LF LearnFrenzy

QUANTITATIVE APTITUDE · FREE STUDY MATERIAL

Probability

Formulas & Shortcut Tricks

Every important formula, shortcut and exam trick for Probability in one place – with solved examples, common mistakes and a one-page revision sheet.

WHAT'S INSIDE

1. Topic introduction
2. Important formulas
3. Shortcut tricks & smart techniques
4. Solved examples
5. Important exam tips
6. Quick revision sheet
7. A message from LearnFrenzy

USEFUL FOR

- Bank PO & Clerk (IBPS, SBI, RBI)
- SSC CGL / CHSL
- Railways (RRB NTPC)
- Campus placements (TCS, Infosys, Wipro, Accenture)
- UPSC CSAT & state PSC exams

Practise **Probability** free on LearnFrenzy – questions with instant explanations →

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1 Topic introduction

What it is, why it matters and how it is asked

Probability measures how likely an event is, on a scale from 0 (impossible) to 1 (certain). When all outcomes are equally likely, it is the number of favourable outcomes divided by the total number of outcomes.

Exams build questions on coins, dice, playing cards, balls drawn from bags, letters of words and people seated in rows. Harder questions add independent events, conditional probability, Bayes' theorem and repeated trials.

Why it matters in exams

- Bank PO papers ask a set of 2–5 probability questions.
- Placement tests use cards, dice and conditional probability.
- It reuses counting from Permutations and Combinations.

Where it is used

- Risk, insurance and weather forecasts.
- Quality checks on defective items.
- Games, lotteries and sports predictions.

Common question patterns

Coins and dice
Heads, sums and doubles.

Playing cards
Suits, face cards, kings and aces.

Balls from a bag
With and without replacement.

Addition rule
"A or B" with an overlap.

Independent events
Shooters, solvers and truth-tellers.

Conditional and Bayes
Given one event, find another.

Arrangements
Letters of words, people in a row or round a table.

Repeated trials
Exactly r successes in n tries.

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2 Important formulas

Cards marked MOST USED are the ones to revise first

Basics

Classical probability

MOST USED

P(E) = favourable outcomes ÷ total outcomes; 0 ≤ P(E) ≤ 1; P(not E) = 1 − P(E)

Count the sample space first, then the favourable cases.

EXAMPLE One card from a pack: P(king) = 4/52 = **1/13**.

Odds

Odds in favour a : b → P(E) = a/(a + b). Odds against a : b → P(E) = b/(a + b)

Odds compare cases for and against; probability compares with the total.

EXAMPLE Odds against 5 : 3 → P(E) = **3/8**.

Rules

Addition rule

MOST USED

P(A or B) = P(A) + P(B) − P(A and B); mutually exclusive: P(A) + P(B)

Subtract the overlap so it is not counted twice.

EXAMPLE Red card or king: 26/52 + 4/52 − 2/52 = **7/13**.

Independent events

MOST USED

P(A and B) = P(A) × P(B); P(at least one) = 1 − P(neither)

“And” multiplies; “at least one” is easiest through “none”.

EXAMPLE A solves with 1/3, B with 1/4 → at least one: 1 − 2/3 × 3/4 = **1/2**.

Conditional probability

P(A | B) = P(A and B) ÷ P(B)

The given event B becomes the new sample space.

EXAMPLE Two children, at least one boy (BB, BG, GB) → both boys = **1/3**.

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Bayes' theorem

$$P(\text{Bag } i \mid \text{result}) = P(\text{Bag } i) \times P(\text{result} \mid \text{Bag } i) \div \Sigma\, P(\text{Bag } j) \times P(\text{result} \mid \text{Bag } j)$$

Work backwards from the result to its likely source.

EXAMPLE Worked in Example 9 (two bags, a red ball drawn) → **3/4**.

Counting and repeated trials

Drawing without replacement

MOST USED

$$P = (\text{ways to choose the wanted items}) \div (\text{ways to choose any items}) - \text{use } {}^{n}C_{r}$$

Without replacement the bag shrinks after each draw.

EXAMPLE 5 red, 4 blue; draw 2 → both red = ${}^{5}C_{2} / {}^{9}C_{2} = 10/36 =$ **5/18**.

Repeated trials (binomial)

$$P(\text{exactly } r \text{ successes in } n) = {}^{n}C_{r}\, p^{r}\, q^{n-r},\ q = 1 - p$$

Choose which trials succeed, then multiply the chances.

EXAMPLE A coin tossed 4 times → exactly 2 heads = ${}^{4}C_{2}/16 =$ **3/8**.

Expected value

$$E = \Sigma\,(\text{value} \times \text{its probability})$$

The long-run average result.

EXAMPLE A fair die: $(1 + 2 + \ldots + 6)/6 =$ **3.5**.

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3 Shortcut tricks & smart techniques

Each trick says when to use it – that matters as much as the trick

Two-dice sum table

MOST USED

USE WHEN Any question on the sum of two dice (36 outcomes).

Sum	2	3	4	5	6	7	8	9	10	11	12
Ways	1	2	3	4	5	6	5	4	3	2	1

EXAMPLE Sum 7 → 6/36 = **1/6**.

"At least one" through "none"

MOST USED

USE WHEN At least one head, one hit, one defective, one woman.

1. P(at least one) = 1 – P(none).
2. Much shorter than adding exactly 1, 2, 3 … cases.

EXAMPLE 3 coins → at least one head = 1 – 1/8 = **7/8**.

Card facts

USE WHEN Questions on a pack of 52 cards.

1. 4 suits × 13; 26 red (hearts, diamonds), 26 black (spades, clubs).
2. 12 face cards (J, Q, K); 4 aces, 4 of each rank.

EXAMPLE P(face card) = 12/52 = **3/13**.

Two people together

USE WHEN n people seated at random; two particular people side by side.

1. In a row: 2/n.
2. Round a table: 2/(n – 1).

EXAMPLE 6 people in a row → 2·5!/6! = **1/3**; round a table → 2/5.

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4 Solved examples

The full method on the left, the exam shortcut on the right

1 DICE

Two dice are thrown. What is the probability that the sum is a prime number?

STEP BY STEP

1. Prime sums: 2, 3, 5, 7, 11.
2. Ways: 1 + 2 + 4 + 6 + 2 = 15.
3. P = 15/36 = 5/12.

SHORTCUT

Read the ways from the sum table.

Why it works: Trap: counting 9 (not prime) or missing 2.

Answer: 5/12

2 CARDS

A card is drawn from a pack of 52. Find the probability that it is a heart or a face card.

STEP BY STEP

1. Hearts = 13; face cards = 12.
2. Face cards that are hearts = 3.
3. P = (13 + 12 − 3)/52 = 22/52 = 11/26.

SHORTCUT

A + B − overlap.

Why it works: Trap: 25/52 – the 3 heart face cards counted twice.

Answer: 11/26

3 BAG

A bag has 6 white and 4 black balls. Three are drawn at random. Find the probability that exactly two are white.

STEP BY STEP

1. Total ways = $^{10}C_3 = 120$.
2. Favourable = $^{6}C_2 \times {}^{4}C_1 = 15 \times 4 = 60$.
3. P = 60/120 = 1/2.

SHORTCUT

Choose 2 of the white, 1 of the black.

Why it works: Each colour is chosen separately, then multiplied.

Answer: 1/2

4 WITHOUT REPLACEMENT

A box of 10 bulbs has 3 defective ones. Two bulbs are taken out one after the other without replacement. Find the probability that both are defective.

STEP BY STEP

1. First defective: 3/10.
2. Second defective: 2/9.
3. P = 3/10 × 2/9 = 1/15.

SHORTCUT

$^{3}C_2/{}^{10}C_2 = 3/45$.

Why it works: Trap: 9/100 – treating the draws as with replacement.

Answer: 1/15

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5 INDEPENDENT

A hits a target 2 times in 3 and B hits it 3 times in 5. Both fire once. Find the probability that the target is hit.

STEP BY STEP

1. A misses: 1/3; B misses: 2/5.
2. Both miss: 1/3 × 2/5 = 2/15.
3. P(hit) = 1 − 2/15 = 13/15.

SHORTCUT

At least one hit = 1 − both miss.

Why it works: Trap: adding 2/3 + 3/5, which is more than 1.

Answer: 13/15

6 EXACTLY ONE

The chances of A and B solving a problem are 1/2 and 1/3. Find the probability that exactly one of them solves it.

STEP BY STEP

1. A solves, B fails: 1/2 × 2/3 = 1/3.
2. A fails, B solves: 1/2 × 1/3 = 1/6.
3. P = 1/3 + 1/6 = 1/2.

SHORTCUT

$p_1q_2 + q_1p_2$.

Why it works: The two cases cannot happen together, so they add.

Answer: 1/2

7 LETTERS

The letters of the word ORANGE are arranged at random. Find the probability that the vowels come together.

STEP BY STEP

1. Total arrangements = 6! = 720.
2. Vowels O, A, E as one block: 4! × 3! = 144.
3. P = 144/720 = 1/5.

SHORTCUT

4! × 3!/6! = 1/5.

Why it works: Trap: forgetting the 3! arrangements inside the block.

Answer: 1/5

8 CONDITIONAL

A die is rolled and shows an even number. What is the probability that it is greater than 3?

STEP BY STEP

1. Given: {2, 4, 6}.
2. Greater than 3 in it: {4, 6}.
3. P = 2/3.

SHORTCUT

The given event is the new sample space.

Why it works: Trap: 1/3 – using all six faces.

Answer: 2/3

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9 BAYES

Bag I has 3 red and 2 blue balls; Bag II has 1 red and 4 blue. A bag is chosen at random and a red ball is drawn. Find the probability that it came from Bag I.

STEP BY STEP

1. P(red from I) = 1/2 × 3/5 = 3/10.
2. P(red from II) = 1/2 × 1/5 = 1/10.
3. P(I | red) = 3/10 ÷ 4/10 = 3/4.

SHORTCUT

Red balls 3 : 1 (equal bag sizes) → 3/4.

Why it works: Bags equally likely and of equal size → ratio of red balls.

Answer: 3/4

10 REPEATED TRIALS

A fair coin is tossed 6 times. Find the probability of getting at least 5 heads.

STEP BY STEP

1. Exactly 5: ${}^6C_5 = 6$ ways.
2. Exactly 6: 1 way.
3. P = 7/64.

SHORTCUT

$({}^6C_5 + {}^6C_6)/2^6$.

Why it works: "At least 5" means 5 or 6.

Answer: 7/64

11 COMMITTEE

A committee of 3 is chosen from 4 men and 3 women. Find the probability that it has at least one woman.

STEP BY STEP

1. Total = ${}^7C_3 = 35$.
2. No woman = ${}^4C_3 = 4$.
3. P = 1 − 4/35 = 31/35.

SHORTCUT

1 − P(all men).

Why it works: The complement has only one case to count.

Answer: 31/35

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5 Important exam tips

Patterns, traps and habits that save marks

Frequently asked question patterns

- Sum of two dice; coins tossed together.
- Cards: suits, face cards, “or” questions.
- Balls drawn from a bag.
- Independent events: shooters and solvers.
- Conditional probability and Bayes.
- Letters of a word; people in a row.
- At least one / exactly r in n trials.

Common mistakes to avoid

- Counting the overlap twice in “A or B”.
- Adding where independent events multiply.
- Treating draws as with replacement.
- Forgetting arrangements inside a block.
- Using the full sample space in conditional questions.
- Getting an answer above 1 – always a sign of an error.

Points to remember

- P(not E) = 1 – P(E).
- Or → add, minus overlap.
- And (independent) → multiply.
- $P(A \mid B) = P(A \cap B)/P(B)$.
- ${}^{n}C_{r}\, p^{r}\, q^{n-r}$.

Speed and accuracy

- Learn the two-dice sum table.
- Use “1 – none” for “at least one”.
- Keep card facts at your fingertips.
- Cancel factorials before multiplying.

Preparation strategy

- Always write the sample space size first.
- Practise on LearnFrenzy in order: Easy → Medium → Hard → Exam Pattern Mix → Data Sufficiency.
- Aim for 45–60 seconds per question.
- Revise Permutations and Combinations alongside this topic.
- Read the Quick Revision Sheet (next page) the night before the exam.

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6 Quick revision sheet

Everything on one page for the night before the exam

Formulas

Probability	**favourable ÷ total**	Complement	**1 – P(E)**
Odds in favour a : b	**a/(a + b)**	A or B	**P(A) + P(B) – P(A ∩ B)**
A and B (independent)	**P(A) × P(B)**	At least one	**1 – P(none)**
Conditional	**P(A ∩ B) ÷ P(B)**	Bayes	**one path ÷ all paths**
Without replacement	**^nC_r ratios**	Binomial	**$^nC_r\, p^r\, q^{n-r}$**
Expected value	**Σ x · p**		

Shortcut tricks

- Dice sums: 1-2-3-4-5-6-5-4-3-2-1.
- At least one = 1 – none.
- Two together in a row: 2/n.
- Round a table: 2/(n – 1).
- Answer > 1 → recheck.
- Bayes with equal bags → ratio.

Must-know numbers

Sample spaces	1 coin 2 · 2 coins 4 · 3 coins 8 · 1 die 6 · 2 dice 36 · 3 dice 216 · cards 52
Cards	26 red · 26 black · 12 face · 4 aces · 13 per suit
Calendar	Leap year has 53 Sundays: 2/7 · ordinary year: 1/7

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7 A message from LearnFrenzy

For everyone preparing for placements, competitive and government exams

Keep going – you are closer than you think

Success in examinations is not just about how many hours you study. It is about how effectively you understand concepts, practise questions, and improve yourself every day.

Every formula you learn, every problem you solve, and every mistake you correct brings you one step closer to your goal.

Whether you are preparing for campus placements, competitive examinations, or government jobs, remember that consistency, confidence, and smart preparation make a real difference.

Don’t just memorize formulas. Understand the concepts, practise smart techniques, and develop the confidence to solve problems independently.

Your hard work today can create the opportunities you dream of tomorrow.

— Team LearnFrenzy

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