INDEPENDENT CAT PREPARATION / ORIGINAL MOCK

CAT 2026 Prediction Paper 04

Answer key & worked solutions

68 questions · 120 minutes · Maximum 204 marks

This is an original practice paper informed by recent CAT patterns and the forecast in this study. It is not the official CAT 2026 paper and does not claim to reproduce unreleased questions. Its difficulty has not been calibrated on a candidate cohort.

SECTION	QUESTIONS	TIME	MARKS
Verbal Ability & Reading Comprehension	24	40 minutes	72
Data Interpretation & Logical Reasoning	22	40 minutes	66
Quantitative Ability	22	40 minutes	66

Correct answer: +3. Incorrect MCQ: –1. Incorrect TITA or unanswered question: 0. Each MCQ has exactly one correct option. TITA answers are whole numbers.

Design reference: IMS CAT 2025 exam analysis and the instructions of the official CAT 2026 mock (released 6 November 2026). The 24/22/22 structure, four-question RC passages and four- or five-question DILR sets inform this mock. Original contexts and exact question allocations are authoring choices. Method and source limitations: validation.html. Practice profile: Rates, ratios & decisions.

Quick answer key

V01 D	**V02** B	**V03** C	**V04** A	**V05** C	**V06** A
V07 B	**V08** D	**V09** B	**V10** D	**V11** A	**V12** C
V13 A	**V14** C	**V15** D	**V16** B	**V17** D	**V18** A
V19 C	**V20** B	**V21** 3241	**V22** 3124	**V23** 2	**V24** 5
D01 20	**D02** B	**D03** 8	**D04** D	**D05** A	**D06** 6
D07 B	**D08** 4	**D09** 3	**D10** A	**D11** 80	**D12** C
D13 400	**D14** D	**D15** 5	**D16** B	**D17** 10	**D18** D
D19 8	**D20** B	**D21** 360	**D22** D	**Q01** A	**Q02** 16
Q03 C	**Q04** D	**Q05** 20	**Q06** B	**Q07** C	**Q08** 5
Q09 A	**Q10** 30000	**Q11** C	**Q12** D	**Q13** 81	**Q14** B
Q15 C	**Q16** D	**Q17** 125	**Q18** B	**Q19** 6	**Q20** D
Q21 2880	**Q22** B				

VARC · 24 questions

RC 1 · A field after farming

A field abandoned after decades of cultivation does not begin its new life from an ecological blank. Its soil has been shaped by ploughing, fertiliser, drainage and the plants repeatedly grown upon it. Some effects fade quickly; others can influence what establishes there long after farming ends. Calling the site abandoned describes a current human activity, not the disappearance of that activity's material consequences.

This history can help explain why two neighbouring fields respond differently to the same restoration treatment. Adding identical seeds does not create identical starting conditions. One field may retain nutrients that favour fast-growing competitors; another may have compacted layers that restrict roots or water movement. The treatment encounters a landscape already organised by earlier processes. A failed attempt to establish a particular plant need not show that the species is unsuited to the regional climate; the difficulty may be much more local.

Ecologists sometimes describe such persistence as a legacy. The term should not suggest that a site has a single fixed destiny. Subsequent organisms modify the conditions they encounter. A plant that changes shade or litter can make establishment easier for some successors and harder for others. An initial difference can therefore be amplified, redirected or gradually erased. History matters through continuing mechanisms, not through an invisible instruction telling the field to reproduce its past.

Restoration choices depend on which mechanisms are still active. Removing nutrient-rich topsoil may help under some conditions but destroy useful structure under others. Waiting may be sensible where an obstacle is temporary, but ineffective where a self-reinforcing pattern keeps recreating it. The appropriate intervention cannot be read from the age of abandonment alone. It requires a hypothesis about what is preventing the desired change and observations that can test that hypothesis.

There is also a question about the desired change itself. Restoring an earlier plant community may be unrealistic when surrounding land use and water flows have changed permanently. A project might instead seek a diverse community that performs valued functions under current conditions. That decision should be explicit rather than concealed by the language of returning the field to nature. Historical understanding expands the choices available to restoration; it does not dictate that every site must be sent backwards to one selected date. The field's past supplies constraints and possibilities, while its future remains an outcome of processes still unfolding.

V01. Which statement best summarises the passage? MCQ

A. Abandoned fields inevitably return to the plant communities that existed before agriculture.
B. Historical land use matters only when restoration introduces species from outside the region.
C. Removing altered soil is the most dependable way to eliminate every agricultural legacy.
D. Restoration must understand persisting mechanisms from land-use history while making explicit choices about attainable future conditions.

Answer: D. Restoration must understand persisting mechanisms from land-use history while making explicit choices about attainable future conditions.

The correct answer connects mechanisms, intervention and goals. Automatic return and a universal soil-removal prescription contradict the qualifications. Local species can also fail under inherited soil conditions, so history is not relevant only to introduced species.

V02. Two adjacent fields receive the same seeds but develop different vegetation. Which explanation is most consistent with the passage? MCQ

A. At least one field must lie outside the species' regional climatic range.
B. Earlier treatments may have produced different soil conditions that favour different establishment processes.
C. Identical treatments necessarily have identical effects unless the seeds are defective.
D. Abandonment prevents plants from modifying the conditions in which later plants establish.

Answer: B. Earlier treatments may have produced different soil conditions that favour different establishment processes.

Different nutrient or compaction histories can mediate the same treatment. The regional-climate conclusion is expressly cautioned against. Identical outcomes and inability of plants to modify conditions are both denied.

V03. The author distinguishes an ecological legacy from a fixed destiny because: MCQ

A. legacy refers only to human memories, whereas destiny refers to physical soil conditions.
B. a legacy ceases to matter as soon as the last farmer leaves the site.
C. past effects persist through mechanisms that subsequent processes can amplify, redirect or erase.
D. all historical differences are erased after a predictable period of abandonment.

Answer: C. past effects persist through mechanisms that subsequent processes can amplify, redirect or erase.

A legacy operates materially but can change through later interactions. The remaining options turn it into memory, immediate disappearance or uniformly timed erasure, none of which follows from the argument.

V04. Which restoration decision best follows the final paragraph? MCQ

A. Choosing a feasible future community after explicitly considering permanent changes in water flows and surrounding land use.
B. Selecting an earlier date and reproducing its community regardless of present constraints.
C. Avoiding historical research because changed surroundings make the past irrelevant.
D. Assuming that “returning to nature” identifies one universally agreed ecological target.

Answer: A. Choosing a feasible future community after explicitly considering permanent changes in water flows and surrounding land use.

The author favours explicit objectives informed by historical and current conditions. A compulsory return, historical irrelevance and a single self-evident target are the three simplifications the conclusion resists.

RC 2 · What a recipe leaves to the cook

An old recipe that asks for a "good handful" can frustrate a modern cook accustomed to grams. It is tempting to explain the phrase as imprecision waiting to be corrected by better instruments. Yet a recipe is not always intended to convey an entire practice to a stranger. It may remind an experienced cook of a procedure already learned by watching and doing. What the page leaves unstated can belong to the knowledge shared by its original users.

Ingredients also resist complete standardisation. Flour absorbs different amounts of water, fruit varies in acidity, and a fire does not supply the same heat merely because it has burned for the same number of minutes. An instruction to add liquid until the dough feels right may respond to this variation more effectively than a fixed quantity followed without adjustment. The sensory judgement is not the absence of a rule; it can be the rule through which changing materials are handled.

This does not make numerical instructions useless or traditional knowledge automatically superior. Measurements can allow novices to begin, reveal errors in memory and support consistent production at a larger scale. They can also expose practices that teachers have performed so habitually that they struggle to describe them. Recording the weight of several successful handfuls may reveal a narrower range than the informal phrase suggests. Precision and practical judgement can inform each other.

The difficulty arises when a recipe is translated across settings while its assumptions remain invisible. A fixed oven temperature may replace a description of the fire, but the two instructions need not produce the same pattern of heat. An ingredient sold under the same name may have different properties. Following the translated text exactly can then depart further from the intended result than an informed adjustment would. Fidelity to a dish is not always fidelity to every number in one transcription.

For historians, such difficulties are evidence as well as obstacles. They reveal what kinds of knowledge the document expected its readers to possess and what materials it took for granted. Reconstructing a dish becomes an experiment in possible practice, not a guaranteed recovery of one original taste. Several workable versions may fit the surviving instructions. The aim should be to explain the choices and limits

of a reconstruction, preserving the distinction between what the recipe says, what a cook supplies from experience and what the present experiment makes newly necessary.

V05. The passage argues that recipe instructions should be understood as: MCQ

A. incomplete records whose defects can always be corrected by replacing words with precise quantities.
B. evidence that traditional cooks obtained better results because they avoided measurement.
C. parts of a practical system involving shared skills, variable materials and context-sensitive interpretation.
D. strictly private reminders that cannot help anyone outside the original community.

Answer: C. parts of a practical system involving shared skills, variable materials and context-sensitive interpretation.

The correct option integrates text with practice and material variation. Numerical replacement is not universally sufficient; measurement can improve practice. Recipes can help novices, so private usefulness alone is also too restrictive.

V06. Why can "add liquid until the dough feels right" constitute a rule? MCQ

A. It specifies a sensory condition that permits adjustment to variable ingredients.
B. It instructs the cook to ignore the properties of the flour.
C. It guarantees that all cooks will recognise the same texture immediately.
D. It is more precise numerically than a stated volume of water.

Answer: A. It specifies a sensory condition that permits adjustment to variable ingredients.

The instruction regulates an outcome while allowing quantities to vary. It relies on material properties and learned recognition, not their absence or universal immediate mastery. Its value does not depend on superior numerical precision.

V07. What does recording the weight of successful handfuls illustrate? MCQ

A. Informal cooking instructions are deliberately designed to conceal exact quantities.
B. Measurement can clarify tacit practice rather than merely replace or invalidate it.
C. Every apparently vague instruction corresponds to a single unchanging weight.
D. Experienced cooks become less skilful when their actions are measured.

Answer: B. Measurement can clarify tacit practice rather than merely replace or invalidate it.

The example shows reciprocal learning between precision and judgement. Deliberate concealment, a universally exact weight and reduced skill are not established. A narrower observed range still need not be one fixed quantity.

V08. Which claim about a reconstructed historical dish is most defensible under the passage?

MCQ

A. It reproduces the original taste because the surviving words were followed literally.
B. It disproves the original recipe if a different modern ingredient requires adjustment.
C. It is historically worthless whenever more than one version fits the instructions.
D. It is a workable interpretation whose choices and uncertainties should be stated.

Answer: D. It is a workable interpretation whose choices and uncertainties should be stated.

The conclusion explicitly permits multiple workable reconstructions with transparent choices. Literal compliance cannot guarantee recovered taste. Modern material differences need not disprove the recipe, and multiplicity is an evidential limit rather than automatic worthlessness.

RC 3 · What the premium purchases

Insurance permits people to exchange an uncertain large loss for a smaller predictable payment. The arrangement works because members of a pool will not all experience the same loss at the same time. It does not make losses disappear. It reorganises who pays for them and when. That distinction becomes important when an insurance scheme is judged solely by whether each participant receives more in claims than was paid in premiums.

A person whose house remains undamaged may receive no claim payment for years and still have benefited from the arrangement. During those years, a serious loss would have been partly borne by the pool. The purchased protection concerns a contingency, not a promise that the contingency will occur. Comparing realised claims with premiums can therefore miss what the contract supplied, just as judging a fire service only by the number of fires at one's own house would be an unusual account of its usefulness.

Pooling nevertheless raises difficult questions about membership and price. If people know more about their own risk than an insurer does, a common premium can appeal most strongly to those expecting larger losses. Lower-risk members may then leave, raising the expected cost of those remaining and putting pressure on premiums again. This is a possible dynamic, not proof that every common-price scheme must unravel. Information, subsidies, rules of participation and reasons for valuing coverage can change the outcome.

Charging each member a price closely matched to predicted risk offers one response, but it changes the distributional purpose of the pool. People facing high unavoidable risks may find coverage unaffordable precisely when they need it most. A community may instead choose to share some of those risks deliberately. The resulting transfer is not necessarily a pricing error; it can be part of the scheme's objective. Whether that objective is justified cannot be answered by actuarial calculation alone.

Good design therefore distinguishes several questions: whether the pool can meet its obligations, whether participation is sustainable and which differences in risk its members intend to share. These

questions interact without becoming identical. A financially balanced scheme can exclude those most exposed, while an inclusive promise can fail if contributions cannot support it. Explaining insurance requires both the arithmetic of uncertain losses and a public account of the commitments embodied in the pool. Neither individual hindsight about claims nor a perfectly differentiated price settles the entire matter.

V09. The passage primarily argues that insurance should be assessed through: MCQ

A. the requirement that every participant eventually receive claims exceeding premiums.
B. contingent protection, financial sustainability and explicit choices about shared risk.
C. risk-based pricing as the only legitimate principle of membership.
D. the elimination of large losses from the community through pooled contributions.

Answer: B. contingent protection, financial sustainability and explicit choices about shared risk.

The correct option covers protection and the three design questions. Positive realised returns for everyone and elimination of losses misunderstand pooling. Exact risk pricing is discussed as one response with distributional costs, not a sole legitimate rule.

V10. A participant pays premiums for years without making a claim. What can be concluded from this alone? MCQ

A. The participant necessarily received a financial return larger than the premiums.
B. The insurer must have charged more than the participant's predicted risk justified.
C. The pool failed to distribute losses among its members.
D. It does not establish lack of benefit, because protection against a possible loss was supplied.

Answer: D. It does not establish lack of benefit, because protection against a possible loss was supplied.

No claim can coexist with valuable protection. The passage does not guarantee a positive realised financial return or diagnose overpricing and pooling failure from that observation alone.

V11. Which change most directly illustrates the membership dynamic described in paragraph three? MCQ

A. Lower-risk members leave a common-premium pool, increasing the expected losses per remaining member.
B. Every member suffers an identical loss on the same day.
C. The insurer invests premium income before paying a claim.
D. High-risk members receive no claims because their feared losses do not occur.

Answer: A. Lower-risk members leave a common-premium pool, increasing the expected losses per remaining member.

Selective exit changes the risk composition and can pressure premiums upward. Simultaneous identical loss threatens diversification but is a different mechanism. Investment and unrealised high-risk losses do not describe membership selection.

V12. Why is a deliberate transfer to high-risk members not necessarily a pricing error? MCQ

A. Predicted risks are always equal across members of an insurance pool.
B. Actuarial calculations cannot contribute to any decision about insurance.
C. Sharing some unavoidable risk can be a chosen objective rather than an accidental departure from exact risk pricing.
D. An inclusive scheme is guaranteed to remain financially sustainable.

Answer: C. Sharing some unavoidable risk can be a chosen objective rather than an accidental departure from exact risk pricing.

The author separates distributive objectives from calculation errors. Risks need not be equal, actuarial work remains necessary, and inclusive promises can fail financially. A justified goal does not remove resource constraints.

RC 4 · Rules that create a game

Rules are frequently treated as the part of a game that limits invention. Players must remain within a boundary, take turns or move pieces in prescribed ways. On this view, creativity enters only where the rules leave something unspecified. Yet many possibilities that count as creative would not exist without the restrictions. A surprising sacrifice in chess depends on what pieces can do and on the value their constrained movements acquire within the game.

The point is not that adding rules always increases creativity. A game can become so rigid that decisions cease to matter, or so elaborate that learning its procedures consumes the pleasure of playing. Restrictions are generative when they create a field of meaningful alternatives. Their effect depends on how they interact, not simply on how many there are. Removing one rule can open a rich new game or dissolve the tensions that made the old one interesting.

Improvisation makes this interaction especially clear. Two players inventing a game may begin with a loose agreement and discover problems through play. A move that is technically permitted may allow one player to win immediately and repeatedly. They may then revise the agreement, not because freedom has disappointed them, but because the discovered freedom makes the remaining choices trivial. A new restriction can restore the possibility of surprise by preventing the same easy resolution from dominating every round.

There is nevertheless a difference between revising the rules together and ignoring them when one is losing. A game requires enough shared expectation for actions to become intelligible. A player cannot defend an unannounced change merely by calling it creative. Whether a departure enriches the activity depends partly on when and how others can recognise and respond to it. Even highly improvisational play relies on forms of consent, attention and continuity.

The relation between rules and freedom is therefore not a contest in which one can grow only by shrinking the other. Rules can establish capacities, obstacles and stakes that make inventive action possible; invention can in turn reveal which rules deserve revision. Neither side is sufficient. A printed rulebook without players produces no game, while unrestricted movement without any shared distinction between a move and an interruption may not produce play at all. The creative object is the activity sustained between participants, whose constraints can be both inherited and reconsidered without being treated as either sacred or dispensable.

V13. Which statement best captures the author's argument? MCQ

A. Shared constraints can generate meaningful creative possibilities and can themselves be revised through play.
B. Creativity begins only when players disregard the rules that define a game.
C. The most elaborate rulebooks necessarily produce the most inventive games.
D. Once agreed, rules should remain unchanged because revision destroys shared expectations.

Answer: A. Shared constraints can generate meaningful creative possibilities and can themselves be revised through play.

The correct answer captures mutual dependence and revisability. Disregard alone lacks shared intelligibility. More rules do not automatically help, and agreed revisions are distinguished from unannounced violations.

V14. Why might players prohibit a move that previously allowed an immediate easy victory? MCQ

A. The players have decided that winning should no longer have any place in the game.
B. Any strategically effective move is incompatible with creativity.
C. The restriction can restore meaningful alternatives and uncertainty to the remaining play.
D. A game becomes fair only when every possible move has exactly the same result.

Answer: C. The restriction can restore meaningful alternatives and uncertainty to the remaining play.

Blocking a dominant trivial resolution can restore choice and surprise. The passage does not remove winning, reject effective strategy or require identical outcomes; identical outcomes would undermine meaningful alternatives.

V15. What distinguishes collaborative rule revision from an unannounced violation? MCQ

A. Revision is creative only when it reduces the number of rules.
B. A violation becomes acceptable whenever it prevents the player from losing.
C. Revision must reproduce the rules of an older established game.
D. Revision can preserve shared recognition and response, whereas a unilateral change may defeat those conditions.

Answer: D. Revision can preserve shared recognition and response, whereas a unilateral change may defeat those conditions.

The passage makes shared expectation and consent central. Rule counts, a losing player's advantage and conformity to an older game are not its criteria.

V16. The chess-sacrifice example primarily shows that: MCQ

A. sacrificing a valuable piece is always the most creative available move.
B. an inventive move can derive its significance from restrictions constituting the game.
C. creative action is restricted to games with fixed physical pieces.
D. players must memorise every rule before they can recognise any surprising action.

Answer: B. an inventive move can derive its significance from restrictions constituting the game.

The example demonstrates constitutive rather than merely limiting rules. It neither ranks every sacrifice nor confines creativity to board games. A universal requirement of complete memorisation is also absent.

V17. Choose the best summary.

Removing a statue from a public square does not necessarily remove the person it depicts from history. A square can honour a figure in a way that a museum exhibition examining the same figure does not. The disagreement may therefore concern the form of public recognition rather than whether the past should be remembered at all. Moving the statue can still conceal or simplify history if the new arrangement suppresses difficult evidence. But keeping it in place can also simplify history by presenting an inherited honour as if it required no continuing justification. The decision needs an account of what each setting invites the public to recognise and evaluate.

MCQ

A. Historical figures can be remembered accurately only after their statues have been placed in museums.
B. Keeping a statue guarantees historical continuity, whereas removing it makes the past inaccessible.
C. Public honours should never require renewed justification once a community has established them.
D. Debates over statues concern forms of recognition as well as remembrance, and either removal or retention can simplify history.

Answer: D. Debates over statues concern forms of recognition as well as remembrance, and either removal or retention can simplify history.

The correct summary preserves both the distinction and the two-sided qualification. Exclusive museum accuracy, guaranteed erasure and permanent immunity from justification are each stronger than, or contrary to, the paragraph.

V18. Choose the best summary.

An animal's playful action may resemble a movement used later in hunting or escape, but resemblance alone does not prove that practice for adulthood is its only function. Play can alter relationships among companions, allow exploration of an unfamiliar object or arise when immediate demands are low. These possibilities need not exclude one another. A behaviour can have several consequences, only some of which explain why it persists. Studying play therefore requires comparing contexts and outcomes rather than assigning a training purpose to every apparently unnecessary movement. The fact that an action is not immediately directed towards food or safety does not make its value either obvious or nonexistent. MCQ

A. Play may have several consequences, so its value and persistence require contextual evidence rather than automatic assignment to future training.
B. Play cannot prepare animals for adult behaviour because it occurs when immediate demands are low.
C. Every consequence of playful behaviour explains equally well why that behaviour has persisted.
D. Actions unrelated to immediate food or safety are biologically valueless unless they strengthen social relationships.

Answer: A. Play may have several consequences, so its value and persistence require contextual evidence rather than automatic assignment to future training.

The correct answer retains multiple possibilities and evidential caution. The paragraph does not deny training, equate every consequence with explanation or make social bonding the exclusive alternative source of value.

V19. Choose the best position for the missing sentence.

Sentence: The cast could thus travel to a classroom while the original remained in the collection.

(1) A museum wishing to teach students about a particularly fragile ancient sculpture faced a practical difficulty: repeated transport could damage the object. Staff made a mould and used it to produce a durable replica with the same overall shape and visible surface features. (2) Students could handle this substitute and inspect features that were hard to see behind a display barrier. (3) It did not preserve every property of the original material, and that limitation had to be explained. (4) The teaching value depended on identifying which questions the replica could answer and which still required direct examination of the original sculpture in its protected setting. MCQ

A. Position (1)
B. Position (3)
C. Position (2)
D. Position (4)

Answer: C. Position (2)

Position (2) follows creation of the replica and explains its movement into the classroom, preparing “this substitute”. Earlier placement lacks the cast’s introduction; later placements interrupt either the handling example or the transition to material limits.

V20. Choose the best position for the missing sentence.

Sentence: This alternative route was longer, but it remained usable when the direct connection failed.

A village had depended on a single bridge to reach its nearest market. When heavy rain closed the crossing, deliveries stopped even though the market itself remained open. (1) Planners first proposed strengthening the same bridge. They then considered improving a road that reached another crossing several kilometres away. (2) The choice was therefore not simply between a strong bridge and a weak one, but between two different ways of maintaining access. (3) Assessing the second proposal required considering the value of backup access as well as everyday travel time. (4) A route that receives little use in ordinary conditions can still be important during a disruption. MCQ

A. Position (1)
B. Position (2)
C. Position (3)
D. Position (4)

Answer: B. Position (2)

Position (2) introduces the alternative road's relevant trade-off immediately after that road appears. It supports "therefore" and the later backup discussion. The other positions lack the referent or separate the explanation from the inference it enables.

V21. Arrange the sentences and enter their numbers without spaces.

1. The new coastline on the map therefore reflected these two contributions: a physical change and a difference in when the boundary was measured.
2. On this return visit, high tide covered a strip exposed at the time of the earlier survey.
3. A surveyor returned to a shore and found that its apparent boundary had shifted.
4. This tidal mismatch accounted for only part of the shift; measurements of the remaining difference indicated erosion as well. TITA

Answer: 3241

3 introduces the return and shifted boundary; 2's "this return visit" supplies the tidal mismatch. 4 refers to that mismatch and adds erosion as a second contribution. 1's "these two contributions" requires both explanations and concludes the paragraph.

V22. Arrange the sentences and enter their numbers without spaces.

1. Only after recording those judgements did they learn which samples had been labelled as expensive.
2. This delayed disclosure produced a baseline of judgements made without price information.
3. Participants tasted several unmarked drinks and rated their flavour.
4. Comparing that baseline with a later labelled trial could then help estimate an effect of the price information. TITA

Answer: 3124

3 establishes unmarked tasting and judgements; 1 places disclosure after those judgements. 2's "This delayed disclosure" names the procedure's baseline, and 4's "that baseline" develops the comparison. The reference chain fixes 3–1–2–4.

V23. Four sentences form a coherent paragraph. Enter the odd sentence number.

1. A library's catalogue can direct readers to a book even when it is temporarily on loan.
2. Books with unusually large pages may require taller shelves than ordinary volumes.
3. The record represents the library's holdings rather than only the objects currently on its shelves.
4. Confusing those two things would make a borrowed book appear to have left the collection permanently.
5. Information about availability must therefore be recorded separately from information about ownership. TITA

Answer: 2

1–3–4–5 distinguish catalogue holdings, current location and availability. Shelf height is a physical storage issue that does not develop the distinction.

V24. Four sentences form a coherent paragraph. Enter the odd sentence number.

1. A promise to deliver tomorrow creates an expectation about a future action.
2. Breaking it can therefore matter even when the promised object has little monetary value.
3. The recipient may have arranged other activities around the expected delivery.
4. The consequence of failure includes those dependent plans, not merely the price of the missing object.
5. Delivery vehicles are often painted in colours that make their operators easy to identify. TITA

Answer: 5

1–3–2–4 connect a promise to dependent plans and explain why its breach matters beyond object value. Vehicle colours concern identification, not the consequences of the promise.

DILR · 22 questions

What changed in the basket index?

A standard basket contains 90 items of types A, B and C. Base prices per item are ₹2, ₹3 and ₹5 respectively. The basket's base cost is ₹270 and its A:B quantity ratio is 4:3. In the next period A's price rises 25%, B's rises 10% and C's rises 20%. Basket quantities remain fixed unless a question explicitly changes them.

Any additional condition or change in a question applies only to that question.

D01. How many C items does the standard basket contain? TITA

Answer: 20

Write quantities A = 4t, B = 3t and C = 90 − 7t. The base-cost equation is 8t + 9t + 5(90 − 7t) = 270, giving t = 10. Thus quantities are 40, 30 and 20. New prices are ₹2.50, ₹3.30 and ₹6.00, and new contributions are ₹100, ₹99 and ₹120. Base contributions were ₹80, ₹90 and ₹100.

C = 90 − 70 = 20.

D02. What is the new cost of the unchanged basket? MCQ

A. 297
B. 319
C. 324
D. 309

Answer: B. 319

Write quantities A = 4t, B = 3t and C = 90 − 7t. The base-cost equation is 8t + 9t + 5(90 − 7t) = 270, giving t = 10. Thus quantities are 40, 30 and 20. New prices are ₹2.50, ₹3.30 and ₹6.00, and new contributions are ₹100, ₹99 and ₹120. Base contributions were ₹80, ₹90 and ₹100.

100 + 99 + 120 = ₹319.

D03. At the new prices, how many rupees are saved if ten B items are replaced by ten A items? TITA

Answer: 8

Write quantities A = 4t, B = 3t and C = 90 − 7t. The base-cost equation is 8t + 9t + 5(90 − 7t) = 270, giving t = 10. Thus quantities are 40, 30 and 20. New prices are ₹2.50, ₹3.30 and ₹6.00, and new contributions are ₹100, ₹99 and ₹120. Base contributions were ₹80, ₹90 and ₹100.

The per-item saving is 3.30 − 2.50 = ₹0.80; ten replacements save ₹8.

D04. Which type or types contribute the greatest absolute increase in basket cost? MCQ

A. B only
B. C only
C. A only
D. A and C equally

Answer: D. A and C equally

Write quantities A = 4t, B = 3t and C = 90 − 7t. The base-cost equation is 8t + 9t + 5(90 − 7t) = 270, giving t = 10. Thus quantities are 40, 30 and 20. New prices are ₹2.50, ₹3.30 and ₹6.00, and new contributions are ₹100, ₹99 and ₹120. Base contributions were ₹80, ₹90 and ₹100.

A adds ₹20, B adds ₹9, and C adds ₹20.

D05. What is the new fixed-basket price index, with the base period set to 100, rounded to two decimals? MCQ

A. 118.15
B. 117.00
C. 120.00
D. 118.00

Answer: A. 118.15

Write quantities A = 4t, B = 3t and C = 90 − 7t. The base-cost equation is 8t + 9t + 5(90 − 7t) = 270, giving t = 10. Thus quantities are 40, 30 and 20. New prices are ₹2.50, ₹3.30 and ₹6.00, and new contributions are ₹100, ₹99 and ₹120. Base contributions were ₹80, ₹90 and ₹100.

The index is 319/270 × 100 = 118.148..., which rounds to 118.15.

Two machines and one technician

Five jobs A, B, C, D and E must be completed. Times are measured in whole minutes from time 0. Every start time is a nonnegative integer. Jobs cannot be interrupted, and two jobs cannot use the same

machine simultaneously.
Job | Machine(s) | Duration | Restriction
A | 1 | 2 | Starts at 0
B | 2 | 2 | Starts at 1
C | 1 | 1 | Starts only after A finishes
D | 2 | 1 | Starts only after B finishes
E | 1 and 2 | 2 | Starts only after both C and D finish
C and D each additionally need the same single technician throughout their execution, so they cannot overlap. That technician is unavailable from time 4 inclusive to time 5 exclusive. No other job needs the technician. One job may start exactly when another finishes. Idle time is permitted. Every job must finish by time 8. Two schedules are different if at least one of C, D or E has a different start time.

Any additional condition or change in a question applies only to that question.

D06. What is the earliest possible time at which all jobs are complete? TITA

Answer: 6

A occupies machine 1 during [0,2), and B occupies machine 2 during [1,3). Consequently C must start at $c \geq 2$ and D at $d \geq 3$. Their one-minute durations and the common technician imply $c \neq d$; the technician's outage forbids $c=4$ and $d=4$. E must start at $e \geq \max(c+1, d+1)$ and $e \leq 6$. Enumerating these integer bounds gives:
C start | D start | E start | Final completion
2 | 3 | 4 | 6
2 | 3 | 5 | 7
2 | 3 | 6 | 8
2 | 5 | 6 | 8
3 | 5 | 6 | 8
5 | 3 | 6 | 8
All unused machine or technician time is allowed to remain idle.

C can run during [2,3), D during [3,4), and E during [4,6). The two one-minute technician jobs cannot both finish before 4, so final completion before 6 is impossible.

D07. How many different complete schedules meet all the conditions? MCQ

A. 4
B. 6
C. 5
D. 8

Answer: B. 6

A occupies machine 1 during [0,2), and B occupies machine 2 during [1,3). Consequently C must start at c≥2 and D at d≥3. Their one-minute durations and the common technician imply c≠d; the technician's outage forbids c=4 and d=4. E must start at e≥max(c+1,d+1) and e≤6. Enumerating these integer bounds gives:
C start | D start | E start | Final completion
2 | 3 | 4 | 6
2 | 3 | 5 | 7
2 | 3 | 6 | 8
2 | 5 | 6 | 8
3 | 5 | 6 | 8
5 | 3 | 6 | 8
All unused machine or technician time is allowed to remain idle.

The full enumeration has six distinct triples of start times for C, D and E.

D08. If E starts at time 6, how many different schedules are possible? TITA

Answer: 4

A occupies machine 1 during [0,2), and B occupies machine 2 during [1,3). Consequently C must start at c≥2 and D at d≥3. Their one-minute durations and the common technician imply c≠d; the technician's outage forbids c=4 and d=4. E must start at e≥max(c+1,d+1) and e≤6. Enumerating these integer bounds gives:
C start | D start | E start | Final completion
2 | 3 | 4 | 6
2 | 3 | 5 | 7
2 | 3 | 6 | 8
2 | 5 | 6 | 8
3 | 5 | 6 | 8
5 | 3 | 6 | 8
All unused machine or technician time is allowed to remain idle.

The possible (C,D) start pairs are (2,3), (2,5), (3,5) and (5,3): four schedules.

D09. If C starts at time 3 and D at time 5, for how many minutes in total is machine 1 idle from time 0 until E starts? TITA

Answer: 3

A occupies machine 1 during [0,2), and B occupies machine 2 during [1,3). Consequently C must start at $c \geq 2$ and D at $d \geq 3$. Their one-minute durations and the common technician imply $c \neq d$; the technician's outage forbids $c=4$ and $d=4$. E must start at $e \geq \max(c+1, d+1)$ and $e \leq 6$. Enumerating these integer bounds gives:

C start | D start | E start | Final completion
2 | 3 | 4 | 6
2 | 3 | 5 | 7
2 | 3 | 6 | 8
2 | 5 | 6 | 8
3 | 5 | 6 | 8
5 | 3 | 6 | 8

All unused machine or technician time is allowed to remain idle.

D finishes at 6, forcing E to start at 6 to meet the deadline. Before time 6, machine 1 works for two minutes on A and one minute on C. Its idle time is $6-2-1=3$ minutes: [2,3) and [4,6).

D10. If every job must instead finish by time 7, which start-time pair for C and D is possible? MCQ

A. C at 2, D at 3
B. C at 3, D at 5
C. C at 5, D at 3
D. C at 2, D at 5

Answer: A. C at 2, D at 3

A occupies machine 1 during [0,2), and B occupies machine 2 during [1,3). Consequently C must start at $c \geq 2$ and D at $d \geq 3$. Their one-minute durations and the common technician imply $c \neq d$; the technician's outage forbids $c=4$ and $d=4$. E must start at $e \geq \max(c+1, d+1)$ and $e \leq 6$. Enumerating these integer bounds gives:

C start | D start | E start | Final completion
2 | 3 | 4 | 6
2 | 3 | 5 | 7
2 | 3 | 6 | 8
2 | 5 | 6 | 8
3 | 5 | 6 | 8
5 | 3 | 6 | 8

All unused machine or technician time is allowed to remain idle.

Only the first two rows finish by 7. Both have C starting at 2 and D at 3. Each other listed pair forces E to start at 6, so completion is at 8.

Turnout and a tied election

Booths A, B and C have 1250, 1250 and 1000 registered voters respectively. The same percentage of registered voters votes at each booth. Every voter casts one ballot. Invalid ballots are 10% of votes cast at A, 20% at B and 12.5% at C. There are 2400 valid ballots overall. All valid ballots go to candidates R or S. Their valid-vote ratios R:S are 5:4 at A, 3:5 at B and 4:3 at C.

Any additional condition or change in a question applies only to that question.

D11. What is the common turnout percentage? TITA

Answer: 80

If the common turnout fraction is t, valid ballots total $t(1250 \times 0.9 + 1250 \times 0.8 + 1000 \times 0.875) = 3000t = 2400$. Thus $t = 0.8$.
Booth | Cast | Valid | R | S
A | 1000 | 900 | 500 | 400
B | 1000 | 800 | 300 | 500
C | 800 | 700 | 400 | 300

$t = 0.8$, so turnout is 80%.

D12. What is the overall outcome based on valid ballots? MCQ

A. S wins by 100
B. R wins by 100
C. Tie
D. R wins by 200

Answer: C. Tie

If the common turnout fraction is t, valid ballots total $t(1250 \times 0.9 + 1250 \times 0.8 + 1000 \times 0.875) = 3000t = 2400$. Thus $t = 0.8$.
Booth | Cast | Valid | R | S
A | 1000 | 900 | 500 | 400
B | 1000 | 800 | 300 | 500
C | 800 | 700 | 400 | 300

Both candidates receive 1200 valid votes.

D13. How many invalid ballots are cast in total? TITA

Answer: 400

If the common turnout fraction is t, valid ballots total t(1250 × 0.9 + 1250 × 0.8 + 1000 × 0.875) = 3000t = 2400. Thus t = 0.8.
Booth | Cast | Valid | R | S
A | 1000 | 900 | 500 | 400
B | 1000 | 800 | 300 | 500
C | 800 | 700 | 400 | 300

Ballots cast total 2800; subtract 2400 valid ballots to obtain 400 invalid ballots.

D14. If a recount transfers 10% of S's booth-B votes to R, leaving all else unchanged, what is R's winning margin? MCQ

A. 150
B. 50
C. 200
D. 100

Answer: D. 100

If the common turnout fraction is t, valid ballots total t(1250 × 0.9 + 1250 × 0.8 + 1000 × 0.875) = 3000t = 2400. Thus t = 0.8.
Booth | Cast | Valid | R | S
A | 1000 | 900 | 500 | 400
B | 1000 | 800 | 300 | 500
C | 800 | 700 | 400 | 300

S has 500 votes at B, so 50 votes transfer. R gains 50 and S loses 50, producing a 100-vote margin.

Number holders and true statements

Five people A, B, C, D and E hold the integers 1, 2, 3, 4 and 5, one distinct integer each. They make the following statements.
A: 'B's number is greater than mine.'
B: 'C's number is even.'
C: 'D's number is either 1 or 5.'
D: 'A's and E's numbers add to 6.'
E: 'B's number is 3.'
Exactly two of these five statements are true. The numbers held by the two people whose statements are true add to 7. A statement's truth is determined only by the number assignment; there is no additional rule about permanent truth-tellers or liars.

Any additional condition or change in a question applies only to that question.

D15. How many assignments of numbers satisfy all the information? TITA

Answer: 5

The two truthful speakers must hold numbers 2 and 5, or 3 and 4, since their distinct numbers total 7. For each assignment of the five numbers, calculate all five statements and retain it only if exactly two are true and those speakers' numbers total 7. The complete possibilities are:
A | B | C | D | E | Truthful speakers
2 | 3 | 1 | 4 | 5 | AE
2 | 4 | 5 | 1 | 3 | AC
2 | 5 | 4 | 3 | 1 | AB
4 | 5 | 1 | 3 | 2 | AD
5 | 4 | 2 | 3 | 1 | BD
For example, in the first row only A's comparison (3>2) and E's claim (B=3) are true; those speakers hold 2 and 5. The other rows are checked in the same way.

There are five assignments in the exhaustive table.

D16. Which pair cannot be exactly the two people making true statements? MCQ

A. A and D
B. C and E
C. A and C
D. A and B

Answer: B. C and E

The two truthful speakers must hold numbers 2 and 5, or 3 and 4, since their distinct numbers total 7. For each assignment of the five numbers, calculate all five statements and retain it only if exactly two are true and those speakers' numbers total 7. The complete possibilities are:
A | B | C | D | E | Truthful speakers
2 | 3 | 1 | 4 | 5 | AE
2 | 4 | 5 | 1 | 3 | AC
2 | 5 | 4 | 3 | 1 | AB
4 | 5 | 1 | 3 | 2 | AD
5 | 4 | 2 | 3 | 1 | BD
For example, in the first row only A's comparison (3>2) and E's claim (B=3) are true; those speakers hold 2 and 5. The other rows are checked in the same way.

The feasible truthful pairs are AE, AC, AB, AD and BD. CE does not occur, whereas each of AB, AC and AD does.

D17. If E holds 1, what is the largest possible product of the numbers held by A and C? TITA

Answer: 10

The two truthful speakers must hold numbers 2 and 5, or 3 and 4, since their distinct numbers total 7. For each assignment of the five numbers, calculate all five statements and retain it only if exactly two are true and those speakers' numbers total 7. The complete possibilities are:
A | B | C | D | E | Truthful speakers
2 | 3 | 1 | 4 | 5 | AE
2 | 4 | 5 | 1 | 3 | AC
2 | 5 | 4 | 3 | 1 | AB
4 | 5 | 1 | 3 | 2 | AD
5 | 4 | 2 | 3 | 1 | BD
For example, in the first row only A's comparison (3>2) and E's claim (B=3) are true; those speakers hold 2 and 5. The other rows are checked in the same way.

Two assignments have E=1: (A,B,C,D,E)=(2,5,4,3,1) and (5,4,2,3,1). The products A×C are 8 and 10 respectively. Thus the maximum is 10.

D18. What is the largest number that A can hold? MCQ

A. 2
B. 3
C. 4
D. 5

Answer: D. 5

The two truthful speakers must hold numbers 2 and 5, or 3 and 4, since their distinct numbers total 7. For each assignment of the five numbers, calculate all five statements and retain it only if exactly two are true and those speakers' numbers total 7. The complete possibilities are:
A | B | C | D | E | Truthful speakers
2 | 3 | 1 | 4 | 5 | AE
2 | 4 | 5 | 1 | 3 | AC
2 | 5 | 4 | 3 | 1 | AB
4 | 5 | 1 | 3 | 2 | AD
5 | 4 | 2 | 3 | 1 | BD
For example, in the first row only A's comparison (3>2) and E's claim (B=3) are true; those speakers hold 2 and 5. The other rows are checked in the same way.

A can hold 2, 4 or 5. In the final row A holds 5 and only B and D are truthful, holding 4 and 3. Hence 5 is attainable and is the maximum.

Three phases of filling a reservoir

An empty 720-litre reservoir is filled using inlet P at 30 litres/minute and inlet Q at 20 litres/minute. A leak removes 10 litres/minute whenever water is present. First only P runs for a minutes; next P and Q run together for b minutes; finally only Q runs for c minutes. The phase durations satisfy a:b = 3:2 and c = 2b. The reservoir becomes exactly full at the end of the third phase and never overflows.

Any additional condition or change in a question applies only to that question.

D19. How many minutes does the middle phase last? TITA

Answer: 8

Net filling rates in the phases are 20, 40 and 10 litres/minute. Put a = 3t, b = 2t and c = 4t. Then total water is 60t + 80t + 40t = 180t = 720, giving t = 4 and durations 12, 8 and 16 minutes. The phases contribute 240, 320 and 160 litres. Total time is 36 minutes; gross inflow is 1080 litres and leak loss is 360 litres.

b = 2t = 8.

D20. What fraction of final water is added during the middle phase? MCQ

A. 2/5
B. 4/9
C. 1/2
D. 1/3

Answer: B. 4/9

Net filling rates in the phases are 20, 40 and 10 litres/minute. Put a = 3t, b = 2t and c = 4t. Then total water is 60t + 80t + 40t = 180t = 720, giving t = 4 and durations 12, 8 and 16 minutes. The phases contribute 240, 320 and 160 litres. Total time is 36 minutes; gross inflow is 1080 litres and leak loss is 360 litres.

Its 320 litres form 320/720 = 4/9 of the final contents.

D21. How many litres escape through the leak during the entire process? TITA

Answer: 360

Net filling rates in the phases are 20, 40 and 10 litres/minute. Put a = 3t, b = 2t and c = 4t. Then total water is 60t + 80t + 40t = 180t = 720, giving t = 4 and durations 12, 8 and 16 minutes. The phases contribute 240, 320 and 160 litres. Total time is 36 minutes; gross inflow is 1080 litres and leak loss is 360 litres.

Water is present after filling starts, and the leak operates for 36 minutes: 10 × 36 = 360 litres.

D22. If the leak were blocked but the same inlet schedule were run in a larger initially empty reservoir, what capacity would just avoid overflow? MCQ

A. 1200
B. 960
C. 900
D. 1080

Answer: D. 1080

Net filling rates in the phases are 20, 40 and 10 litres/minute. Put a = 3t, b = 2t and c = 4t. Then total water is 60t + 80t + 40t = 180t = 720, giving t = 4 and durations 12, 8 and 16 minutes. The phases contribute 240, 320 and 160 litres. Total time is 36 minutes; gross inflow is 1080 litres and leak loss is 360 litres.

Gross inflow is 30(12 + 8) + 20(8 + 16) = 600 + 480 = 1080 litres.

QA · 22 questions

Q01. A retailer gives a discount of 20% on an article's marked price and still gains 25% on its cost. By what percentage is the marked price above cost? MCQ

A. 56.25
B. 45
C. 50
D. 60

Answer: A. 56.25

Let cost be 100. The selling price is 125 and equals 80% of marked price. Marked price is therefore 125/0.8 = 156.25. Its excess over cost is 56.25%. Profit and discount use different bases.

Q02. Four men and six women can complete a job in 10 days, while six men and three women complete the same job in 8 days. Every man has the same constant rate, as does every woman. How many women working alone as a team would complete the job in 15 days? TITA

Answer: 16

Let individual daily rates be m and w. Then 4m + 6w = 1/10 and 6m + 3w = 1/8. Doubling the second and subtracting the first gives 8m = 3/20, so m = 3/160. The first equation then gives w = 1/240. To finish in 15 days, the required number of women is 240/15 = 16.

Q03. A runs 400 metres in 50 seconds and B runs 400 metres in 60 seconds, both at constant speeds. In a 400-metre race, A gives B an 80-metre head start. B finishes before A. By how many seconds? MCQ

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

Answer: C. 2

A must still cover 400 metres and takes 50 seconds. B covers only 320 metres at 400/60 m/s, requiring 320×60/400 = 48 seconds. Thus B wins by 2 seconds. The start is a distance advantage, not an 80-metre gap maintained throughout.

Q04. The average of 12 numbers is 18. The average of the first seven is 16 and the average of the last six is 21. What is the seventh number? MCQ

A. 18
B. 20
C. 24
D. 22

Answer: D. 22

The total of all 12 numbers is 216. The first seven sum to 112 and the last six sum to 126. Adding these subgroup totals counts the seventh number twice and every other number once. Therefore the seventh number is 112 + 126 − 216 = 22.

Q05. Vessel A contains 40 litres of milk and water in the ratio 1:1. Vessel B contains 60 litres in the ratio 1:2. Some thoroughly mixed liquid is transferred from A to B, after which B's milk–water ratio becomes 3:5. How many litres are transferred? TITA

Answer: 20

A's milk fraction is 1/2, while B initially has 20 litres of milk. If x litres are transferred, B has 20 + x/2 litres of milk in 60 + x litres. Thus (20 + x/2)/(60 + x) = 3/8. This gives 160 + 4x = 180 + 3x, so x = 20 litres.

Q06. A sum invested at a fixed positive annual rate, compounded annually, becomes ₹12,100 after two years and ₹14,641 after four years. What simple interest would the original principal earn in three years at that same annual rate? MCQ

A. 2500
B. 3000
C. 3300
D. 3600

Answer: B. 3000

The two-year growth factor is 14,641/12,100 = 1.21. Thus the positive annual factor is 1.1 and the rate is 10%. Original principal is 12,100/1.21 = ₹10,000. Three-year simple interest is 10,000×0.10×3 = ₹3,000.

Q07. A tiled floor is laid in rows. The first row has 5 tiles and each later row has 3 more tiles than the row before it. If exactly 670 tiles are used, how many rows are there? MCQ

A. 18
B. 22
C. 20
D. 25

Answer: C. 20

With n rows the tile counts form an arithmetic progression with first term 5 and common difference 3, so the total is $(n/2)(2 \times 5 + 3(n - 1)) = n(3n + 7)/2$. Setting this equal to 670 gives $3n^2 + 7n - 1340 = 0$, whose positive root is $n = 20$. Check: $20 \times 67/2 = 670$.

Q08. A and B start simultaneously from diametrically opposite points of a circular track 600 metres long, moving in opposite directions. A runs at 5 m/s but rests for 20 seconds immediately after each completed lap. B runs continuously at 3 m/s. How many times do they meet during the first 400 seconds? TITA

Answer: 5

A's full run–rest cycle lasts 120 + 20 = 140 seconds. By 400 seconds, A has completed two such cycles and another 120 seconds of running: distance 1,800 m. B covers 1,200 m. Their cumulative opposite-direction travel grows continuously and strictly, even while A rests. Starting half a lap apart, meetings occur when this total equals 300,900,1500,2100,2700,... metres. The total reaches 3,000 m by 400 seconds, so exactly five meeting thresholds are crossed.

Q09. A father is currently three times as old as his son. Eight years ago he was five times as old as his son. After how many years will he be twice his son's age? MCQ

A. 16
B. 8
C. 12
D. 20

Answer: A. 16

If the son is s now, the father is 3s. Eight years ago, $3s - 8 = 5(s - 8)$, giving $s = 16$ and father's age 48. After t years, $48 + t = 2(16 + t)$, so $t = 16$.

Q10. A person's monthly income and expenditure are initially in the ratio 5:4. Income then rises by 20% and expenditure by 10%. Monthly savings increase by ₹3,600. What was the original monthly income, in rupees? TITA

Answer: 30000

Write original income and expenditure as 5x and 4x; savings are x. After the increases they become 6x and 4.4x, so savings are 1.6x. The increase 0.6x equals 3,600, giving x = 6,000. Original income is 5x = ₹30,000.

Q11. Real numbers p and q satisfy p + q = 4 and pq = −5. Find $p^4 + q^4$. MCQ

A. 576
B. 676
C. 626
D. 726

Answer: C. 626

First $p^2 + q^2 = (p + q)^2 - 2pq = 16 + 10 = 26$. Squaring this sum counts $2p^2q^2$ in addition to $p^4 + q^4$. Therefore the required value is $26^2 - 2\times25 = 626$.

Q12. How many integers x between 1 and 10 inclusive satisfy $[(x - 1)(x - 4)]/[(x - 2)(x - 6)] \geq 0$? The expression must be defined. MCQ

A. 5
B. 6
C. 8
D. 7

Answer: D. 7

The critical points are 1,2,4,6. The expression is non-negative on (−∞,1], (2,4] and (6,∞); the denominator excludes 2 and 6. In the specified integer range, the allowed values are 1,3,4,7,8,9,10. Their count is seven.

Q13. A real number x satisfies the equation $\log_2(\log_3 x) = 2$, with both logarithms defined. What is x? TITA

Answer: 81

The outer logarithm gives $\log_3 x = 2^2 = 4$. Therefore $x = 3^4 = 81$. This is within the domain: $x > 0$ and $\log_3 x > 0$, so $x > 1$. No additional branch is introduced by logarithms.

Q14. How many ordered pairs of positive integers (x,y) satisfy 3x + 5y = 47? MCQ

A. 2
B. 3
C. 4
D. 5

Answer: B. 3

Modulo 3, 2y ≡ 2, so y ≡ 1 modulo 3. Positivity of x limits y to at most 8. Hence y can be 1,4,7, giving x = 14,9,4 respectively. These three ordered pairs exhaust all possibilities.

Q15. As x varies over all real numbers, the expression $(x^2 + 4x + 5)/(x^2 + 2x + 2)$ attains a minimum m and a maximum M. What is mM? MCQ

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

Answer: C. 1

Put y = x + 1 and let the expression equal r. Then $r(y^2 + 1) = y^2 + 2y + 2$, or $(r - 1)y^2 - 2y + (r - 2) = 0$. Real y requires discriminant $4 - 4(r - 1)(r - 2) \geq 0$, equivalent to $r^2 - 3r + 1 \leq 0$. Thus extremes are $(3 - \sqrt{5})/2$ and $(3 + \sqrt{5})/2$, whose product is 1. The denominator is always positive.

Q16. Two chords AB and CD intersect inside a circle at P. AP = 4 cm, PB = 9 cm and CP = 3 cm. The circle has radius 8 cm. What is the square of the perpendicular distance from the centre to chord CD? MCQ

A. 15/4
B. 25/4
C. 39/4
D. 31/4

Answer: D. 31/4

By the intersecting-chords theorem, CP×PD = AP×PB = 36, so PD = 12 and CD = 15. The perpendicular from the centre bisects the chord. Hence the squared distance is $8^2 - (15/2)^2 = 64 - 225/4 = 31/4$.

Q17. A right triangle has perimeter 120 cm and area 600 cm². What is the square of the distance, in cm², between its incentre and circumcentre? TITA

Answer: 125

Let the legs be a,b and hypotenuse c. Then ab = 1200 and a + b = 120 − c. Using $a^2 + b^2 = c^2$ gives $(120 - c)^2 - 2400 = c^2$, hence c = 50. The legs are 30 and 40, and inradius is (30 + 40 − 50)/2 = 10. Place the right angle at (0,0) with legs on the axes. Incentre is (10,10); circumcentre is the midpoint of the hypotenuse, (15,20). Squared separation is $5^2 + 10^2 = 125$. Check with Euler's relation: $R^2 - 2Rr = 625 - 500 = 125$.

Q18. A square has perimeter 24 cm. What is the square of the diameter of its circumcircle, in cm²? MCQ

A. 36
B. 72
C. 48
D. 144

Answer: B. 72

Each side is 24/4 = 6 cm. The circumcircle's diameter is a diagonal of the square. By Pythagoras, its square is $6^2 + 6^2 = 72$ cm².

Q19. Find the remainder when $2^1 + 2^2 + 2^3 + \ldots + 2^{50}$ is divided by 7. TITA

Answer: 6

Powers of 2 modulo 7 repeat 2,4,1. Each block of three powers sums to 7, contributing remainder 0. The first 48 powers form 16 blocks. The last two have remainders 2 and 4, so the required remainder is 6.

Q20. How many positive divisors of 1,440 are not perfect squares? MCQ

A. 24
B. 32
C. 36
D. 30

Answer: D. 30

Factor $1,440 = 2^5 \times 3^2 \times 5$. It has $(5 + 1)(2 + 1)(1 + 1) = 36$ positive divisors. Square divisors have even exponents: three choices for the exponent of 2, two for 3 and one for 5. Thus there are 6 square divisors and 36 − 6 = 30 non-square divisors.

Q21. Eight distinct books comprise three mathematics books, two physics books and three literature books. They are arranged in a row so that all mathematics books are consecutive and the two physics books are not adjacent. How many arrangements are possible? TITA

Answer: 2880

Treat the three mathematics books as one block. There are six objects, internally ordered in 3! ways, giving 6!×3! arrangements before restricting physics. Forbidden arrangements also group the two physics books into one block: 5!×2!×3!. Subtracting gives 4,320 − 1,440 = 2,880.

Q22. How many integers n satisfy $3 < (2n - 1)/5 \leq 7$? MCQ

A. 9
B. 10
C. 11
D. 18

Answer: B. 10

Multiply through by 5 to get $15 < 2n - 1 \leq 35$, then add 1 to get $16 < 2n \leq 36$, so $8 < n \leq 18$. The integers 9, 10, ..., 18 qualify, which is 10 values.