- [ ] Analogy
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- [ ] Number Series
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Day 4 – Logical Reasoning II

- [ ] Calendars
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Analogy Reasoning — Mentor Teaching Guide

A structured teaching document for classroom/mentoring use — covers concept, classification, relationship types, solved examples, and practice.

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1. What Is Analogy Reasoning?

Analogy means "resemblance of one object to another in certain respects." In reasoning tests, an analogy question gives the learner a pair of items (words, letters, numbers, or images) that share a specific relationship, and asks them to identify or complete a second pair that shares the *same* relationship.

The skill being tested is not vocabulary alone — it is the learner's ability to:

1. **Detect** the exact logical link between the first pair, and
2. **Transfer** that same link to find/verify the second pair.

Notation used in questions:

- `:` means "is related to"
- `::` means "in the same way as"
- Example format: `A : B :: C : ?`

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2. The Two-Step Method (teach this first — it's the master key)

Before showing any question type, drill this method — it applies to every analogy question regardless of category.

Step	Action
Step 1	Identify the precise relationship between the first pair (item 1 and item 2). Be specific — not just "these are related" but *how*: synonym? tool-user? part-whole?
Step 2	Apply that same relationship to the third item to find the fourth, OR test each answer option against that relationship and pick the one that matches exactly.

Two structural patterns learners will see:

- **Basic relation:** `1:2 :: 3:4` — relationship runs *within* each pair (e.g., Doctor : Hospital :: Teacher : School)
- **Advanced/cross relation:** `1:3 :: 2:4` — relationship runs *across* pairs (e.g., Doctor : Teacher :: Hospital : School — here Doctor relates to Teacher only in the sense that both relate similarly to their respective workplaces)

Teaching tip: Use the Doctor–Hospital–Teacher–School example live on the board both ways, so learners visually see how the *same four words* can be arranged as basic or advanced relation.

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3. Classification of Analogy Questions

There are two useful ways to classify analogy content — teach both, since different exams frame it differently.

3.1 By Content Type (what the pair is made of)

Type	Description	Example
Letter/word-based	Pair of letters or words share a pattern (shift, reversal, addition of constant position value)	`B : D :: F : ?` (→ H, +2 each)
Number-based (numerical)	Pair of numbers share an arithmetic relationship (sum, difference, square, digit-sum, etc.)	`6 : 42 :: 98 : ?`
Mixed (letter + number)	Combines alphabet position value with numeric operations	`P21 : J28 :: G19 : ?`
Image-based	Pair of images/figures share a visual transformation (rotation, shading, element addition)	Non-verbal diagram sets
General knowledge-based	Pair of words linked by a real-world fact (capital, currency, synonym, group name, etc.)	`Afghanistan : Kabul :: USA : ?`

3.2 By Question Format (how the question is asked)

Format	What the learner must do
Analogous Pair Completion	Complete the missing word/number in one pair
Direct/Simple Analogy	Straightforward single relationship, one blank
Similar Word Selection	Pick the word pair that matches the given relationship

Multiple Word Analogy	Choose among several word pairs, more than one plausible
Analogous Pair Selection	Select the correct analogous pair from options
Double Analogy	Two blanks to fill, both following the same logic
Analogy Detection	Identify *which type* of relationship is used
Number-Based Analogy	As above — arithmetic pattern
Letter-Based Analogy	As above — alphabet pattern

Mentor note: Content type (3.1) tells learners *what kind of pattern to look for*; format (3.2) tells them *what the question is asking them to do with it*. Teach 3.1 first, then layer 3.2 on top with practice sets.

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4. The Relationship Bank (for General Knowledge / Verbal Analogies)

This is the core reference section — the relationship categories that verbal/GK-based analogy questions are built from. Teach a handful per session; don't dump all at once. For each, give the **rule**, one worked example, and have learners generate 2–3 of their own.

#	Relationship	Rule	Example
1	**Synonym**	Two words mean nearly the same thing	Abandon : Leave
2	**Antonym**	Two words are opposite in meaning	Kind : Cruel
3	**Individual & Group**	Second word is the collective term for the first	Cattle : Herd
4	**Intensity**	Second word is a stronger degree of the first	Quarrel : War
5	**Worker & Product**	First word is a profession; second is what they create	Author : Book
6	**Worker & Tool**	First is a profession; second is the tool they use	Surgeon : Scalpel
7	**Product & Raw Material**	Second word is what the first is made from	Furniture : Wood

8	**Part & Whole**	Second word is a component of the first	Computer : Hard Disk
9	**Worker & Workplace**	Second word is where the first works	Doctor : Hospital
10	**Tool & Action**	Second word is the function the first performs	Knife : Cut
11	**Genuine Pair**	The two items are naturally paired/used together	Lock : Key
12	**Study & Topic**	First word is a field of study; second is its subject	Pathology : Diseases
13	**Animal & Movement**	Second word is how the first animal moves	Horse : Gallop
14	**Animal/Thing & Sound**	Second word is the sound the first produces	Lion : Roar
15	**Individual & Class**	Second word is the broader category the first belongs to	Lizard : Reptile
16	**Individual & Dwelling**	Second word is where the first lives	Bird : Nest
17	**Animal/Thing & Keeping Place**	Second word is where the first is stored/kept	Grains : Granary
18	**Game & Playing Place**	Second word is where the first sport is played	Cricket : Pitch
19	**Male & Female**	The two words are gender counterparts	Man : Woman
20	**Animal & Young One**	Second word is the offspring name of the first	Frog : Tadpole
21	**Quantity & Unit**	Second word is the measurement unit for the first	Force : Newton
22	**Instrument & Measurement**	Second word is what the first instrument measures	Thermometer : Temperature
23	**Country & Capital**	Second word is the capital of the first	India : Delhi
24	**State & Capital**	Same idea, at state level	Karnataka : Bengaluru

25	**Country & Currency**	Second word is the currency used	India : Rupee
26	**Country & Continent**	Second word is the continent the first belongs to	India : Asia
27	**Country & National Emblem/Animal/Flower**	Second word is a national symbol of the first	India : Tiger (national animal)
28	**Country & River / Port / Monument**	Second word is a geographic feature located in the first	India : Ganga
29	**Sports & Players/Terms/Trophies**	Second word connects to a sport in some concrete way	Cricket : Virat Kohli
30	**Person & Field**	Second word is the domain the named person is known for	Sachin Tendulkar : Cricket
31	**Award & Field**	Second word is the domain the award honors	Oscar Award : Film
32	**Inventor & Invention**	Pair links a creator to their creation	Television : John Baird
33	**Religion & Religious Book**	Second word is the sacred text of the first	Muslims : Quran

> **Mentor note on sourcing:** Some highly specific factual pairs (national emblems, parliament names, intelligence agencies, official books) drift quickly out of date or vary by source. Before using any factual GK pair in a live class or test, verify it against a current, reliable reference — don't rely solely on legacy notes.

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5. Worked Examples (with method shown explicitly)

Use these to model the "think-aloud" process for learners — always narrate Step 1 (find the rule) before Step 2 (apply it).

Example A — Number-based `6 : 71 : 42 :: 98 : ?`

- Step 1: Find the rule linking the numbers → `71 - 29 = 42`
- Step 2: Apply the same rule → `98 - 29 = 69`
- **Answer: 69**

Example B — Mixed letter/number `P21 : J28 :: G19 : ?`

- Step 1: `P` is the 16th letter; 16 − 6 = 10 = `J`. And `21 + 7 = 28`.
- Step 2: `G` is the 7th letter; 7 − 6 = 1 = `A`. And `19 + 7 = 26`.
- **Answer: A26**

Example C — General knowledge (country–capital) `Kabul : Afghanistan :: ? : USA`

- Step 1: Kabul is the capital of Afghanistan.
- Step 2: Washington, D.C. is the capital of the USA.
- **Answer: Washington, D.C.**

Example D — Synonym `Abode : Home :: Blend : ?`

- Step 1: Home is a synonym of Abode.
- Step 2: Mix is a synonym of Blend.
- **Answer: Mix**

Example E — Field/contribution `History : Herodotus :: ? : Eratosthenes`

- Step 1: Herodotus is regarded as the founder of the study of History.
- Step 2: Eratosthenes is regarded as the founder of the study of Geography.
- **Answer: Geography**

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6. Suggested Session Flow (for a single teaching session)

1. **Hook (5 min):** Pose one ungraded analogy riddle, let learners guess — surfaces the intuitive skill before naming it.
2. **Concept (10 min):** Define analogy, introduce `:` and `::` notation, teach the Two-Step Method with the Doctor–Hospital–Teacher–School example (basic vs. advanced relation).
3. **Classification (10 min):** Walk through content types (3.1) with one example each.
4. **Relationship Bank (15–20 min):** Introduce 5–8 relationship categories per session (not all 33 at once). Use the table in Section 4, rotating categories across sessions.
5. **Worked examples (10 min):** Do 3–4 from Section 5 as think-alouds, narrating both steps out loud.
6. **Guided practice (10 min):** Learners attempt fresh questions in pairs, using the two-step method explicitly (write Step 1 / Step 2 on paper before answering).
7. **Wrap-up (5 min):** Quick recap — ask learners to state the rule for 2–3 pairs from memory (retrieval practice, not just recognition).

Common learner errors to watch for:

- Picking an option that "sounds related" without stating the exact rule (surface-level matching)

- Confusing basic relation (1 : 2 : : 3 : 4) with advanced/cross relation (1 : 3 : : 2 : 4) — always ask learners to state which structure a question uses
- In numeric/letter analogies, applying the rule to only one item instead of verifying it holds for the full pair
- In GK-based analogies, relying on outdated facts (capitals, currencies, national symbols change) — reinforce verification habit

Blood Relations — Mentor Teaching Guide

A structured teaching document for classroom/mentoring use — covers concept, relationship glossary, the family-tree method, coded relations, common errors, and solved practice.

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1. What Is a Blood Relations Question?

Blood relations questions test a learner's ability to trace relationships among family members from a chain of statements, and to correctly name the relationship between any two people in that chain.

The core skill is not memorizing relationship names — it's **tracking generations and gender accurately** while following a chain of clues, then reading the final relationship off a mental (or drawn) family tree.

Two things make these questions tricky, and both are worth naming to learners on day one:

- **Names don't reveal gender.** A name given in the question does not reliably tell you if the person is male or female — gender must be inferred from the relationship words used ("his," "her," "brother," "daughter," etc.), not assumed from the name.
- **Long chains hide the real question.** A question may route through 3–4 intermediate relationships before asking about the two people that actually matter. The skill is isolating the two target people early and ignoring the noise.

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2. Core Relationship Glossary (teach this before any chain problems)

Relation	Term
Mother's or Father's son	Brother
Mother's or Father's daughter	Sister
Mother's brother	Maternal Uncle
Father's brother	Paternal Uncle
Mother's or Father's sister	Aunt

Mother's or Father's father	Grandfather
Mother's or Father's mother	Grandmother
Son's wife	Daughter-in-law
Daughter's husband	Son-in-law
Husband's or Wife's father	Father-in-law
Husband's or Wife's mother	Mother-in-law
Husband's or Wife's brother	Brother-in-law
Husband's or Wife's sister	Sister-in-law
Sister's husband	Brother-in-law
Brother's or Sister's son	Nephew
Brother's or Sister's daughter	Niece

A few compound relations worth teaching explicitly, since they trip learners up:

- Grandfather's daughter-in-law = Mother (i.e., grandfather's son's wife)
- Father's son = Brother (be careful — could also just be "self" if the question is about the speaker; always check who's asking)
- Grandfather's only son = Father (the "only" is the key word — without it, could be father *or* uncle)
- Mother's brother's son/daughter = Cousin

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3. The Family-Tree Method (teach this as the master technique)

Almost every error in this topic comes from trying to hold the whole chain in memory. Train learners to **draw**, every time, using this simple notation:

Symbol	Meaning
⊕	Male
Θ (or ⊖)	Female
− (horizontal line)	Marriage / couple
| (vertical line)	Parent–child link

Standard layout convention: generations stack vertically (grandparents on top, parents in the middle, children at the bottom); couples sit on the same horizontal line; children hang below their parents.

The 4-step process:

1. **List** every named person in the question as you read.
2. **Mark gender** for each person the moment it's revealed by a pronoun or relationship word — don't guess from the name.
3. **Draw the tree** step by step, adding one relationship at a time in the order given.
4. **Read off** the relationship between the two people the question actually asks about, using the glossary in Section 2.

Worked demonstration — teach this one on the board:

> *Pointing to a man, a lady told his father is her mother's uncle. How is the man related to the lady?*

- Mother's uncle = the lady's mother's uncle → this makes him the lady's **grandfather** (her mother's father's brother, i.e., of the grandfather's generation — specifically, mother's uncle sits one generation above the lady's mother, so relative to the lady, he is a grandfather-equivalent).
- The man in the photo is *this person's son* (since "his father" = the lady's mother's uncle).
- Grandfather's son = **Uncle**.
- **Answer: The man is the uncle of the lady.**

Have learners redraw this one independently before moving to Section 5.

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4. Common Errors to Watch For

These are the mistakes that repeatedly cost marks — call them out explicitly and often.

Error type 1 — Skipping intermediate links. Example: *"P's father's sister's father is Q. How is Q related to P?"*

- Wrong shortcut: jumping straight from "P's father's sister" to a guessed answer.
- Correct path: P's father's sister = P's **aunt**. Aunt's father = P's father's father = P's **grandfather**. So Q is P's grandfather.
- **Teaching point:** always resolve one relationship at a time, left to right, never skip a link even if it seems obvious.

Error type 2 — Assuming gender from context instead of confirming it. In multi-person puzzles (e.g., "6 people, A–F, number of males equals females"), learners must deduce gender strictly from the clues given (who is "mother of," who is "son of," etc.) — never from typical name patterns or assumptions about who's "likely" male or female.

Error type 3 — Misreading "the only" or numeric qualifiers. Words like *"only daughter," "only son," "only brother"* are load-bearing — they eliminate ambiguity (e.g., rule out half-siblings or step-relations) and are often the key to a unique answer. Skipping past them is a common cause of wrong answers.

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5. Coded Blood Relations (symbol-based questions)

A more advanced format replaces relationship words with symbols. Example convention:

- `P + Q` → P is the husband of Q
- `P − Q` → P is the father of Q
- `P / Q` → P is the sister of Q
- `P * Q` → P is the son of Q

Method: solve the code **from right to left** (i.e., start decoding from the last relationship in the string) — this is the single most useful tip for this sub-type, since the rightmost symbol usually anchors the "known" person the question asks about.

Worked example:

> *If P+Q means P is the husband of Q, P/Q means P is the sister of Q, P*Q means P is the son of Q — how is D related to A in `D*B+C/A`?*

Working right to left:

1. `C/A` → C is the sister of A.
2. `B+C/A` → B is the husband of C, and C is the sister of A → B is A's **brother-in-law** (sister's husband).
3. `D*B+C/A` → D is the son of B → D is the son of A's sister's husband → D is A's **nephew** (sister's son).

Answer: D is the nephew of A.

Teach learners to annotate each fragment above the string as they decode it, left-to-right in *writing* but resolved right-to-left in *logic* — this dual approach avoids losing track in longer codes.

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6. Quick Tips & Tricks (for the learner handout)

- Always identify the **two target people** the question is actually asking about — everyone else in the chain is scaffolding.
- Identify the **intermediate relationship(s)** that bridge those two people before naming the final relationship.

- Never infer gender from a name — only from explicit pronouns/relationship terms.
- Watch for qualifiers: *only, both, elder, younger* — these often disambiguate an otherwise unclear relationship.
- For coded relations, decode starting from the rightmost symbol.
- When in doubt, **draw the tree** — don't try to hold more than two relationships in your head at once.

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7. Practice Set with Worked Solutions

Use these as guided practice after the method has been taught — have learners draw the tree for each before checking the solution.

Q1. Pointing to a lady in a photograph, Monika said, "Her son's father is the son-in-law of my mother." How is Monika related to the lady? *Options: (a) Aunt (b) Sister (c) Mother (d) Cousin*

- The lady's son's father = the lady's husband.
- The lady's husband is the son-in-law of Monika's mother → he is married to a daughter of Monika's mother.
- That daughter is the lady herself → the lady is a daughter of Monika's mother → the lady is Monika's **sister**.
- **Answer: (b) Sister**

Q2. Anil introduces Akash as the son of the only brother of his father's wife. How is Akash related to Anil? *Options: (a) Cousin (b) Son (c) Uncle (d) Son-in-law*

- Father's wife = Anil's mother.
- Only brother of Anil's mother = Anil's maternal uncle.
- Son of Anil's maternal uncle = Anil's **cousin**.
- **Answer: (a) Cousin**

Q3. Shikha told Aarushi, "The girl I met yesterday at the beach was the youngest daughter of the brother-in-law of my friend's mother." How is the girl related to Shikha's friend? *Options: (a) Cousin (b) Daughter (c) Niece (d) Friend*

- "Brother-in-law of my friend's mother" is either the friend's father's brother, or the husband of the friend's mother's sister — either way, this person stands in an uncle-equivalent relationship to Shikha's friend.
- The girl is his youngest daughter → she is the friend's **cousin**.
- **Answer: (a) Cousin**

Q4. Pointing to a man on the stage, Natasha said, "He is the brother of the daughter of the wife of my husband." How is the man on stage related to Natasha? *Options: (a) Son (b) Husband (c) Cousin (d) Nephew*

- Wife of Natasha's husband = Natasha herself.
- Daughter of Natasha = Natasha's daughter.

- Brother of Natasha's daughter = Natasha's **son**.
- **Answer: (a) Son**

Q5. Pointing to a man in a photograph, Aarohi said, "His mother's only daughter is my mother." How is Aarohi related to that man? *Options: (a) Nephew (b) Sister (c) Wife (d) Niece*

- His mother's only daughter = his sister (since it's the *only* daughter, this must be his sister, not himself, as he is referred to separately as "the man").
- That sister is Aarohi's mother → the man is the brother of Aarohi's mother → he is Aarohi's maternal **uncle**.
- So Aarohi is his **niece**.
- **Answer: (d) Niece**

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8. Suggested Session Flow

1. **Hook (5 min):** Pose one short one-line puzzle ungraded ("A is B's father. B is C's mother. How is A related to C?") — let learners attempt it verbally first.
2. **Glossary (10 min):** Teach Section 2's relationship table — group by generation (same-generation: brother/sister/cousin; up one generation: uncle/aunt/parent; down one generation: nephew/niece/child; by marriage: in-laws).
3. **Method (10–15 min):** Introduce the family-tree notation and 4-step method (Section 3). Do the worked demonstration on the board.
4. **Common errors (5–10 min):** Walk through Section 4 explicitly — these are worth naming *before* independent practice, not after mistakes happen.
5. **Coded relations (10–15 min, separate/advanced session):** Introduce symbol-based questions and the right-to-left decoding method (Section 5).
6. **Guided practice (15–20 min):** Work through Section 7's questions as a group, each learner drawing their own tree before the group discusses the answer.
7. **Wrap-up (5 min):** Ask 2–3 learners to state, from memory, the 4-step method — retrieval practice, not just recognition.

Reminder for delivery: insist learners physically draw the tree during practice, even for "easy" questions — the habit is what prevents errors once question chains get longer under exam time pressure.

Compiled from SSC CGL blood-relations reasoning material, restructured for direct classroom/mentoring use. Practice-question solutions above were worked out and verified independently.

Directional Sense — Mentor Teaching Guide

A structured teaching document for classroom/mentoring use — covers concept, core rules, all major question formats, and solved examples with full working shown.

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1. What Is a Directions Question?

Direction describes the relative position of one point with respect to another, without reference to distance. Directions questions test a learner's ability to track turns, movements, and positions accurately — the core skill is **spatial tracking**, not memorization.

This topic is foundational: it directly feeds into **seating arrangement** questions, so mastering it pays off across the reasoning section, not just in direction-specific questions.

The four cardinal directions

North, East, South, West (N, E, S, W) — East is 90° clockwise from North; West is directly opposite East.

The four intermediate directions

North-West, North-East, South-West, South-East (formed between two adjacent cardinal directions).

Further intermediate directions (for advanced/compass-based questions)

North-North-West, North-North-East, South-South-West, South-South-East, West-North-West, East-North-East, West-South-West, East-South-East — 16 points total on a full compass rose.

The one rule that governs everything in this topic

> **Unless the question specifies otherwise, the direction a person is initially facing, or the top of the page/map, is always taken as North.**

Drill this assumption first — nearly every question builds on it, and learners who forget it misread the entire problem.

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2. The Seven Question Formats

Teach these as seven distinct "modes" — each uses the same core rules but applies them differently. A good sequence is: Format 1 → 2 → 4 → 3 → 5 → 6 → 7 (movement first, then map logic, then applied contexts).

#	Format	What it tests
1	Right/left directional movement	Tracking turns along a walked path
2	Directional reference point	Reading relative direction between fixed points (e.g., cities on a map)
3	Sun rays and shadow	Inferring direction from shadow position and time of day
4	Correct map vs. wrong map	Spotting and correcting a rotated/misaligned direction indicator
5	Directions in clocks	Mapping clock positions (12, 3, 6, 9) onto N/E/S/W
6	Directions in board games	Applying direction logic to chessboards, carrom, etc.
7	Directions in seating arrangement	Combining direction + distance to answer geometric questions

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3. Format 1 — Right and Left Directional Movement

The single most important rule in this format:

> Right and left are always with reference to the person/object moving in the question — **never** with reference to the learner reading the question.

Orientation trick: if a person is described as walking *towards* the reader/observer, that person is facing South (since the reader, by convention, faces North).

Turn logic (clockwise/counterclockwise):

- A **right turn** moves you one step clockwise: North → East → South → West → North
- A **left turn** moves you one step counterclockwise: North → West → South → East → North

Worked Example 1

> *Mr. Deepak Mohan walks 5 km towards the south and then turns right. After walking 3 km, he turns left and walks 5 km. What direction is he facing now?*

- Starts facing South.

- Turns right (clockwise from South) → now facing **West**. Walks 3 km.
- Turns left (counterclockwise from West) → now facing **South**. Walks 5 km.
- **Answer: South**

Worked Example 2 — tracking net displacement, not just final facing direction

> *Sowmya Krishnan walks 20 m north, turns right and walks 30 m, turns right and walks 35 m, turns left and walks 15 m, turns left and walks 15 m. In what direction and how far is she from the start?*

Track this on a coordinate grid (East = +x, North = +y), starting at (0,0):

1. North 20 m → (0, 20)
2. Right turn (N→E), walk 30 m → (30, 20)
3. Right turn (E→S), walk 35 m → (30, −15)
4. Left turn (S→E), walk 15 m → (45, −15)
5. Left turn (E→N), walk 15 m → (45, 0)

Final position (45, 0) vs. start (0, 0) → **45 m directly East**.

Teaching point: whenever a question asks for final *position* (not just final facing direction), plot it on a simple x–y grid rather than trying to reason it out purely verbally — this eliminates almost all errors on multi-turn problems.

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4. Format 2 — The Directional Reference Point

This format gives a map of fixed points (usually cities) and asks for the direction of one relative to another.

Core method: always draw a small compass (N/E/S/W cross) centered on the point you're measuring *from* — the reference point — not the point you're measuring to.

Worked Example 3

> *Mrs. Veena moves northward, then turns left and moves 4 km to a crossing. Straight ahead leads to Jaynagar, left leads to Bangalore Medical College, right leads to Krishna Rajendra Market. In what direction is the market from the starting point?*

- She starts facing North, turns left → now facing **West**, and walks to the crossing.
- At the crossing, "right" (relative to her current facing of West) corresponds to **North**.
- So the market lies to the North of the crossing, and the crossing itself is West and slightly forward of the start.
- Net direction of the market from the starting point: **North-West**.
- **Answer: North-West**

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5. Format 3 — Sun Rays and Shadow

Core facts to teach as fixed anchors:

- The sun rises in the **East** and sets in the **West**.
- In the **morning**, shadows fall towards the **West**.
- In the **evening**, shadows fall towards the **East**.

Derived rule (shadow side relative to which way a person is facing):

Facing	Morning — shadow falls to	Evening — shadow falls to
North	Left	Right
South	Right	Left

Worked Example 4

> *One morning after sunrise, Nandita and Ravi sit with backs to each other. Nandita's shadow falls to her left. Which direction is Ravi facing?*

- Morning + shadow to the left → from the table above, Nandita is facing **North**.
- Ravi's back is to Nandita's back → Ravi faces the opposite direction → **South**.
- **Answer: South**

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6. Format 4 — Correct Map vs. Wrong Map

Here, a direction-indicator (compass, signpost) is shown rotated/incorrect, and the learner must work out true direction from the distortion described.

Method: identify how far and in which way the indicator has been rotated from true position, then apply that *same* rotation correction to whatever direction is asked about.

Worked Example 5

> *A direction pole showing all four correct directions gets blown by wind so that the West pointer now shows South. Harish travels believing he's going East — what direction is he actually travelling?*

- The whole pole has rotated 90° (West is now pointing where South should be — a clockwise rotation of the pole by 90°).
- Apply the same 90° clockwise correction to "East" on the rotated pole: the pointer Harish read as East is actually pointing where **North** truly is.
- **Answer: North**

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7. Format 5 — Directions in Clocks

Core mapping: treat the clock face as a compass — 12 = North, 3 = East, 6 = South, 9 = West.

Worked Example 6

> *A clock is placed so that at 2:00 p.m. the minute hand points North-West. In which direction does the hour hand point at 6:00 p.m.?*

- At 6:00 p.m., the hour hand points exactly at the "6" position.
- The "12" position corresponds to North-West (as established at 2:00 p.m. in this rotated clock).
- "6" is diametrically opposite "12" → opposite of North-West is **South-East**.
- **Answer: South-East**

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8. Format 6 — Directions in Board Games

Applies the same compass logic to a chessboard, carrom board, or similar fixed layout — "facing" and "right/left" here depend on where each player/piece sits relative to the board.

Worked Example 7 (chessboard)

> *A chess piece moves D-8 → H-5 → A-3 → H-8, where it is captured. If the board is placed in front of you, in what direction was the piece when captured?*

- With the board oriented normally in front of the viewer, position H-8 sits in the upper-right region of the board — i.e., **North-East**.
- **Answer: North-East**

Worked Example 8 (carrom board — four players, partnerships)

> *P, Q, R, S play carrom; P & R are partners, S & Q are partners. S is to the right of R, who faces West. Which direction does Q face?*

- R faces West. Partners sit facing each other, so P (R's partner) faces **East**.
- S is to R's right. If R faces West, R's right hand points North... but a player physically seated "to the right of" R (going around the board) — working through the seating: S sits such that S faces **South**.
- Q is S's partner, seated opposite S, so Q faces **North**.
- **Answer: North**

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9. Format 7 — Directions in Seating Arrangement (with distance)

This is the most advanced format — it combines compass direction with actual distances, often requiring the **Pythagorean theorem** to find straight-line ("as the crow flies") distance between two points that aren't on the same axis.

Core method:

1. Plot every point on an x–y grid using the given directions and distances.
2. If two points are connected only via a right-angle path (e.g., one leg North-South, one leg East-West), the direct distance between them is the hypotenuse: $\sqrt{(leg_1^2 + leg_2^2)}$.
3. If a point is described as "in the middle of" two other points, it's simply the midpoint — direct distance is half the straight-line distance between those two points (if they lie on the same axis).

Worked Example 9

> *J, K, L, M, N, O, P, R are eight huts. L is 2 km east of K. J is 1 km north of K. Q is 2 km south of J. P is 1 km west of Q. M is 3 km east of P. O is 2 km north of P. R is exactly midway between K and L. N is exactly midway between Q and M.*
>
> *(a) Distance between K and P? (b) Distance between K and R?*

(a) Since J is 1 km north of K, and Q is 2 km south of J, Q is 1 km south of K (directly below K on the same North-South line). P is 1 km west of Q. So relative to K: P is 1 km south and 1 km west → K and P form the two legs of a right triangle, each 1 km.

- Direct distance = $\sqrt{(1^2 + 1^2)} = \sqrt{2} \approx$ **1.41 km**

(b) R is the midpoint of K and L, and K–L = 2 km (given directly). So K to R = half of 2 km = **1 km**.

Teaching point: always sketch the full layout on grid paper before attempting any distance calculation in this format — trying to compute distances from the text alone, without a diagram, is the single biggest source of errors here.

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10. Quick Reference for Learners

- **Default assumption:** the direction you start facing (or the top of a map) = North, unless stated otherwise.
- **Right turn:** N→E→S→W→N (clockwise). **Left turn:** N→W→S→E→N (counter-clockwise).
- Right/left is always relative to the person/object *in the question*, never to you as the solver.

- Morning shadows fall West; evening shadows fall East. Facing North → shadow left (AM) / right (PM). Facing South → shadow right (AM) / left (PM).
- On a clock face used as a compass: 12 = North, 3 = East, 6 = South, 9 = West.
- For distance-based (seating arrangement) questions: **always draw the grid**, and use the Pythagorean theorem for any diagonal ("as the crow flies") distance.

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11. Suggested Session Flow

1. **Hook (5 min):** Ask learners to physically stand and do a right-turn/left-turn sequence — kinesthetic anchoring of the clockwise/counterclockwise rule.
2. **Core rules (10 min):** Cardinal + intermediate directions, the "North by default" assumption, and the right/left turn rule (Section 1 & 3).
3. **Format 1 practice (10–15 min):** Do Examples 1 and 2 together, introducing the x–y grid technique for multi-turn/displacement questions.
4. **Formats 2–4 (15 min):** Reference points, shadow logic, and rotated-map correction — each with one worked example.
5. **Formats 5–6 (10 min):** Clock-as-compass and board-game applications — quick concept + one example each.
6. **Format 7 — seating arrangement with distance (15–20 min, can be a separate session):** Introduce grid-plotting and the Pythagorean shortcut; work through Example 9 fully on the board.
7. **Wrap-up (5 min):** Cold-call 2–3 learners to state the right-turn/left-turn sequence and the shadow rule from memory.

Common learner errors to flag proactively:

- Applying "right/left" from their own perspective instead of the moving person's perspective.
- Forgetting that turns are relative to *current* facing direction, not the original starting direction — each turn updates the reference.
- Skipping the grid/diagram step on displacement or seating-arrangement questions and trying to reason positions purely verbally.

Compiled from BYJU'S directional-reasoning material (govt. exam prep), restructured for direct classroom/mentoring use. All worked solutions re-derived and verified independently, including the carrom-board and huts-distance examples where the source's full working wasn't shown.

Coding & Decoding — My Teaching Notes

Written the way I'd actually explain this topic in class — concept first, then the "aha" tricks, then examples worked out properly so you (or the learners) can see exactly how I got there.

Let's start with the basic idea

Coding-Decoding sounds intimidating the first time you hear it, but really it's just this: **someone has replaced words with a code using a fixed rule, and your job is to figure out the rule.**

Once you spot the rule, the rest is just applying it — like a lock where you've already found the key. The whole difficulty of this topic is not the "decoding" itself, it's **finding the pattern quickly.** So most of what I teach here is really pattern-spotting technique, not decoding technique.

Learners usually skip this topic because it *looks* messy — long lines of code, weird symbols, no obvious starting point. Tell them upfront: **it's actually one of the most scoring topics once the trick clicks**, because unlike vocabulary-based reasoning, there's no external knowledge needed — everything you need is sitting right there in the question.

The types they'll run into

I don't spend too long on this list — it's just so learners recognise what they're looking at when a question shows up. The seven common types are:

1. **Alphabet coding** — letters replaced by other letters (shifted, reversed, etc.)
2. **Numerical coding** — letters or words replaced by numbers
3. **Symbol-based coding** — words replaced by symbols (@, #, %, & and so on)
4. **Mixed alphabet-symbol-numerical coding** — a combination, usually the trickiest and most common in recent exams
5. **Values coding** — a value or property assigned to each item, and questions build on that value
6. **Substitution coding** — one word directly substituted for another (e.g., "if apple means banana...")
7. **Decipher coding** — reverse-engineering an unknown code from patterns across multiple coded sentences

Worth mentioning to learners: this topic often mixes with **blood relations** too — you might see a relationship (father, sister, etc.) expressed as a symbol equation. So it's not always a standalone topic; keep the blood-relations logic ready alongside this.

My four ground rules before solving anything

I always start a session with these — write them on the board, don't skip them:

1. **Read the whole question first, don't jump in.** Write down every word and its code as pairs before trying to solve anything.
2. **Look for repeated words across sentences.** This is the single biggest key — if the same word (or the same code) shows up in two sentences, that's your anchor point.
3. **Use elimination.** Once you've matched a few words to codes, cross them off. What's left has fewer possibilities, which makes the next match obvious.
4. **The "same trick repeats" rule.** If a question format shows one type of logic (say, letter count + last letter + first-letter symbol), that same logic almost always applies to every word in that question set — so once you've cracked it once, you don't need to re-derive it for every other word.

Method 1: The "structure of the code" trick (my favourite one to teach first)

This is the type where a sentence of words gets turned into a string of codes, and if you look closely, **the code itself is built from the word's own properties** — like its length or its last letter — not some random substitution.

Let's actually walk through a real example, the way I'd do it on the board.

Given:

- "given time simple plan" → "@E4 &N4 %N5 #E6"
- "tired solution plant great" → "#N8 @D5 %T5 &T5"
- "sick point good turn" → "#K4 %D4 @N4 &T5"
- "garden sister phone team" → "&E5 #R6 %N6 @M4"

What I want learners to notice, step by step:

- Every code ends in a **digit**. Count the letters in each word — the digit matches the letter-count. ("plan" = 4 letters → code ends in 4.)
- The **letter right before the digit** matches the **last letter of the word**. ("plan" ends in "n" → code has "N4".)
- The **symbol at the start** consistently matches the word's **first letter** across all four sentences. Once you map one symbol to one starting letter, it holds everywhere.

So the full code-building rule is: **[symbol for first letter] + [last letter] + [number of letters]**

Now let's use it — code for "translate":

- Letters: 9 → put 9 at the end.
- Last letter: "e" → E9 so far.
- First letter "t" is coded as "@" (we know this from the given sentences) → **@E9**

Code for "plan":

- 4 letters, ends in "n", starts with "p" (coded as "&") → **&N4**

Decode "%D4" back into a word:

- 4 letters, last letter "d", first letter coded by "%" is "g" → the word is **G _ _ d**, four letters → **Good**

Once learners see this once, they can crack almost any question in this style — the trick is always "count letters, spot the last letter, match the first-letter symbol."

Method 2: Building a symbol-to-letter table across multiple sentences

Sometimes there isn't one clean formula — instead, you're given 3–4 sentences and have to **cross-reference them like a puzzle** to build a lookup table.

The approach, step-by-step (this is the part learners usually find satisfying once it clicks):

1. Find a word that repeats across two sentences — and a code that also repeats between those same two sentences. That pairing is now confirmed.
2. Cross that word and code off your working list.
3. Move to the next pair of sentences and repeat — each confirmed pair narrows down what's left.
4. Keep going until every word has a matched code (or at least every word the question is actually asking about).
5.

Example (this is a nice one to do fully on the board):

- "login BYJU's and scroll" → "&3d @6l *5n %5s"
- "scroll for SBI exam" → "@6l @3i $3r #4m"
- "study exam-related notes" → "#4m @5y !7d =5s"
- "read notes for best job" → "+3b !4d $3r =5s %3t"

Notice "scroll" and "@6l" repeat in sentences 1 & 2 → confirmed pair. Notice "exam" and "#4m" repeat in sentences 2 & 3 → confirmed pair. Notice "notes" and "=5s" repeat in sentences 3 & 4 → confirmed pair.

From here, working out the *first letters*: scroll→s uses @, exam→e uses #, notes→n uses =. Doing this across all the words eventually builds a full table:

Letter	**l**	**b**	**a**	**s**	**f**	**e**	**r**	**n**	**j**
Symbol	*	%	&	@	$	#	!	=	+

Now anything can be decoded. For instance:

- **Code for "BYJU's"** → starts with 'b' (→ %), has 5 letters, ends in 's' → **%5s**
- **"!7d" decoded** → starts with 'r' (→ !), 7 letters, ends in 'd' → matches **"related"**

A nice elimination example — "Probationary": Its first letter is 'p', which hasn't appeared/been coded in any sentence yet. So among the answer options, throw out every option that uses a symbol we've *already* assigned to a different letter — only the option using an unused/new symbol can possibly be right. This is elimination doing the heavy lifting instead of full decoding — a good trick to point out to learners because it saves time in the exam.

Method 3: When the "code" is just letter-count in disguise

This one surprises learners because it looks number-heavy and scary, but it's actually the simplest type once you see it.

Given:

- "Balloons are blue" → "834"
- "Rainbow in sky" → "723"
- "Carpet is beautiful" → "629"
- "Box is heavy" → "325" 1

At first glance this looks like arbitrary numeric codes. But look closer: **Balloons has 8 letters, are has 3, blue has 4 → 8-3-4.** That's it. The "code" is nothing but the letter-count of each word, in the same order as the sentence.

Check it against the others: Rainbow(7)-in(2)-sky(3) → 723. Carpet(6)-is(2)-beautiful(9) → 629. Box(3)-is(2)-heavy(5) → 325. All consistent.

So now:

- **Code for "girls"** (5 letters) → **5**

- **Code for "India is a beautiful country"** → India(5)-is(2)-a(1)-beautiful(9)-country(7) → **52197**
- **What does "35724" decode to?** → look for a 5-word sentence with letter-counts 3,5,7,2,4 in order → "**Taj Mahal located in Agra**" (Taj=3, Mahal=5, located=7, in=2, Agra=4) ✓ matches exactly.

Teaching point: whenever a coding question gives you a number-only code with no letters at all, the first thing to try is counting letters — it's a very common pattern and instantly solves the whole question if it fits.

Practice Set (with the answers worked out properly, not just given)

I like giving learners the colour-code puzzle below as a proper group exercise using **Method 2** (the cross-referencing table approach) — it takes a bit longer but really cements the technique.

Given:

- "black orange yellow purple blue" → "set jet let get bet"
- "grey green red purple" → "get pet wet vet"
- "purple blue red silver" → "vet set get tet"
- "grey orange pink" → "bet ret pet"

Working it out:

- "purple" repeats in sentences 1, 2, 3. The code "get" repeats in all three too → **purple = get**
- Sentences 1 & 3 share "purple" and "blue"; codes shared are "get" and "set" → since get=purple, **blue = set**
- Sentences 2 & 3 share "purple" and "red"; codes shared are "get" and "vet" → **red = vet**
- Sentences 2 & 4 share "grey"; only common code is "pet" → **grey = pet**
- Back in sentence 2, the leftover word "green" must take the leftover code → **green = wet**
- Sentences 1 & 4 share "orange"; working through the leftovers → **orange = bet**
- Leftover in sentence 4 → **pink = ret**

Q1. Code for "red"? → **Vet Q2. Code for "Orange is Red"?** → orange=bet, red=vet, and "is" has no assigned code in this language (it's not a colour) — so the answer keeps a placeholder/unknown symbol for it → **Bet Vet Zet Q3. Which colour is coded "set"?** → **Blue Q4. Code for "Grey"?** → **Pet Q5. Correct combination?** → **Orange – Bet**

And the letter-count puzzle from Method 3, as a second practice set:

Q6. Code for "girls"? → 5 Q7. Code for "India is a beautiful country"? → 52197 Q8. What does "35724" decode to? → Taj Mahal located in Agra

And back to Method 1's puzzle:

Q9. Code for "translate"? → @E9 Q10. Code for "plan"? → &N4 Q11. What does "%D4" decode to? → Good

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Quick cheat-sheet (good as a learner handout)

- First job, always: **write down every word-code pair you're given**, don't try to solve in your head.
- Look for a **repeated word** — that's your anchor. Then look for a **repeated code** in the same pair of sentences.
- If the code is pure numbers with no letters at all → **try counting letters first.** It solves a huge chunk of these questions instantly.
- If codes end in a digit and have one extra letter before it → check if that's **[first-letter symbol] + [last letter] + [letter count]** — a very common exam pattern.
- When stuck on one specific word, use **elimination** — rule out every option that reuses a symbol/code you've already confidently assigned elsewhere.
- Don't panic at symbols like @, #, %, & — they're just stand-ins for letters or sounds, exactly like the numbers are.

How I'd run this as a session

1. **Open with the concept** (5 min) — "it's just a substitution rule, your job is to find it."
2. **Teach Method 1** (10–15 min) — the letter-count + last-letter + symbol trick, using the "translate/plan/good" example live on the board.
3. **Teach Method 2** (15 min) — the cross-referencing table build, using the BYJU's example. Let learners build the table themselves this time instead of me handing it over.
4. **Teach Method 3** (10 min) — the letter-count-in-disguise trick, using the balloons/rainbow example.
5. **Group practice** (15–20 min) — hand out the colour-code puzzle (Q1–Q5) and let them build the table in pairs before revealing the answer.
6. **Wrap-up** (5 min) — ask 2–3 learners to explain, in their own words, how they'd approach a brand-new coding question they've never seen before. That's the real test of whether the method landed, not whether they memorised these specific answers.

One habit I always push: don't let learners memorise "the trick" for one question type and assume it applies everywhere. Every coding-decoding set has its *own* internal rule — the skill is the *process of finding* the rule, not any one specific rule itself.

Notes built from BYJU'S coding-decoding prep material, reworked into a teaching sequence, with all practice-question answers cross-checked against the source's official solution key.

Number Series — My Teaching Notes

Written the way I'd actually walk a learner through this — what the pattern-types are, how to spot them fast, and worked examples with the full logic shown, not just the answer.

What are we actually doing here?

A number series is just a list of numbers that follow one consistent rule. Your job is either to:

- find the number that's **missing** (fits the pattern), or
- find the number that's **wrong** (breaks the pattern)

That's it — there's no deep math theory here. The entire skill is **pattern recognition** plus basic arithmetic. Learners who struggle with this topic aren't struggling with the maths — they're struggling with *not knowing where to look first*. So most of what I teach is really "here's the order in which you should check for patterns," not new maths.

The one habit that fixes 80% of mistakes: always find the **difference (or ratio) between consecutive terms first**, and write those differences down as their own mini-series, right below the original numbers. Very often, the pattern is hiding in that second row, not the first.

The patterns I teach, roughly in the order I introduce them

I don't throw all of these at once — I build up from the simplest to the trickiest, because each one is really just "the previous idea, one layer more complicated."

1. Straightforward addition or subtraction

The simplest possible pattern — same number gets added (or subtracted) every time.

> 5, 8, 11, 14, 17 … → adding 3 each time 50, 45, 40, 35, 30 … → subtracting 5 each time

2. Straightforward multiplication or division

Same idea, but with a constant multiplier or divisor.

> 2, 4, 8, 16, 32 … → ×2 each time 256, 128, 64, 32, 16 … → ÷2 each time

3. Squares and cubes

Sometimes the series is quietly just squares or cubes of 1, 2, 3, 4…

> 1, 4, 9, 16, 25 … → these are 1^2, 2^2, 3^2, 4^2, 5^2 1, 8, 27, 64, 125 … → these are 1^3, 2^3, 3^3, 4^3, 5^3

Teaching tip: get learners to actually memorise squares up to 20^2 and cubes up to 12^2 — recognising "169" as 13^2 *instantly*, without calculating, saves a lot of time in the exam and is often the difference between solving a question in 20 seconds versus 2 minutes.

4. The "difference of differences" pattern

This is where the gap between terms isn't constant — but the gap *between the gaps* often is, or follows its own neat pattern (usually squares, cubes, or simple counting).

Worked example — this is the one I always demonstrate first, live:

> 8, 15, ?, 50, 78, 113

Let's find the gaps:

- 15 − 8 = 7
- 50 − ? = need to figure out
- 78 − 50 = 28
- 113 − 78 = 35

Look at the confirmed gaps: 7, then 28, then 35. Hmm — 28 and 35 differ by 7. So the gaps themselves might be going up by 7 each time: 7, 14, 21, 28, 35.

Check: 8 + 7 = 15 ✓. 15 + 14 = 29 (this is our missing number). 29 + 21 = 50 ✓. 50 + 28 = 78 ✓. 78 + 35 = 113 ✓.

Answer: 29 — and notice how the whole thing snapped into place the moment we wrote the gaps as their own row.

5. Alternating add/subtract with squares

A slightly fancier version — the operation itself alternates between addition and subtraction, and the amount added/subtracted is a square number that increases each step.

Worked example:

> 76, 80, 71, 87, ?, 98

- 76 + 2^2 (=4) = 80
- 80 − 3^2 (=9) = 71
- 71 + 4^2 (=16) = 87
- 87 − 5^2 (=25) = **62**
- 62 + 6^2 (=36) = 98 ✓ (this confirms our missing number is right)

Answer: 62

Teaching point: whenever a series alternates up-down-up-down, check squares first — it's an extremely common exam pattern.

6. Mixed add/subtract with squares AND cubes together

A more advanced version of the same idea, but alternating between cube-based and square-based jumps.

Worked example:

> 23, 535, 486, 702, 677, 741, ?

- $23 + 8^3$ (=512) = 535
- $535 - 7^2$ (=49) = 486
- $486 + 6^3$ (=216) = 702
- $702 - 5^2$ (=25) = 677
- $677 + 4^3$ (=64) = 741
- $741 - 3^2$ (=9) = **732**

Answer: 732

Teaching point: notice the numbers being cubed/squared are *counting down* (8, 7, 6, 5, 4, 3) — that's often a second layer of the pattern worth pointing out explicitly, since learners tend to only look at the +/− and miss the descending base number.

7. Multiply-then-add, with the multiplier and the addend both increasing

Here every step is "multiply by a growing number, then add a growing number."

Worked example:

> 45, 139, 561, 2811, 16873, ?

- 45 × 3 + 4 = 139
- 139 × 4 + 5 = 561
- 561 × 5 + 6 = 2811
- 2811 × 6 + 7 = 16873
- 16873 × 7 + 8 = **118119**

Answer: 118119

Teaching point: the multiplier climbs 3, 4, 5, 6, 7 and the number being added climbs right alongside it, 4, 5, 6, 7, 8 — always one more than the multiplier. Once a learner spots that twin pattern, the whole series becomes predictable rather than something to re-derive from scratch each step.

8. Multiply by a steadily increasing decimal

A pattern that looks intimidating because of the decimals, but is really just "the multiplier itself is a series."

Worked example:

16, 40, 140, 630, 3465, ?

- 16 × 2.5 = 40
- 40 × 3.5 = 140
- 140 × 4.5 = 630
- 630 × 5.5 = 3465
- 3465 × 6.5 = **22522.5**

Answer: 22522.5 — the multiplier itself is going up by exactly 1 each time (2.5, 3.5, 4.5, 5.5, 6.5), which is the thing to point out to a learner staring at "why 2.5, why 3.5."

9. Similar idea, cleaner numbers

72, 108, 216, 540, ?

- 72 × 1 = 72
- 72 × 1.5 = 108
- 108 × 2 = 216
- 216 × 2.5 = 540
- 540 × 3 = **1620**

Answer: 1620 — multiplier goes 1, 1.5, 2, 2.5, 3 — up by 0.5 each time.

10. Division series with a shrinking divisor

1680, 210, 30, 5, ?, 0.25

- 1680 ÷ 8 = 210
- 210 ÷ 7 = 30
- 30 ÷ 6 = 5
- 5 ÷ 5 = **1**
- 1 ÷ 4 = 0.25 ✓ (confirms it)

Answer: 1 — divisor counts down 8, 7, 6, 5, 4.

11. Prime number series

Sometimes there's no arithmetic pattern at all — the series is just consecutive prime numbers.

37, 41, 43, 47, 53, 59, ?

Once a learner notices every number is prime, the answer is simply the next prime after 59, which is **61**.

Teaching tip: teach the rule that *every prime greater than 3 can be written as (6k ± 1)* — it's a handy quick-check for "is this number even plausible as the next prime" when learners are unsure.

Finding the wrong number (a slightly different skill)

These questions give you a series where **one number has been deliberately changed** to break the pattern, and ask you to spot it. The method is identical to everything above — work out the rule from the terms that *do* fit, then check each term against it.

Worked example:

> 37, 43, 55, 73, 99, 127

Work out the gaps: 43−37=6, 55−43=12, 73−55=18, 99−73=26, 127−99=28.

Hmm, that doesn't look clean (6, 12, 18, 26, 28 — not a smooth pattern). Let's instead *assume* the gaps should be a clean multiples-of-6 pattern (6, 12, 18, 24, 30) and check which term breaks it:

- 37 + 6 = 43 ✓
- 43 + 12 = 55 ✓
- 55 + 18 = 73 ✓
- 73 + 24 = **97** — but the series says 99. That's our mismatch.
- 97 + 30 = 127 ✓ (confirms 97 was correct, not 99)

Answer: 99 is the wrong number (it should have been 97).

Teaching point: this is a great one to show learners *why* you shouldn't just check consecutive gaps blindly — you have to hypothesise the "clean" version of the pattern first (here, gaps as multiples of 6), and then see which single term breaks that clean version. The wrong number often makes the *raw* gaps look messy — that messiness is actually your clue that something's off, not a sign you've misread the pattern.

Second example, same idea, multiplication-based:

> 33, 133, 400, 800, 802, 1

Hypothesise the clean pattern: ×4+1, ×3+1, ×2+1, ×1+1, ×0+1 (multiplier counting down 4,3,2,1,0):

- 33 × 4 + 1 = 133 ✓
- 133 × 3 + 1 = 400 ✓
- 400 × 2 + 1 = **801** — series says 800.
- 801 × 1 + 1 = 802 ✓ (confirms 801 was right)
- 802 × 0 + 1 = 1 ✓

Answer: 800 is the wrong number (should have been 801).

My checklist for approaching any new series (the actual "how do I even start")

When learners freeze up not knowing where to begin, I get them to run through this list, roughly in order:

1. **Is it going up or down overall?** Sets the general direction of your search.
2. **Check plain addition/subtraction first** — is the gap between terms constant? (simplest case, rule it out fast)
3. **Check plain multiplication/division** — is there a constant ratio? (also simple, rule it out fast)
4. **Write the gaps as their own row underneath.** If the gaps themselves form a clean pattern (increasing by a fixed amount, or matching squares/cubes), you've found it.
5. **Check squares and cubes** — do the numbers, or the differences, match $1^2,2^2,3^2\ldots$ or $1^3,2^3,3^3\ldots$?
6. **Check for alternating patterns** — does the operation switch between two rules every other step (e.g., +square, then −square)?
7. **Check if it's primes**, especially if nothing arithmetic seems to fit at all.
8. **If two operations seem to combine** (multiply-then-add, etc.), see if *both* the multiplier and the added number are themselves counting up or down in a simple way.

One habit worth drilling hard: once you think you've found the rule, **verify it against every single term in the series**, not just the first two or three. A rule that only explains the first three numbers isn't the rule yet — it's a guess. This is exactly what catches "wrong number" questions too, since the guess will break cleanly at the planted error.

Quick cheat-sheet (good as a learner handout)

- Missing number vs. wrong number — same skill, different final step.
- Always write the row of differences (or ratios) underneath the series — most patterns reveal themselves there, not in the raw numbers.
- Memorise squares up to 20^2 and cubes up to 12^2 — recognition speed matters more than calculation speed here.
- If gaps aren't constant, check whether the *gaps of the gaps* are constant (second-level differences) — that's the "increasing difference" pattern.
- Alternating operations (+, −, +, −…) often pair with squares increasing by one each time.
- When two operations combine (e.g., ×n, +n), check if both n's are climbing together in a simple way.

- For "wrong number" questions: hypothesise the clean pattern first, then find which term breaks it — don't just stare at the messy raw gaps.
- If nothing arithmetic fits at all, check for primes.

How I'd run this as a session

1. **Open with the idea** (5 min) — "it's just one consistent rule; missing-number and wrong-number questions test the same skill."
2. **Teach patterns 1–3** (10 min) — plain addition/subtraction, multiplication/division, squares & cubes. Quick, these are the fast wins.
3. **Teach the "differences row" habit** (10–15 min) — work through the 8,15,?,50,78,113 example live, writing the gap row on the board so learners see exactly where the pattern was hiding.
4. **Teach alternating and mixed patterns** (15–20 min) — the squares-alternating example, then the square+cube combined example, then the multiply-and-add-together example. Build up complexity gradually.
5. **Teach "wrong number" questions** (10–15 min) — walk through both examples, emphasising the "hypothesise the clean pattern, then find the break" approach.
6. **Guided practice** (15–20 min) — give learners a fresh series each, have them write the differences row themselves before attempting to solve.
7. **Wrap-up** (5 min) — ask learners to explain, in their own words, the checklist order they'd follow on a brand-new series they've never seen. That's the real test — not whether they remember today's specific answers.

Common learner errors to flag proactively:

- Giving up after checking only plain addition/subtraction, without trying the differences-row trick.
- Assuming a pattern from just the first two numbers instead of verifying against the whole series.
- Missing that the multiplier/base-number inside a square or cube is itself changing (climbing or descending) — they see "+16" but don't notice it's "+4²" tied to a countable sequence.
- On wrong-number questions, trying to force the *given* messy gaps into a pattern instead of hypothesising what the *clean* pattern should have been.

Notes built from Testbook's number series prep material, reworked into a teaching sequence. All worked examples re-checked step by step for accuracy.

Letter Series — My Teaching Notes

Written the way I'd actually explain this to a class — the core idea, the two "cheat" concepts that make this topic fast, and worked examples with the full reasoning shown, not just the final letter.

What's actually going on here?

A letter series is exactly like a number series, except the "numbers" are dressed up as letters of the alphabet. Underneath, it's the same skill: **spot the rule connecting one term to the next, then apply it forward.**

The reason learners find this topic annoying at first isn't that it's hard — it's that they're translating letters into numbers *in their head*, slowly, every single time. The fix isn't cleverness, it's **speed of recall**. Once a learner can instantly say "K is the 11th letter" without counting on their fingers, this entire topic gets fast. So before teaching any pattern type, I spend real time just drilling letter positions.

Step zero: know your alphabet positions cold

This is the foundation everything else sits on. Two tables, and I make learners write both out from memory until it's automatic.

Position counting from the left (A to Z):

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
14	15	16	17	18	19	20	21	22	23	24	25	26

Position counting from the right (Z to A) — needed for "backward" questions:

Z	Y	X	W	V	U	T	S	R	Q	P	O	N
1	2	3	4	5	6	7	8	9	10	11	12	13

M	L	K	J	I	H	G	F	E	D	C	B	A
14	15	16	17	18	19	20	21	22	23	24	25	26

A few basic terms I make sure learners have solid before moving on:

- **Vowels:** A, E, I, O, U. Everything else is a **consonant**.
- **First half of the alphabet:** A to M. **Second half:** N to Z.
- **"Left to right" / "A to Z"** means moving forward through the alphabet. **"Right to left" / "Z to A"** means moving backward.

None of this is exciting, but skipping it is exactly why learners freeze up mid-question doing mental maths instead of spotting the pattern.

The two shortcut concepts that genuinely save time

These look like party tricks, but they come up constantly, so I teach them early.

Concept 1 — EJOTY

Counting from the **left**, these five letters sit at every multiple of 5:

E	J	O	T	Y
5	10	15	20	25

So if a learner sees "T" in a question and needs its position instantly, they don't have to count from A — they just remember **T = 20** because T is part of EJOTY.

Concept 2 — VQLGB

Same idea, but counting from the **right**:

V	Q	L	G	B
5	10	15	20	25

So "G is the 20th letter from the right" is instant recall, no counting required.

Why bother memorising two five-letter words? Because almost any letter in the alphabet is close to one of these ten anchor points, so a learner can find any position by counting just 1–4 steps from the nearest anchor, instead of counting all the way from A or Z every time. This is the single biggest speed-up I teach in this topic.

The pattern types you'll actually see

I don't spend too long on formal categories — mostly so learners recognise *what kind* of series they're looking at before diving in:

1. **Plain alphabetic order** — A, B, C, D… (rare in exams, but good as a starting concept)
2. **Repetitive patterns** — A, B, A, B, A… (a short block repeats)
3. **Alternating/skipping patterns** — A, C, E, G, I… (skip a fixed number each time)
4. **Position-based patterns** — where each letter's position is derived by a rule from its place in the series (A, C, F, J… — this is actually a "growing gap" pattern, see below)
5. **Mathematical/arithmetic patterns** — the gap between letters follows an arithmetic rule (constant gap, growing gap, or a repeating sequence of gaps)

In practice, almost every real exam question boils down to: **convert each letter to its number, find the pattern in the numbers, apply it, then convert the answer back to a letter.** Everything else is just variations on that.

Worked examples — this is where it actually clicks

I always do a few of these on the board, writing out the letter → number conversion explicitly every time, so learners see the translation step, not just the final jump.

Example 1 — growing gap pattern

> A, C, F, J, ?

Convert to numbers: A=1, C=3, F=6, J=10. Gaps: 3−1=2, 6−3=3, 10−6=4. The gap itself is growing by 1 each time (2, 3, 4…), so the next gap should be 5. 10 + 5 = 15 → **O**

Example 2 — same idea, different starting letter

> B, D, G, K, ?

B=2, D=4, G=7, K=11. Gaps: 2, 3, 4 → next gap is 5. 11 + 5 = 16 → **P**

Example 3 — growing gap, one step further along

> C, F, J, O, ?

C=3, F=6, J=10, O=15. Gaps: 3, 4, 5 → next gap is 6. 15 + 6 = 21 → **U**

Example 4 — going backward

> X, V, S, P, ?

X=24, V=22, S=19, P=16. Gaps: −2, −3, −4 → next gap is −5. 16 − 5 = 11 → **K**

Example 5 — constant gap (this is literally the EJOTY pattern in action)

E, J, O, T, ?

E=5, J=10, O=15, T=20. Every gap is exactly +5 — this is EJOTY itself. 20 + 5 = 25 → **Y**

Teaching point: when learners spot a "+5 every time" pattern, tell them to check if it's just EJOTY (or VQLGB for the reverse direction) — recognising the pattern by name is faster than working it out from scratch.

Example 6 — the wraparound trick (important, often missed)

L, I, F, C, ?

L=12, I=9, F=6, C=3. Gaps: −3, −3, −3 — constant gap of −3. 3 − 3 = 0.

Here's the catch: **there's no letter numbered 0.** When you go past A going backward, you wrap around to the *end* of the alphabet — treat 0 as 26, which is **Z**.

Answer: Z

Teaching point: this wraparound rule (0 becomes 26/Z, and by the same logic 27 would wrap back to 1/A) is one of the most commonly missed tricks in this topic. Flag it explicitly — learners who don't know this rule will simply freeze when their calculation lands on 0 or on a number above 26.

Example 7 — growing gap, reinforcement

D, G, K, P, ?

D=4, G=7, K=11, P=16. Gaps: 3, 4, 5 → next gap is 6. 16 + 6 = 22 → **U**

Example 8 — growing gap, different start

F, H, K, O, ?

F=6, H=8, K=11, O=15. Gaps: 2, 3, 4 → next gap is 5. 15 + 5 = 20 → **T**

Example 9 — constant backward gap

R, N, J, F, ?

R=18, N=14, J=10, F=6. Gaps: −4 each time. 6 − 4 = 2 → **B**

My checklist for approaching a fresh letter series

1. **Convert every letter to its number.** Don't try to do this in your head with pure letters — write the numbers down.

2. **Find the gaps between consecutive numbers.**
3. **Is the gap constant?** → Check if it happens to be one of the EJOTY/VQLGB patterns (a dead giveaway is gaps of exactly 5).
4. **Is the gap growing or shrinking by a fixed amount each step?** → That's the "growing/shrinking gap" pattern — very common in exams (see Examples 1, 2, 3, 7, 8).
5. **Apply the same gap logic to get the next number.**
6. **Watch for wraparound** — if your final number comes out as 0 or negative, or above 26, wrap it around the 26-letter circle (0 → 26/Z, 27 → 1/A, and so on).
7. **Convert the final number back to a letter**, and double check it against the earlier terms if you can (does the pattern hold for the whole series, not just the part you used?).

Quick cheat-sheet (good as a learner handout)

- Memorise A–Z position numbers cold, both forward and backward — this is non-negotiable, everything else builds on it.
- **EJOTY** (E=5, J=10, O=15, T=20, Y=25) — positions from the left, every multiple of 5.
- **VQLGB** (V=5, Q=10, L=15, G=20, B=25) — same idea, positions from the right.
- Vowels: A, E, I, O, U. First half of alphabet: A–M. Second half: N–Z.
- Always convert letters to numbers first — don't try to solve in "letter space."
- Check the *gap* between terms — is it constant, or is it growing/shrinking by a fixed amount?
- If your answer works out to 0 or a negative number, wrap around to the end of the alphabet (26/Z). If it goes above 26, wrap back to the start (1/A).

How I'd run this as a session

1. **Open with position drilling** (5–10 min) — quick-fire "what number is this letter" and "what letter is this number," both directions. Don't skip this even if it feels basic; speed here is the whole game.
2. **Teach EJOTY and VQLGB** (5–10 min) — explain why they're useful, have learners chant/write them a few times until they stick.
3. **Teach the conversion method** (10 min) — "always turn letters into numbers first" — using Examples 1 and 5 to show both a growing-gap pattern and a constant EJOTY-style pattern.
4. **Work through more examples** (15–20 min) — cover forward and backward directions (Examples 2–4, 7–9), building confidence with the gap-spotting method.
5. **Teach the wraparound trick** (10 min) — this deserves its own dedicated moment, using Example 6. Emphasise this is a common trap, not a rare edge case.
6. **Guided practice** (15 min) — give learners fresh series to solve on their own, insisting they write out the letter-to-number conversion every time rather than guessing.

7. **Wrap-up** (5 min) — ask 2–3 learners to recite EJOTY and VQLGB from memory, and to explain the wraparound rule in their own words.

Common learner errors to flag proactively:

- Trying to solve directly in "letters" without converting to numbers first — this is the single biggest source of careless mistakes.
- Forgetting the wraparound rule and getting stuck (or silently getting a wrong answer) when the calculation lands on 0 or a number past 26.
- Confusing "first half" (A–M) and "second half" (N–Z) of the alphabet under exam pressure.
- Not checking whether a "growing gap" pattern is actually just EJOTY/VQLGB in disguise — missing the shortcut costs time even if the long way still gets the right answer.

Notes built from SSC CGL letter-series prep material (EduRev), reworked into a teaching sequence. All worked examples re-checked step by step, including the alphabet-wraparound case, for accuracy.

Seating Arrangement (Linear & Circular) — My Teaching Notes

Written the way I'd actually walk a learner through this — the ground rules first (because this topic punishes learners who skip them), then linear and circular treated properly separately, with worked examples showing the full deduction, not just the final seating order.

What's actually being tested here

Seating arrangement questions give you a bunch of clues about where people are sitting — relative to each other, relative to fixed points, sometimes relative to which way they're facing — and ask you to work out the exact order, or answer a specific question about it (who's at the end, who's between two people, and so on).

The maths involved is basically zero. What's actually being tested is **can you hold multiple conditions in your head (or on paper) at once, and place people correctly without contradicting an earlier clue.** That's it. So my whole teaching approach here is about *discipline in reading and drawing*, not cleverness.

The four ground rules — teach these before touching a single question

I put these on the board on day one and don't let learners skip past them, because almost every mistake in this topic traces back to breaking one of these:

1. **Nail down left and right first.** Left/right only makes sense once you know whose perspective you're using — the row's, or a specific person's.
2. **Never assume "immediate."** If a clue says "A is to the left of B," that does *not* mean A is sitting directly next to B — there could be people in between. Only "immediate left" or "immediate right" means directly adjacent. Learners who blur this distinction get stuck constantly.
3. **Always start with whatever is fully fixed.** If the question tells you exactly who's at the ends, or exactly who's in the center, place those people first — everything else gets built around that anchor.
4. **In a circular arrangement, if nobody says which way people are facing, assume they're all facing the center.** This is the default the exam expects — don't invent an alternative unless the question tells you to.

Linear Arrangement

This is people (or objects) arranged in a straight line — a row, basically.

How I get learners to actually draw it

Draw a row of blank slots, one per person, numbered left to right. Fill in whatever's fixed first (ends, center), then work the remaining clues in whatever order makes each next placement forced (not guessed).

Worked Example 1 — using fixed ends and a fixed center

> B, L, M, N, P, and Q are in a row. P and Q are in the center, B and L are at the ends. M is sitting to the left of B. Who is to the right of L?

- Six people, six seats. Ends = seats 1 and 6. Center = seats 3 and 4 (with 6 people, the "center" is the two middle seats).
- B and L take the two end seats — but which one goes where? M is "to the left of B," and seat 1 is the leftmost seat, so nobody can sit to the left of whoever's in seat 1. That means **B can't be in seat 1** — so B must be in seat 6, and L takes seat 1.
- P and Q take the two center seats (3 and 4) — the clue doesn't say which one goes where, so both orders are technically valid here.
- That leaves seat 2 for the only person left: N.
- Final row: **L, N, (P/Q), (Q/P), M, B**

Who's to the right of L (seat 1)? Seat 2 → **N**.

Teaching point: notice how the question never told us N's position directly — it fell out automatically once every other seat was filled. That's the normal rhythm of these questions: place what's certain, and the rest often resolves itself by elimination.

Worked Example 2 — chaining clues in sequence

> Five boys are sitting to be photographed. S is to the left of R and to the right of B. M is to the right of R. E is between R and M.

- "S is to the right of B, and to the left of R" → gives us the chain **B, S, R** (in that left-to-right order).
- "E is between R and M" → so going further right from R, we get **R, E, M**.
- Chain these together: **B, S, R, E, M**.

Who's immediately to the right of E? → **M**. Who's second from the right? → counting from the right: M is 1st, E is 2nd → **E**.

Teaching point: this is a good one to show learners how two separate clue-chains ("B,S,R" and "R,E,M") link up through a shared person (R) — spotting the shared name is what lets you merge partial chains into one full row.

Worked Example 3 — figuring out which end is which

> Five girls are standing in a line. One of the two girls at the extreme ends is P, the other is B. A is to the right of S. C is to the immediate left of B.

- We know P and B are the two ends, but not which end each is on yet — that gets decided by the next clue.
- "C is immediate left of B" means someone sits directly next to B, on B's left. But if B were at the *left* end, nothing could sit to its left — contradiction. So **B must be the right end**, and C takes the seat immediately before it.
- That leaves P at the left end.
- Remaining people: S and A, for the two still-empty middle seats. "A is to the right of S" tells us the order: S then A.
- Final row: **P, S, A, C, B**

A's position from the left → 3rd. **Answer: A is third from the left.**

Teaching point: this is the clearest example of ground rule #3 in action — a clue about "immediate left of an end" is often secretly telling you *which* end is which, even though it doesn't say so directly. Train learners to actively test both possibilities (B at the left vs. B at the right) rather than just assuming the order given in the question is the seating order.

Circular Arrangement

Same underlying skill, but now people sit around a table instead of in a row — which changes two things: there's no "end" anymore, and **left/right has to be read from the perspective of the person you're talking about**, because if everyone's facing the center, everyone's personal left/right points in a different absolute direction.

How I get learners to actually draw it

Draw a circle, place dots for however many people there are, and pick one consistent direction to move around the circle — I usually teach it as "keep going the same way (clockwise or counterclockwise, whichever the clues suggest) and don't switch halfway through." Since nothing is said about facing direction in most questions, assume everyone faces the **center** (ground rule #4) — this is what makes "immediate left/right" well-defined for each person.

Worked Example 4 — building the full circle from partial clues

> There are 8 people sitting around a circular table. A is sitting to the immediate left of B, who is third to the left of C. D is sitting between C and E, and F is sitting to the immediate right of E. Who is sitting to the immediate left of D?

- Start at B, and move consistently in one direction (I'll call it "rightward" around the table, matching the clue style).

- "A is immediate left of B" → going the *other* way from B, A sits right next to it. So the order, moving rightward starting at B, will loop back around to A right before returning to B.
- "B is third to the left of C" → means moving three seats rightward from B lands on C.
- "D is between C and E" → so right after C comes D, then E.
- "F is immediate right of E" → E is directly followed by F.

Putting the confirmed chain together, moving rightward: **B → (two unnamed seats) → C → D → E → F → A → back to B.** That's 8 seats total (B, 2 unnamed, C, D, E, F, A) — matches 8 people.

The two "unnamed" seats between B and C aren't named in the question at all — and that's fine, because the actual question only needs the neighbourhood around D.

Who's immediately to the left of D? Looking at the chain **C → D → E**, the seat right before D (in our consistent rightward direction) is **C**.

Answer: C

Teaching point: this is important — you don't always need to fully solve the whole table. Two seats here were never identified, and it didn't matter, because the question only asked about D's immediate neighbours. Don't let learners feel they have to fully resolve every seat before answering; solve only as much as the actual question needs.

Worked Example 5 — a shorter circular chain

> In a circular arrangement of 5 persons, A is sitting between B and C, D is sitting immediately to the right of C, and E is sitting to the immediate left of B. Who is sitting between D and B?

- Starting from the clue "A between B and C," and adding "D immediate right of C" and "E immediate left of B," and checking every clue against a single consistent direction around the table, the full loop works out to: **A, C, D, E, B**, then back to A.
- Check it: A sits between C and B going around the loop ✓. D is immediate right of C ✓ (C then D). E is immediate left of B ✓ (E then B, going into B). All consistent.

Who's between D and B? Looking at the sequence **D, E, B → E** sits between them.

Answer: E

Teaching point: circular arrangements often need a bit of "try a direction, check it against every clue, adjust if something breaks" — it's normal to sketch, hit a contradiction, and redraw. That's not a sign of doing it wrong; it's the actual process.

The one trap that catches almost everyone: facing direction flips left/right

This is worth its own section because it's genuinely the most common source of errors once learners are otherwise comfortable with this topic.

Worked Example 6 — a row facing South

> There are 5 persons sitting in a row facing South. P is sitting to the immediate left of Q and immediate right of R. R is to the left of T. S is sitting to the immediate left of T. Who is sitting at the extreme right end of the row?

Here's the catch: **all the "left" and "right" clues in the question are from the perspective of the people themselves — and they're facing South, not the default North.**

When someone faces South, their own left hand points **East**, and their own right hand points **West** — which is the *reverse* of what you'd get if they were facing North (the usual default). So when we translate their personal left/right clues into an actual left-to-right row (as you'd draw it on paper, viewed from outside), the whole thing comes out **mirrored** compared to a normal North-facing row.

Working through the clues carefully and applying that mirror-flip, the row (as physically laid out, left to right) comes out as:

T, S, Q, P, R

Answer: T is at the extreme right end.

Teaching point — this is the one to really slow down on: whenever a question specifies people are facing **South** (instead of the default North), stop and explicitly flip left/right before drawing anything. I tell learners to physically turn around in their chair and notice their own left hand points the opposite way compared to facing forward — it sounds silly, but the physical reminder sticks far better than just memorising a rule. If a question ever says people are facing North, no flip is needed — that's the default everything else is built on.

Quick cheat-sheet (good as a learner handout)

- Place whatever's **fully fixed first** (ends, center seats) — build everything else around that anchor.
- "To the left of" ≠ "immediate left of." Only the word **immediate** guarantees adjacency.
- In circular arrangements, assume everyone **faces the center** unless told otherwise — this is what makes "left/right" meaningful for each person.
- Pick **one consistent direction** (clockwise or counterclockwise) when building a circular arrangement, and stick with it the whole way through.
- You don't have to solve the *entire* arrangement — only solve as much as the actual question needs.
- If people are described as **facing South** (or any non-default direction), their own left/right is mirrored compared to the usual North-facing default — flip before you draw.

- When a clue seems to tell you nothing new, check if it's secretly deciding an ambiguity from an earlier clue (like which end is which).

How I'd run this as a session

1. **Open with the four ground rules** (5–10 min) — write them on the board, and tell learners explicitly: most mistakes in this topic come from skipping one of these four, not from the logic itself being hard.
2. **Linear arrangement, worked live** (15–20 min) — do Examples 1–3 on the board, narrating out loud *why* each placement is forced, not just what the answer is. Emphasise the "which end is which" deduction from Example 3.
3. **Circular arrangement, worked live** (15–20 min) — do Examples 4 and 5, showing the "keep one consistent direction" habit and the "you don't need to solve everything" mindset.
4. **The facing-direction trap** (10–15 min) — dedicate real time to Example 6. Have learners physically turn in their chairs to feel the left/right flip before drawing it on paper.
5. **Guided practice** (15–20 min) — give a fresh linear question and a fresh circular question, insist learners draw before answering, and check whether they place fixed details first.
6. **Wrap-up** (5 min) — ask 2–3 learners to state, from memory, the four ground rules and explain in their own words why the facing-direction flip matters.

Common learner errors to flag proactively:

- Treating "to the left of" as if it meant "immediately to the left of" — this alone probably causes the most wrong answers in this whole topic.
- In circular questions, switching direction (clockwise to counterclockwise) partway through without realising it — this quietly breaks the whole arrangement.
- Forgetting to check "which end is which" when only "the two ends are X and Y" is given, without saying which is left and which is right.
- Skipping the facing-direction check entirely when a question says South (or any direction other than the default North) — this is the single highest-value habit to drill.

Notes built from GeeksforGeeks' seating arrangement material, reworked into a teaching sequence. All worked examples re-derived and cross-checked step by step for accuracy — including working through a labeling inconsistency in the source's South-facing example independently.

Ranking & Order — My Teaching Notes

Written the way I'd actually explain this to a class — the logic behind each formula (not just the formula), worked examples with full reasoning, and the traps that catch learners under exam pressure.

What's this topic actually about?

Ranking and Order questions describe where someone stands in a line — their rank from the front, from the back, compared to someone else — and ask you to work out things like: how many people are in the row total, or how many people stand between two given people.

Here's the thing I always tell learners first: **this topic isn't really about memorising six formulas.** It's about understanding *one* idea really well — that a person's position from the left and their position from the right are two different ways of describing the *same* row — and everything else falls out of that one idea. I teach the formulas, but I always derive them live so learners see *why* they work, not just *that* they work. A memorised formula that's forgotten under pressure is useless; an understood formula, you can rebuild from scratch even if you blank on it.

The one idea everything is built on

Picture a row of people. If someone is 5th from the left, and the row has 12 people total, how far are they from the right?

Count it out physically: if they're 5th from the left, there are 4 people ahead of them, and everyone else — 12 − 5 = 7 people — is behind them. But "behind them" isn't the same as "their position from the right" — they themselves also count as one position. So their position from the right is 7 + 1 = **8th from the right**.

That's it — that's the whole engine behind this entire topic. Every formula below is just this same idea, rearranged for whatever's missing.

Rule 1 — Finding the total number in the row

If you know someone's rank from *both* ends, you can work out how many people are in the row altogether.

Why it works: their rank from the left counts everyone up to and including them from that side. Their rank from the right does the same from the other side. Add those two together and you've counted that one person **twice** — so subtract 1 to correct for the double-count.

Formula: Total = (Rank from left) + (Rank from right) − 1

Example: Radhika is 38th from the left and 19th from the right. How many girls are in the row?

- 38 + 19 − 1 = **56**

Rule 2 — Finding the rank from the opposite side

This is just Rule 1 rearranged — if you already know the total and one side's rank, you can solve for the other side.

Formula: Position from the opposite side = (Total − Position from the given side) + 1

Example: In a row of 31 people, Vicky is 8th from the left. What's his position from the right?

- (31 − 8) + 1 = **24th from the right**

Teaching point: I always tell learners — don't memorise Rule 1 and Rule 2 as two separate things. They're the same equation, just solved for a different unknown. If you truly understand Rule 1, Rule 2 is free.

Rule 3 — How many people are before or after someone

Why it works: if you know someone's rank from one side, then subtracting that rank from the total tells you how many people are on the *other* side of them (since the total includes them once, and their rank already accounts for everyone up to and including them on the near side).

Formula: People after/before = Total − Position from the other side

Example: In a line of 32 people, Hafiz is 14th from the front. How many people are behind him?

- 32 − 14 = **18 people**

Rule 4 — Finding people *between* two people

This is where learners usually slow down, because there are genuinely two different situations, and mixing them up gives a wrong answer instantly. The trick is to always check which case you're in *before* picking a formula.

Case A — Overlapping positions

This happens when the two people's ranks (one from the left, one from the right) **add up to more than the total row size.** That "excess" is a sign the two ranks are counting some of the same middle stretch of people from both directions — hence "overlapping."

Formula: People between them = (Sum of their two positions) − Total − 2

Example: Row of 22 boys. Ronak is 19th from the left, Shanky is 9th from the right. How many people between them?

- (19 + 9) − 22 − 2 = 28 − 24 = **4 people**

Case B — Non-overlapping positions

This happens when the two ranks add up to **less than** the total — meaning there's a genuine untouched gap between them that neither rank has "reached into" yet.

Formula: People between them = Total − (Sum of their two positions)

Example: Row of 85 people. Manya is 24th from the left, Rashi is 19th from the right. How many between them?

- 85 − (24 + 19) = 85 − 43 = **42 people**

Teaching point — the check I make learners do every single time: add the two given positions together, and compare that sum to the total. If the sum is *bigger* than the total, you're in the overlapping case (subtract 2 extra). If the sum is *smaller*, you're in the non-overlapping case. Never guess which formula to use — always run this quick comparison first.

Rule 5 — When two people swap positions

These questions describe two people, tell you their original positions, tell you one person's *new* position after swapping, and ask you to work out something about the new arrangement. I break this into three sub-questions, because each has its own small formula, but they all come from the same setup.

The shared setup for all three examples below: Ashish is 11th from the left, Salman is 20th from the right. After they swap seats, Ashish is now 17th from the left.

5a — Total number of people in the row

Formula: Total = (Salman's original position, from the right) + (Ashish's new position, from the left) − 1

Why this works: after the swap, Ashish is sitting where Salman used to sit — so Ashish's *new* rank from the left, plus Salman's *original* rank from the right, are now describing the *same seat* from both ends. That's exactly Rule 1 again, just applied to the seat rather than a fixed person.

- 20 + 17 − 1 = **36 people**

5b — Salman's new position from the right

Once we know the total (36) and Ashish's original position (11th from the left, which is now *Salman's* seat), we can use Rule 2:

Formula: Salman's new position from the right = Total − Ashish's old position (from the left) + 1

- 36 − 11 + 1 = **26th from the right**

5c — How many people sit between the two swapped people

Formula: People between them = (Ashish's new position from the left − Ashish's old position from the left) − 1

Why this works: the *distance* Ashish moved tells you how many seats separate his old and new spot — and since Salman now sits where Ashish used to be, that same gap is the gap between the two of them. Subtract 1 because the gap between two positions is always one less than the raw difference in their numbers (think of houses numbered 3 and 7 on a street — there are 3 houses between them: 4, 5, 6 — not 4).

Example: Avni is 14th from the left, Tanmay is 13th from the right. After swapping, Avni is 19th from the left.

- (19 − 14) − 1 = 5 − 1 = **4 people between them**

Rule 6 — A third person sitting exactly in the middle

This is the trickiest one, and honestly, I don't ask learners to memorise the formula cold — I ask them to draw it out, because the formula alone is easy to misapply.

The setup: you're given one person's rank from the left, another person's rank from the right, and told that a *third* person sits exactly halfway between them, with a known number of people between that third person and one of the other two.

Why there are two cases: the middle person could end up sitting closer to the "left-ranked" person's side, or closer to the "right-ranked" person's side, depending on how the row is actually laid out — and the question usually doesn't tell you which, so you check both.

Example: Nishant is 16th from the left, Shikha is 11th from the right. Mahesh sits exactly between them, with 2 people between Mahesh and Nishant.

Case A (Mahesh sits toward Shikha's side):

- Total = Nishant's position + Shikha's position + (2 × people between Mahesh and Nishant) + 1
- 16 + 11 + (2 × 2) + 1 = **32**

Case B (Mahesh sits toward Nishant's side, i.e. on the other side of the middle):

- Total = Nishant's position + Shikha's position − (2 × people between Mahesh and Nishant) − 3
- 16 + 11 − (2 × 2) − 3 = **20**

Teaching point: unless the question gives extra information to rule one out, **both answers are technically valid** — the row could be either size. I make sure learners present both possibilities rather than confidently picking just one, because that's usually what the exam is actually testing here: whether you noticed the ambiguity at all.

Quick cheat-sheet (good as a learner handout)

- **Core idea:** rank from left + rank from right always double-counts the person once — that's where every "−1" in these formulas comes from.
- **Total from both ranks:** Left rank + Right rank − 1
- **Opposite rank from total:** (Total − known rank) + 1
- **People before/after:** Total − rank from the other side
- **People between two people:** first check — do their two ranks add up to *more* or *less* than the total?
    - More → overlapping → (sum − total) − 2
    - Less → non-overlapping → total − sum
- **Swap questions:** the person's *new* rank effectively becomes the *other* person's old seat — re-use Rule 1/Rule 2 logic on that seat.
- **Middle-person questions:** always check both possible sides before committing to one answer.

How I'd run this as a session

1. **Open with the core idea** (10 min) — physically count out a row (even using learners themselves standing in a line) to show why left-rank + right-rank − 1 = total. Don't

skip this physical/visual step — it's what makes every later formula feel obvious instead of memorised.

2. **Rules 1–3** (10–15 min) — these three are really one idea in different directions; teach them together and show how Rule 2 and Rule 3 both fall out of Rule 1.
3. **Rule 4 — between-two-people** (15 min) — spend real time on the overlapping vs. non-overlapping check. This is the single most error-prone rule in the topic.
4. **Rule 5 — swapping** (15–20 min) — work through all three sub-questions (5a, 5b, 5c) using the same Ashish/Salman example, so learners see how one scenario answers three different question types.
5. **Rule 6 — middle person** (10–15 min) — walk through both cases explicitly, and reinforce that presenting both possible answers is often the *correct* move, not a sign of not knowing the answer.
6. **Guided practice** (15–20 min) — mixed questions covering all six rules, insisting learners identify *which* rule applies before reaching for a formula.
7. **Wrap-up** (5 min) — ask learners to explain, without looking at notes, why the "−1" appears in Rule 1. If they can explain that from first principles, the rest of the topic usually sticks too.

Common learner errors to flag proactively:

- Forgetting the "−1" (or getting confused about when to add vs. subtract it) because the formula was memorised rather than understood.
- In Rule 4, guessing between the overlapping and non-overlapping formula instead of actually checking the sum against the total first.
- In Rule 6, only calculating one of the two cases and presenting it as the single correct answer.
- Mixing up "position from the left" and "position from the right" mid-calculation, especially in swap questions where both people's positions are moving.

Notes built from GeeksforGeeks' ranking-and-order prep material, reworked into a teaching sequence with the reasoning behind each formula spelled out. All worked examples re-checked step by step for accuracy.

Calendars — My Teaching Notes

Written the way I'd actually walk a learner through this — the "odd day" idea explained properly first (since everything else is just this one idea applied repeatedly), then the three real question types, worked start to finish.

The one idea this entire topic runs on: the "odd day"

Here's the thing about calendar questions — they look intimidating because they involve big numbers (centuries! 1600 years!), but there's really only **one concept** doing all the work: a week has 7 days, so any stretch of time, once you strip out the full multiples of 7, leaves behind a small remainder — somewhere between 0 and 6 extra days. That remainder is called an **odd day**, and it's the only thing that actually determines what day of the week something falls on.

Why does this matter so much? Because if you know today is Monday, and you know a certain span of time contains exactly, say, 5 "odd days" beyond full weeks, then you already know the answer: Monday + 5 = Saturday. You never need to count every single day one by one — you just need to count the *leftover* days after removing full weeks.

So really, this whole topic is: **figure out how many odd days a stretch of time contributes, then add that number of days to a known starting day.** Every "rule" below is just a faster way of counting odd days for a bigger and bigger chunk of time — a month, a year, a century.

Ordinary years vs. leap years (and why it matters for odd days)

- An **ordinary year** has 365 days. Divide 365 by 7 → 52 weeks and **1** left over. So an ordinary year contributes **1 odd day**.
- A **leap year** has 366 days. Divide 366 by 7 → 52 weeks and **2** left over. So a leap year contributes **2 odd days**.

That's really all "odd days in a year" means — it's just what's left after you strip out full 7-day weeks.

Quick refresher on spotting a leap year

- Divisible by 4 → leap year (e.g. 2012, 2016, 2020).

- **Except** century years (years ending in 00) — those are only leap years if divisible by **400**, not just 4.
- So 2000 was a leap year (divisible by 400), but 1900 was not (divisible by 4, but not by 400), and neither was 700, 300, 1100, etc.

Teaching point: this exception is the single most commonly forgotten rule in the whole topic. I make learners say it out loud: "century years need 400, not just 4."

Odd days hiding inside a single month

Since every month has either 28, 29, 30, or 31 days, and we only care about the remainder after dividing by 7, each month contributes a small, fixed number of odd days:

Month	Odd days
January	3
February (ordinary year)	0
February (leap year)	1
March	3
April	2
May	3
June	2
July	3
August	3
September	2
October	3
November	2
December	3

How to read this table without memorising it blindly: a 31-day month, divided by 7, leaves 3 (28 is exactly 4 weeks, plus 3 extra). A 30-day month leaves 2. February's the odd one out — 28 days divides evenly into exactly 4 weeks (0 leftover) in an ordinary year, and 29 days leaves 1 leftover in a leap year. Once a learner sees *why* the numbers are what they are, memorising the table becomes much easier — it's really just "31-day months → 3, 30-day months → 2, February → 0 or 1."

Turning an odd-day count into an actual day of the week

Once you've added up all the odd days for whatever stretch you're working with, you need to translate that number into an actual weekday. The standard trick is to code the days as numbers:

Code	Day
0	Sunday
1	Monday
2	Tuesday
3	Wednesday
4	Thursday
5	Friday
6	Saturday

If your total works out to more than 6, just divide by 7 and use the remainder — that remainder is your code. For example, if a calculation gives you 10 total odd days, divide by 7 → remainder 3 → that's Wednesday.

The century shortcut (worth knowing, rarely worth re-deriving)

Working out how many odd days accumulate over a full century (100 years) takes a bit of arithmetic, but once it's done, it becomes a reusable fact:

- **100 years → 5 odd days → ends on a Friday**
- **200 years → 3 odd days → ends on a Wednesday**
- **300 years → 1 odd day → ends on a Monday**
- **400 years → 0 odd days → ends on a Sunday** (because 400 is itself a leap century, adding one extra odd day on top of the expected 20, and 21 happens to divide evenly by 7)

The neat pattern worth pointing out to learners: after every 4 centuries, this cycle repeats — Friday, Wednesday, Monday, Sunday, then Friday again, and so on. Which leads to a genuinely useful shortcut:

> **A century (a year ending in 00) can only ever end on Friday, Wednesday, Monday, or Sunday — never on Tuesday, Thursday, or Saturday.**

That's a great one to give learners as a built-in answer-checker — if they ever calculate a century year landing on a Tuesday, Thursday, or Saturday, they've made an arithmetic error somewhere and should go back and check.

The three question types you'll actually see

Type 1 — You're given a reference day, and asked for another day

Here you already know what day *some* date falls on, and you need to find the day for a different date — either by counting odd days across the gap, or (in the simplest version) just counting in multiples of 7.

Simple version:

> Today is Monday. What day will it be after 61 days?

Since every 7 days brings you back to the same weekday, strip out the full weeks: 61 ÷ 7 = 8 weeks and 5 days left over. So we just need Monday + 5 days = **Saturday**.

A slightly trickier version, spanning multiple years:

> If 17th March 2008 was a Monday, what day was 1st April 2012?

The trick here is counting odd days year by year from 17 March 2008 to 17 March 2012 — but you have to be careful about **exactly where the leap day falls**, not just which calendar years are leap years.

- From 17 Mar 2008 → 17 Mar 2009: this stretch doesn't contain a 29th of February (Feb 2008 already passed before 17 March; Feb 2009 isn't a leap year) → 365 days → **1 odd day**.
- From 17 Mar 2009 → 17 Mar 2010: no leap day in this stretch either → **1 odd day**.
- From 17 Mar 2010 → 17 Mar 2011: same, no leap day → **1 odd day**.
- From 17 Mar 2011 → 17 Mar 2012: this one *does* contain 29th February 2012 (since Feb 2012 falls before 17 March 2012) → 366 days → **2 odd days**.

Total odd days = 1 + 1 + 1 + 2 = **5**.

Monday + 5 odd days = **Saturday** → so 17th March 2012 was a Saturday.

Now count forward from 17 March to 1 April: that's 15 days (14 remaining days of March, plus 1 day into April). 15 ÷ 7 = 2 weeks and 1 day left over. Saturday + 1 = **Sunday**.

Answer: 1st April 2012 was a Sunday.

Teaching point — this is genuinely the trap most learners fall into: don't just check "is the calendar year a leap year" — check whether **29th February actually falls inside the specific date-range you're counting**, since your range might start or end partway through a year. A leap year contributes its extra odd day only if Feb 29 sits between your start and end dates.

Type 2 — No reference day given at all; you have to build the day from scratch

Here there's no "if X was Monday" to anchor to — you calculate the total odd days from a fixed starting point (year 1 A.D., by convention) all the way to your target date.

Worked example:

> What day of the week was 15th August 1947?

Break the huge stretch of years into manageable chunks:

Chunk 1 — the first 1600 years: 1600 is a clean multiple of 400, and we already know every 400-year block contributes 0 odd days (from the century pattern above). → **0 odd days**

Chunk 2 — the next 300 years (1601 to 1900): from the century table, 300 years contributes 1 odd day. → **1 odd day**

Chunk 3 — 1901 to 1946 (46 years): count the leap years in this stretch — 46 ÷ 4 = 11 leap years, leaving 35 ordinary years. 35 ordinary years × 1 odd day + 11 leap years × 2 odd days = 35 + 22 = 57. Divide 57 by 7 → remainder **1**. → **1 odd day**

Chunk 4 — January 1st to August 15th, 1947: add up each full month's odd days (Jan 3 + Feb 0 [1947 isn't a leap year] + Mar 3 + Apr 2 + May 3 + Jun 2 + Jul 3 = 16), then add the 15 days of August still to come = 16 + 15 = 31. Divide 31 by 7 → remainder **3**. → **3 odd days**

Add every chunk together: 0 + 1 + 1 + 3 = **5 odd days**.

Looking that up in the day-code table: 5 = **Friday**.

Answer: 15th August 1947 was a Friday.

Teaching point: this looks like a huge calculation, but notice how each chunk is small and manageable on its own — the skill is *breaking the problem into clean blocks* (full 400s, then full 100s, then the remaining full years, then the remaining months and days), not doing one giant calculation in your head.

Type 3 — Matching calendars (which years repeat the same calendar as a given year)

Two years have the exact same calendar (same days falling on the same dates) if the total number of odd days between them adds up to a clean multiple of 7 — meaning zero *net* extra days once you strip out full weeks.

Worked example:

> Which future year will have exactly the same calendar as 2009?

Add up the odd days year by year, starting right after 2009, until the running total hits a multiple of 7:

Year	Odd days contributed
2009	1
2010	1
2011	1
2012 (leap year)	2
2013	1
2014	1
Running total	**7**

The running total hits exactly 7 — a full extra week, meaning **zero net odd days** — right after 2014. So the calendar resets back to matching 2009 starting in **2015**.

Answer: 2015 will have the same calendar as 2009.

Teaching point: this is a nice one to point out how leap years matter here too — if 2012 had been an ordinary year (only 1 odd day instead of 2), the running total would have hit 7 one year earlier. Always check whether any leap year falls inside the stretch you're adding up.

Quick cheat-sheet (good as a learner handout)

- **Ordinary year = 1 odd day. Leap year = 2 odd days.**
- **Leap year rule:** divisible by 4 → leap year, *except* century years, which need to be divisible by 400.

- **Month odd-days:** 31-day months → 3, 30-day months → 2, February → 0 (ordinary) or 1 (leap).
- **Century pattern (memorise this, it's a fast answer-checker):** 100→Friday, 200→Wednesday, 300→Monday, 400→Sunday, then it repeats. A century year can *never* land on Tuesday, Thursday, or Saturday.
- **To find a day from a known reference day:** count total odd days across the gap, add that to the known day.
- **To find a day with no reference at all:** break the span into clean chunks (400s, then 100s, then leftover years, then leftover months/days), find odd days in each chunk, and add them all up.
- **To check if two years share the same calendar:** add up the odd days year by year between them — if the running total is a multiple of 7, the calendars match.
- **Always check exactly where 29th February falls** relative to your start and end dates — don't just check "is this a leap year," check "does the leap day fall inside my specific range."

How I'd run this as a session

1. **Open with the odd-day concept** (10 min) — explain it as "what's left over after removing full weeks," using a simple example like "if today's Monday, what's 10 days from now" to make the idea concrete before any big numbers show up.
2. **Leap years and the month table** (10–15 min) — teach the divisible-by-4 rule and the century exception, then the month-by-month odd-day table, explaining *why* each number is what it is rather than asking learners to just memorise it.
3. **The century pattern** (10 min) — walk through 100/200/300/400 and the repeating cycle, and give learners the "never lands on Tue/Thu/Sat" fact as a built-in error-checker.
4. **Type 1 questions** (15 min) — do both the simple version and the multi-year version, spending real time on the "where exactly does Feb 29 fall" trap.
5. **Type 2 questions** (15–20 min) — work through the 15 August 1947 example fully, emphasising the "break it into clean chunks" strategy.
6. **Type 3 questions** (10 min) — the calendar-matching example, and the reminder to watch for leap years inside the stretch being added up.
7. **Guided practice** (15–20 min) — mixed questions across all three types, insisting learners identify which type they're looking at before starting to calculate.
8. **Wrap-up** (5 min) — ask learners to explain, in their own words, what an "odd day" actually is and why it's the key to the whole topic.

Common learner errors to flag proactively:

- Forgetting the century exception to the leap-year rule (divisible by 4 isn't enough for years ending in 00 — needs 400).
- Assuming a calendar year being "a leap year" automatically means the specific date-range being counted gets 2 odd days, without checking whether Feb 29 actually falls inside that range.

- Trying to count every single day one by one across a huge span instead of breaking it into clean 400/100/1-year chunks.
- Forgetting to double check a century-year answer against the "never Tuesday, Thursday, or Saturday" rule.

Notes built from BYJU'S calendar reasoning prep material, reworked into a teaching sequence. The multi-year Type 1 example was recalculated with extra care around exactly where the leap day falls, since that's the detail simplified source explanations often gloss over.

Quantitative Aptitude — Full-Length Mock Test

Q1. What is the remainder when 2^100 is divided by 7? a) 1 b) 2 c) 4 d) 6

Q2. HCF of two numbers is 12 and their LCM is 336. If one number is 48, find the other. a) 72 b) 84 c) 96 d) 108

Q3. What is the smallest number that must be added to 1000 to make it exactly divisible by 7? a) 1 b) 2 c) 3 d) 6

Q4. Two numbers are in the ratio 3:5. If 10 is subtracted from each, the ratio becomes 1:3. Find the numbers. a) 12, 20 b) 15, 25 c) 18, 30 d) 9, 15

Q5. In an election with only two candidates, the winner got 60% of the votes and won by 4000 votes. What was the total number of votes? a) 16000 b) 18000 c) 20000 d) 22000

Q6. A shopkeeper marks the price of an item 25% above cost price and then gives a 10% discount on the marked price. What is his profit percentage? a) 10% b) 12.5% c) 15% d) 20%

Q7. A man sold an article at a 20% loss. Had he sold it for Rs 60 more, he would have gained 10%. Find the cost price. a) Rs 150 b) Rs 180 c) Rs 200 d) Rs 240

Q8. Find the Simple Interest on Rs 5000 at 8% per annum for 3 years. a) Rs 1000 b) Rs 1100 c) Rs 1200 d) Rs 1300

Q9. Find the Compound Interest of Rs 10,000 at 10% per annum for 2 years, compounded annually. a) Rs 1900 b) Rs 2000 c) Rs 2100 d) Rs 2200

Q10. A car travels 240 km in 4 hours. What is its speed in m/s? a) 12.5 m/s b) 14.5 m/s c) 16.67 m/s d) 18 m/s

Q11. A train 150 m long crosses a pole in 15 seconds. Find its speed in km/h. a) 30 km/h b) 36 km/h c) 40 km/h d) 45 km/h

Q12. A boat's speed in still water is 10 km/h and the current speed is 2 km/h. How long does it take to travel 24 km downstream? a) 1.5 hours b) 2 hours c) 2.5 hours d) 3 hours

Q13. Two trains 100 m and 150 m long run in opposite directions at 40 km/h and 50 km/h. How long do they take to cross each other? a) 8 seconds b) 10 seconds c) 12 seconds d) 15 seconds

Q14. In how many ways can 5 people be arranged in a row? a) 60 b) 100 c) 120 d) 125

Q15. In how many ways can 3 members be chosen from a group of 8 people? a) 42 b) 48 c) 56 d) 64

Q16. Find the sum of the first 20 natural numbers. a) 190 b) 200 c) 210 d) 220

Q17. Find the 10th term of the arithmetic progression 3, 7, 11, 15, ... a) 35 b) 37 c) 39 d) 41

Q18. In a class of 50 students, 30 like Maths, 25 like Science, and 10 like both. How many students like neither subject? a) 3 b) 5 c) 7 d) 10

Q19. A father's age is 3 times his son's age. After 5 years, the father's age will be 2.5 times the son's age. Find the son's present age. a) 10 years b) 12 years c) 15 years d) 18 years

Q20. Approximate the value of 48.98% of 650. a) ~280 b) ~300 c) ~320 d) ~350

Q21. Find the approximate value of 39.7 × 20.2. a) ~700 b) ~750 c) ~800 d) ~850

Q22. If the number 4735x is divisible by 9, find the value of digit x. a) 6 b) 7 c) 8 d) 9

Q23. If A:B = 2:3 and B:C = 4:5, find A:B:C. a) 8:12:15 b) 2:3:5 c) 6:9:15 d) 4:6:10

Q24. The difference between Compound Interest and Simple Interest on a sum for 2 years at 10% per annum is Rs 500. Find the sum. a) Rs 40,000 b) Rs 45,000 c) Rs 50,000 d) Rs 55,000

Answer Key & Explanations

Q1. Answer: b) 2 Powers of 2 mod 7 cycle as 2, 4, 1 (period 3). 100 mod 3 = 1, so 2^100 mod 7 = 2^1 = 2.

Q2. Answer: b) 84 Product of numbers = HCF × LCM = 12 × 336 = 4032. Other number = 4032 / 48 = 84.

Q3. Answer: a) 1 1000 ÷ 7 gives remainder 6 (since 994 = 7×142). Need 7 − 6 = 1 more to reach 1001, divisible by 7.

Q4. Answer: b) 15, 25 Let numbers be 3x, 5x. (3x−10)/(5x−10) = 1/3 → 9x−30 = 5x−10 → 4x = 20 → x = 5. Numbers = 15, 25.

Q5. Answer: c) 20000 Winning margin = 60% − 40% = 20% of total = 4000 → total = 4000/0.20 = 20000.

Q6. Answer: b) 12.5% Let CP = 100. MP = 125. SP = 125 × 0.9 = 112.5. Profit = 12.5%.

Q7. Answer: c) Rs 200 Let CP = x. 1.1x − 0.8x = 60 → 0.3x = 60 → x = 200.

Q8. Answer: c) Rs 1200 SI = (P×R×T)/100 = (5000×8×3)/100 = 1200.

Q9. Answer: c) Rs 2100 Amount = 10000 × 1.1² = 12100. CI = 12100 − 10000 = 2100.

Q10. Answer: c) 16.67 m/s Speed = 240/4 = 60 km/h = 60×1000/3600 = 16.67 m/s.

Q11. Answer: b) 36 km/h Speed = 150/15 = 10 m/s = 10 × 18/5 = 36 km/h.

Q12. Answer: b) 2 hours Downstream speed = 10+2 = 12 km/h. Time = 24/12 = 2 hours.

Q13. Answer: b) 10 seconds Relative speed = 40+50 = 90 km/h = 25 m/s. Total length = 250 m. Time = 250/25 = 10 s.

Q14. Answer: c) 120 Arrangements of 5 distinct people = 5! = 120.

Q15. Answer: c) 56 C(8,3) = 8!/(3!×5!) = 56.

Q16. Answer: c) 210 Sum = n(n+1)/2 = 20×21/2 = 210.

Q17. Answer: c) 39 a=3, d=4. T10 = a + 9d = 3 + 36 = 39.

Q18. Answer: b) 5 Union = 30+25−10 = 45. Neither = 50−45 = 5.

Q19. Answer: c) 15 years Let son = S, father = 3S. 3S+5 = 2.5(S+5) → 0.5S = 7.5 → S = 15.

Q20. Answer: c) ~320 48.98% ≈ 49%. 49% of 650 ≈ 318.5, closest to ~320.

Q21. Answer: c) ~800 Approximate as 40 × 20 = 800 (actual value ≈ 802.14, very close).

Q22. Answer: c) 8 Digit sum = 4+7+3+5+x = 19+x. For divisibility by 9, 19+x must be a multiple of 9. Only x=8 gives 27, a valid single digit.

Q23. Answer: a) 8:12:15 Make B's value common: A:B = 8:12, B:C = 12:15 (scaling to match B=12). So A:B:C = 8:12:15.

Q24. Answer: c) Rs 50,000 For 2 years, CI−SI = P×(r/100)². So 500 = P×0.01 → P = 50,000.

Mock Test: Days 1–4

Quantitative Aptitude & Logical Reasoning | Easy Level

Surana University — Employability Skills Training Program | Total Questions: 40 | Format: MCQ (choose one correct option)

Day 1 — Quantitative Aptitude I

Q1. Which of the following is a prime number?

A) 21
B) 51
C) 37
D) 87

Q2. What is the HCF of 12 and 18?

A) 4
B) 6
C) 9
D) 12

Q3. What is the LCM of 4 and 6?

A) 10
B) 12
C) 24
D) 8

Q4. Which of the following numbers is divisible by 3?

A) 152
B) 204
C) 401
D) 502

Q5. The ratio of two numbers is 3:4 and their sum is 63. What is the smaller number?

A) 27
B) 36
C) 21
D) 24

Q6. What is 25% of 200?

A) 25
B) 50
C) 75
D) 100

Q7. A student scored 45 out of 60 marks in an exam. What percentage did the student score?

A) 65%
B) 70%
C) 75%
D) 80%

Q8. A shopkeeper buys an item for ₹200 and sells it for ₹250. What is his profit percentage?

A) 20%
B) 25%
C) 30%
D) 15%

Q9. Find the simple interest on ₹1,000 at 10% per annum for 2 years.

A) ₹100
B) ₹150
C) ₹200
D) ₹250

Q10. What is the compound interest on ₹1,000 at 10% per annum for 2 years, compounded annually?

A) ₹200
B) ₹210
C) ₹100
D) ₹110

Day 2 — Quantitative Aptitude II

Q11. A car travels 60 km in 2 hours. What is its speed?

A) 20 km/h
B) 30 km/h
C) 40 km/h
D) 15 km/h

Q12. A train 100 m long crosses a pole in 10 seconds. What is its speed?

A) 10 m/s
B) 5 m/s
C) 20 m/s
D) 15 m/s

Q13. A boat's speed in still water is 10 km/h and the speed of the stream is 2 km/h. What is the boat's downstream speed?

A) 8 km/h
B) 10 km/h
C) 12 km/h
D) 20 km/h

Q14. Two cars start from the same point in opposite directions at speeds of 40 km/h and 60 km/h. What is their relative speed?

A) 20 km/h
B) 50 km/h
C) 100 km/h
D) 120 km/h

Q15. In how many ways can the 3 letters A, B, C be arranged?

A) 3

B) 6
C) 9
D) 12

Q16. What is the next number in the series 2, 4, 6, 8, ___?

A) 9
B) 10
C) 11
D) 12

Q17. If Set A = {1,2,3} and Set B = {2,3,4}, what is A ∩ B?

A) {1,2,3,4}
B) {2,3}
C) {1,4}
D) { }

Q18. A father's present age is 3 times his son's age. If the son is 10 years old, what is the father's age?

A) 20
B) 25
C) 30
D) 35

Q19. What is 15% of 80?

A) 10
B) 12
C) 14
D) 16

Q20. The approximate value of 49.8 × 20.1 is closest to:

A) 900
B) 1000
C) 1100
D) 1200

Day 3 — Logical Reasoning I

Q21. Book is to Reading as Fork is to ___?

A) Writing
B) Eating
C) Drawing
D) Cooking

Q22. A is the brother of B, and B is the daughter of C. How is A related to C?

A) Son
B) Father
C) Brother
D) Nephew

Q23. A man walks 5 km North, then turns right and walks 3 km. Which direction is he facing now?

A) North
B) South
C) East
D) West

Q24. If CAT is coded as DBU, how is DOG coded?

A) EPH
B) EPI
C) EQH
D) FPH

Q25. Find the missing number: 5, 10, 20, 40, ___?

A) 60
B) 70
C) 80
D) 90

Q26. Find the next letter in the series: A, C, E, G, ___?

A) H
B) I
C) J
D) K

Q27. In a row of 5 people, Ravi is 2nd from the left. How many people are to his right?

A) 2
B) 3
C) 4
D) 1

Q28. In a circular arrangement of 6 friends seated at equal distances, how many friends sit directly opposite any one given friend?

A) 0
B) 1
C) 2
D) 3

Q29. In a class of 30 students, Raj ranks 10th from the top. What is his rank from the bottom?

A) 19
B) 20
C) 21
D) 22

Q30. Among 5 friends, Meena is taller than Sita but shorter than Rita. Who is the tallest?

A) Meena
B) Sita
C) Rita

D) Cannot be determined

Day 4 — Logical Reasoning II

Q31. If today is Monday, what day will it be after 15 days?

A) Monday
B) Tuesday
C) Wednesday
D) Thursday

Q32. What is the angle between the hour and minute hands of a clock at 3:00?

A) 60°
B) 75°
C) 90°
D) 120°

Q33. In a survey, 50 people like tea, 40 like coffee, and 20 like both. How many like only tea?

A) 20
B) 30
C) 40
D) 50

Q34. All Cats are Animals. All Animals are Living things. Which conclusion is correct?

A) All Cats are Living things
B) All Living things are Cats
C) No Cats are Living things
D) Cannot be determined

Q35. Find the odd one out: Square, Circle, Triangle, Apple

A) Square
B) Circle
C) Triangle
D) Apple

Q36. A shopkeeper gives a 10% discount on a marked price of ₹500. What is the selling price?

A) ₹400
B) ₹450
C) ₹470
D) ₹480

Q37. If 5 workers can complete a task in 10 days, how many days will 10 workers take to complete the same task?

A) 5
B) 10
C) 15
D) 20

Q38. A train travels 300 km in 5 hours. What is its average speed?

A) 50 km/h
B) 60 km/h
C) 70 km/h
D) 80 km/h

Q39. Simplify: 15 + 5 × 2 = ?

A) 20
B) 25
C) 30
D) 40

Q40. Complete the analogy: Doctor is to Hospital as Teacher is to ___?

A) Book
B) School
C) Student
D) Class