomes excluded by the condition	n(S) − n(E), or 1 − P(E)
"At least one" / "exactly one"	how many successes are allowed	"at least one" = all − none; "exactly" = only that number
"Or" / "neither … nor"	the overlap of the two groups	n(A) + n(B) − n(both); neither = n(S) − that
A second draw without replacement	what was removed	Update both counts before the second probability
A probability or a ratio is given; find a number	the unknown count	Set n(E)/n(S) equal to the given value and solve
A long, complicated condition	the event in simple words	Break it into tests joined by and / or / not

Before you calculate, ask yourself

1. Have I understood the event?

2. Have I counted all possible outcomes?

3. Are the outcomes equally likely?

4. Have I identified only the favourable outcomes?

5. Have I avoided double-counting?

6. Is n(E) in the numerator and n(S) in the denominator?

7. Is my final probability between 0 and 1?

8. Is it in simplest form?

Mistake clinic (1 of 3): counting the outcomes

MISTAKE 1 · Favourable and total swapped	
✗ INCORRECT APPROACH	*Bag: 7 green, 3 yellow. P(green)?* "P = 10/7"
⚠ WHY IT FAILS	The total (10) went on top. The answer is above 1, which is impossible.
✓ CORRECT APPROACH	n(E) = 7 green balls; n(S) = 10 balls. P(green) = 7/10.
➤ EXAM-READY LINE	P(green) = n(E)/n(S) = 7/10.
✎ FIX IT E1	Same bag. Find P(yellow).

MISTAKE 2 · Forgetting outcomes	
✗ INCORRECT APPROACH	*Two coins. P(two heads)?* "S = {HH, HT, TT}, P = 1/3"
⚠ WHY IT FAILS	TH is missing; 2 × 2 = 4 outcomes. The three listed are not equally likely.
✓ CORRECT APPROACH	S = {HH, HT, TH, TT}; P(HH) = 1/4.
➤ EXAM-READY LINE	n(S) = 4, n(E) = 1, P = 1/4.
✎ FIX IT E2	Two coins. Find P(two tails).

MISTAKE 3 · Counting an outcome twice	
✗ INCORRECT APPROACH	*P(a heart or a king)?* "13 + 4 = 17, P = 17/52"
⚠ WHY IT FAILS	K♥ is a heart and a king: it was counted in both groups.
✓ CORRECT APPROACH	13 + 4 − 1 = 16; P = 16/52 = 4/13.
➤ EXAM-READY LINE	n(E) = 13 + 4 − 1 = 16 (K♥ counted once); P = 4/13.
✎ FIX IT E3	Find P(a spade or an ace).

MISTAKE 4 · Treating different outcomes as identical	
✗ INCORRECT APPROACH	*Two dice. P(sum 7)?* "Sums are 2 to 12: 11 outcomes, P = 1/11"
⚠ WHY IT FAILS	The 11 sums are not equally likely. Only the 36 ordered pairs are.
✓ CORRECT APPROACH	Sum 7: (1,6), (2,5), (3,4), (4,3), (5,2), (6,1) → 6/36 = 1/6.
➤ EXAM-READY LINE	n(S) = 36 ordered pairs; n(E) = 6; P = 1/6.
✎ FIX IT E4	Two dice. Find P(sum is 6).

Practice level 1: recognise

Learning objective: Identify outcomes, events and totals before any calculation.

1 Recognise | 2 Apply | 3 Connect and reason | 4 Board-style — *Little or no calculation.*

All questions in this section are **original practice** written for this workbook in the CBSE style; none is presented as an official previous-year question.

P1 Two coins are tossed together. The number of possible outcomes is:

(a) 2 (b) 3 (c) 4 (d) 8

Purpose: Size of S. **easy** ★☆☆

P2 A spinner has four equal sectors coloured red, green, blue and yellow. Write the sample space and n(S).

Purpose: Write S. **easy** ★☆☆

Working space

P3 A die is thrown. List the outcomes favourable to "a number less than 5".

Purpose: Favourable list. **easy** ★☆☆

Working space

P4 Which of these cannot be the probability of an event?

(a) 0.01 (b) 101/100 (c) 0 (d) 33%

Purpose: Range. **easy** ★☆☆

P5 Impossible, certain, or neither? (a) getting 7 on a die (b) getting a number less than 7 on a die (c) drawing a red card from a pile containing only spades (d) getting a head when a coin is tossed.

Purpose: Event types. **easy** ★☆☆

Working space

P6 If P(E) = 0.08, find P(not E).

Purpose: Complement. **easy** ★☆☆

Working space

P7 Two dice are thrown. How many outcomes are there? How many are doublets?

Purpose: Grid counts. **easy** ★☆☆

Working space

P8 In a deck of 52 cards, how many are (a) face cards (b) red cards (c) aces (d) black face cards?

Purpose: Deck structure. **easy** ★☆☆

Working space

Quick revision (1 of 2): definitions, formula, checks

Learning objective: Revise the whole chapter in 5–10 minutes. Nothing new here.

Term	Meaning	Example (one die)
Experiment	an action with uncertain result	throwing a die once
Outcome	one possible result	4
Sample space S, n(S)	the complete list of outcomes; how many	{1, ..., 6}; 6
Event E, n(E)	a condition; outcomes satisfying it; how many	"even": 2, 4, 6; 3
Elementary event	an event with one outcome	"getting 4"
Impossible / certain	n(E) = 0, P = 0 / n(E) = n(S), P = 1	"8" / "less than 7"
Complement (not E)	all outcomes where E fails	"not even": 1, 3, 5

➤ FORMULA WITHOUT GUESSWORK

$$P(E) = \frac{n(E)}{n(S)} \qquad 0 \le P(E) \le 1 \qquad P(\text{not } E) = 1 - P(E)$$

Valid when all outcomes are **equally likely**. Example: die, "a number greater than 4": n(E) = 2 (5, 6), n(S) = 6, P = 2/6 = 1/3.

▦ VISUAL OUTCOME ORGANISER

Sample-space sizes: 1 coin 2 · 2 coins 4 · 3 coins 8 · 1 die 6 · 2 dice (or die twice) 36 · coin + die 12 · deck 52 (26 red, 26 black; 13 per suit; 4 per rank; 12 face cards J, Q, K) · numbers a to b: b − a + 1.

★ SPOT THE CLUE

Wording clues: "not" → rest of S · "at least one" → all − none · "exactly" → only that many · "or" → add, remove overlap · "neither … nor" → n(S) − n(A or B) · "not replaced" → update both counts · "between" → ends excluded.

✓ CHECK BEFORE YOU FINISH

Before finalising: (1) n(S) matches a multiplication or rule check. (2) Every favourable outcome passes the test, none is missed, none is counted twice. (3) n(E) on top, n(S) below. (4) 0 ≤ P ≤ 1. (5) Simplest form. (6) Complement check when easy.

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