INDEPENDENT CAT PREPARATION / ORIGINAL MOCK

CAT 2026 Prediction Paper 05

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: Decode the constraints.

Quick answer key

V01 A	**V02** C	**V03** B	**V04** D	**V05** D	**V06** B
V07 C	**V08** A	**V09** C	**V10** A	**V11** D	**V12** B
V13 B	**V14** D	**V15** A	**V16** C	**V17** A	**V18** D
V19 C	**V20** B	**V21** 3214	**V22** 2314	**V23** 3	**V24** 4
D01 3	**D02** A	**D03** 3	**D04** A	**D05** A	**D06** 36000
D07 C	**D08** 6	**D09** 48000	**D10** A	**D11** 25	**D12** A
D13 162	**D14** D	**D15** 4	**D16** D	**D17** 2	**D18** B
D19 4	**D20** D	**D21** 21	**D22** A	**Q01** B	**Q02** 1200
Q03 D	**Q04** A	**Q05** 9	**Q06** C	**Q07** D	**Q08** 40
Q09 B	**Q10** 12	**Q11** D	**Q12** A	**Q13** 5	**Q14** C
Q15 D	**Q16** A	**Q17** 13	**Q18** C	**Q19** 5	**Q20** A
Q21 22	**Q22** C				

VARC · 24 questions

RC 1 · When displays deserve belief

A conspicuous animal display can attract predators as well as mates. This apparent extravagance has encouraged the idea that a signal is credible because producing it is costly: a weak animal cannot afford the display that a strong animal sustains. There is an important insight here, but also a tempting shortcut. An observer cannot establish honesty merely by finding that a display consumes energy. Almost everything an animal does consumes energy, including deception.

What matters in one class of signalling explanations is how the costs and benefits differ between potential signallers. Suppose two animals gain equally from being treated as formidable, but maintaining a particular display imposes a greater survival cost on the weaker animal. There may be a level of display worth producing for the stronger animal but not worth imitating for the weaker one. The signal separates them because their incentives differ, not because waste possesses an independent moral power to certify truth.

Costly separation is not the only route to reliability. Some signals are physically linked to the property being advertised. If a sound's lowest attainable frequency depends on the dimensions of the structure producing it, an animal may be unable to produce the same sound as a much larger rival. Reliability then rests partly on a production constraint. Calling every such constraint a cost can preserve the vocabulary of costly signalling, but only by making the term so broad that distinct mechanisms become harder to investigate.

Nor must every reliable signal advertise an advantage held by one participant over another. Individuals may share an interest in coordinating their actions. A brief call that helps members of a group move together need not be burdensome to be useful. Conflicts can still arise within the group, and receivers may respond differently when the call is easily exploited. The point is that shared interests and conflicting interests generate different questions about what maintains communication.

Experiments should consequently test mechanisms rather than rank displays by apparent extravagance. Changing a signaller's condition, altering the opportunity to cheat, or observing receiver responses can help distinguish explanations that fit the same visible ornament. An expensive signal may indeed be honest because imitation would be disproportionately costly for another animal. But expense alone does not identify that relationship, and inexpensive communication is not automatically fraudulent. The explanatory achievement lies in showing why producing and responding to a particular signal remain worthwhile for the participants under the relevant conditions.

V01. Which claim best captures the passage's argument? MCQ

A. Signal reliability requires identifying the mechanism aligning production and response; visible expense alone is insufficient.
B. All reliable animal signals impose greater absolute costs than deceptive ones.
C. Production constraints explain animal communication better than differences in incentives in every case.
D. Signals are reliable only when all participants have entirely shared interests.

Answer: A. Signal reliability requires identifying the mechanism aligning production and response; visible expense alone is insufficient.

The author distinguishes differential incentives, physical constraints and shared interests. The central claim concerns mechanism, not one universal explanation. Absolute expense does not establish reliability, and neither constraint nor complete shared interest is declared necessary.

V02. Why is discovering that an ornament requires substantial energy insufficient to confirm the costly-separation explanation? MCQ

A. Energy expenditure prevents researchers from comparing the strength of different animals.
B. An ornament that attracts predators cannot also attract mates.
C. The explanation depends on differences in the incentives of potential signallers, not merely on expenditure by the observed animal.
D. A genuinely separating signal must be inexpensive for both strong and weak animals.

Answer: C. The explanation depends on differences in the incentives of potential signallers, not merely on expenditure by the observed animal.

Differential costs and benefits must make imitation unattractive for one type. The passage allows simultaneous attraction of predators and mates and allows expensive separating signals. It does not rule out condition comparisons.

V03. The example of a sound constrained by the size of its producing structure serves to: MCQ

A. show that all apparent differences in body size are produced by deceptive sounds.
B. distinguish a physical limitation on imitation from a signal sustained by differential incentives.
C. demonstrate that constrained sounds necessarily consume no energy.
D. deny that receivers can obtain information from signals they cannot themselves produce.

Answer: B. distinguish a physical limitation on imitation from a signal sustained by differential incentives.

Physical feasibility is the relevant distinction. The sound may still use energy, but energy is not the identified source of reliability. Deceptive body-size differences and receivers' own production abilities are not the argument.

V04. Which finding most directly supports the costly-separation account outlined in paragraph two? MCQ

A. All displays use some energy, including displays known to deceive receivers.
B. A call coordinates animals that gain equally by travelling together.
C. The largest animals alone possess a structure capable of producing a particular frequency.
D. The same display brings similar benefits to two types, but its survival penalty makes imitation unprofitable only for the weaker type.

Answer: D. The same display brings similar benefits to two types, but its survival penalty makes imitation unprofitable only for the weaker type.

Only the first describes the proposed difference in net incentives. Mere energy use is insufficient; coordinated travel illustrates shared interests; the anatomical example illustrates production constraints rather than incentive-based separation.

RC 2 · The rule inside the queue

A queue appears to offer a modest form of equality: whoever arrives first is served first. Its attraction is not that everyone receives service at the same moment, but that a publicly observable event replaces bargaining over personal importance. Strangers can coordinate without deciding who is more admirable, influential or deserving. In this sense the queue does not abolish inequality; it chooses one feature of people, arrival time, and asks the institution to ignore many others.

That choice has consequences. People with flexible schedules may arrive early more easily than those whose work or care duties constrain them. The resulting order can therefore reflect unequal circumstances even when nobody jumps the line. Whether this makes the queue objectionable depends partly on what the institution is allocating. A waiting rule tolerable for admission to an optional exhibition may be difficult to defend when delays intensify serious suffering.

Many institutions respond by establishing exceptions. An emergency department may prioritise urgency; a transport system may reserve seats for people who cannot stand safely. Such arrangements need not be failures to enforce the ordinary rule. They can express a different account of what relevant equality requires. Treating everyone identically in a dimension unrelated to the purpose of a service can sometimes protect the rule at the expense of the reason for having it.

Exceptions, however, create their own informational and political problems. An institution needs a way to recognise qualifying cases, explain its decisions and prevent influence from masquerading as need. A system with many opaque exceptions can recover precisely the bargaining over status that the queue originally displaced. Simplicity thus has a value beyond convenience: an intelligible rule can help people detect departures and challenge them. The question is not whether simple rules or sensitive judgements are always superior, but which departures can be justified and administered without defeating the service's purpose.

Selling priority introduces a further distinction. It may reduce waiting for purchasers and finance improvements that benefit others. Yet its legitimacy does not follow from those possibilities alone. It changes the organising principle from time already spent waiting to ability and willingness to pay. Whether that change is acceptable requires an argument about the good being distributed, the use of revenue and the consequences for those who remain. A queue is a small institution with a theory of relevance built into it. Evaluating it requires making that theory visible, rather than confusing an orderly line with a complete account of fairness.

V05. The author regards queues primarily as: MCQ

A. mechanisms that eliminate inequality whenever arrival times can be publicly observed.
B. inferior substitutes for systems that allocate all services according to ability to pay.
C. informal customs that become fair only when every exception is prohibited.
D. allocation rules whose apparent equality depends on which differences are treated as relevant to the service.

Answer: D. allocation rules whose apparent equality depends on which differences are treated as relevant to the service.

The passage asks which features should govern allocation and tests arrival, urgency and payment against purposes. It explicitly allows unequal circumstances, justified exceptions and context-dependent evaluation of paid priority.

V06. Why might a strictly enforced arrival rule still produce a questionable allocation? MCQ

A. Public observation necessarily makes arrival times inaccurate.
B. The ability to arrive early may reflect unequal constraints, and arrival order may poorly fit the purpose of the service.
C. Anyone waiting in a queue must have chosen to ignore more efficient alternatives.
D. A rule is fair only if everyone ultimately receives service simultaneously.

Answer: B. The ability to arrive early may reflect unequal constraints, and arrival order may poorly fit the purpose of the service.

Paragraphs two and three identify constraints and relevance. Accuracy, alternatives and simultaneous service are unsupported; the opening expressly rejects simultaneity as the queue’s claim to equality.

V07. What is the strongest reason offered for retaining some simplicity in allocation rules? MCQ

A. Simple rules always identify urgent need more precisely than expert assessment.
B. Institutions should avoid explaining any decision that could be challenged.
C. Intelligibility helps users detect departures and prevents opaque exceptions from sheltering influence.
D. Simplicity ensures that people have equal amounts of time available for waiting.

Answer: C. Intelligibility helps users detect departures and prevents opaque exceptions from sheltering influence.

Transparency and contestability give simplicity substantive value. The text does not give simple rules diagnostic superiority, discourage explanation or suggest that they equalise time resources.

V08. An institution says paid priority is fair because its revenue could improve service for everyone. The author would most likely respond that: MCQ

A. possible collective benefits must be considered alongside the changed allocation principle and actual effects on non-purchasers.
B. any use of money makes an allocation unjust regardless of its purpose or effects.
C. the argument is conclusive because extra revenue always benefits those waiting longest.
D. paid priority preserves exactly the same organising principle as arrival order.

Answer: A. possible collective benefits must be considered alongside the changed allocation principle and actual effects on non-purchasers.

The author calls for a fuller argument, not automatic rejection or endorsement. The relevant benefits are possibilities, not guarantees. Payment replaces rather than preserves the arrival-time principle.

RC 3 · The editor’s comma

Punctuation looks like the least controversial part of a written work until an editor must decide which marks belong in it. A comma may appear to organise an already completed thought. Yet moving it can change which words qualify which others, where a reader pauses, and whether an apparent interruption sounds hesitant or emphatic. Punctuation participates in meaning even though its contribution is usually less conspicuous than that of nouns and verbs.

Older texts make editorial responsibility particularly visible. A surviving manuscript, an early printed edition and a later revision may punctuate a sentence differently. The differences might reflect an author's change of mind, a copyist's habits, a printer's conventions or an error. A modern editor cannot assign authorship to every mark simply by selecting the oldest witness. Earlier evidence has advantages, but it does not automatically provide the final intention of an author who continued revising.

One response is to regularise punctuation according to current conventions. This can improve readability, especially when older practices make syntactic relationships difficult for present readers to recognise. Regularisation is not necessarily disrespectful: it may preserve a relationship that modern

typography would otherwise obscure. But it can also settle an ambiguity that the available evidence does not settle, or turn a deliberately breathless sequence into comfortably separated propositions. Accessibility and interpretive restraint can pull in different directions.

A second response is to reproduce one source exactly. This provides a valuable record of that source and makes fewer silent interventions. It does not, however, eliminate interpretation from the edition as a whole. Choosing which source to reproduce already gives one version a privileged position. Readers may also mistake accidental features of that version for artistic decisions unless the edition explains what kind of record it presents. Fidelity to an object and fidelity to a reconstructed intention are different editorial projects.

These difficulties do not imply that an editor should print every possible mark or abandon the possibility of a readable text. They suggest that editorial claims should match editorial procedures. An edition intended for uninterrupted reading may reasonably make choices that a documentary transcription avoids, provided consequential interventions can be identified. Notes can preserve alternatives without forcing them all into the reading line. The reader need not inspect every decision, but should be able to discover that a decision was made. Responsible editing offers both a usable text and an honest account of the authority that text can claim.

V09. Which statement best expresses the passage's position? MCQ

A. The earliest surviving punctuation always provides the most authoritative version of a literary work.
B. Modern punctuation necessarily destroys an author's intended meaning.
C. Different editorial purposes justify different punctuation practices, but consequential choices and the authority claimed should be transparent.
D. A faithful transcription removes all interpretation from an edition.

Answer: C. Different editorial purposes justify different punctuation practices, but consequential choices and the authority claimed should be transparent.

The conclusion links procedures, purposes and discoverable decisions. Earliest priority, inevitable damage from modernisation and interpretation-free transcription are each explicitly qualified or rejected.

V10. Why can modernising punctuation sometimes preserve rather than alter a relationship? MCQ

A. Conventions familiar to present readers may communicate a syntactic relationship that older marks now obscure.
B. Punctuation has no semantic role unless editors change the words as well.
C. Modern readers invariably understand older punctuation better than original readers did.
D. The author's final intention can always be inferred from current typographic conventions.

Answer: A. Conventions familiar to present readers may communicate a syntactic relationship that older marks now obscure.

The passage distinguishes functional preservation from identical marks. Punctuation has semantic effects; no superiority of modern readers or reliable access to final intentions is asserted.

V11. The contrast between fidelity to an object and fidelity to a reconstructed intention implies that: MCQ

A. documentary transcription is impossible because every source is equally corrupt.
B. a reconstruction is necessarily more useful to every reader than a transcription.
C. any editorial intervention proves that the source was accidentally punctuated.
D. accurately reproducing a particular source and constructing an intended text are distinct goals that may produce different editions.

Answer: D. accurately reproducing a particular source and constructing an intended text are distinct goals that may produce different editions.

The distinction concerns projects, not impossibility or a universal ranking. Interventions may address readability or artistic ambiguity, so they cannot establish that every original feature was accidental.

V12. Which editorial practice best matches the author's recommendation? MCQ

A. Silently modernising all marks and advertising the result as an exact transcription.
B. Publishing a readable text while identifying consequential punctuation changes and recording significant alternatives in notes.
C. Combining every surviving punctuation variant within each printed sentence.
D. Choosing the oldest witness and treating every mark in it as demonstrably intentional.

Answer: B. Publishing a readable text while identifying consequential punctuation changes and recording significant alternatives in notes.

This balances usability with an accurate account of intervention. Silent modernisation contradicts an exact-transcription claim; inserting every variant defeats readability; age alone cannot establish intention.

RC 4 · Finding the way with imperfect cues

A migrating animal may reach a distant destination even after one familiar source of directional information has been disrupted. It is easy to interpret this success as evidence that the disrupted cue never mattered. That inference overlooks redundancy. An animal could ordinarily use several sources of information and compensate when one becomes unreliable. Successful arrival would then reveal the flexibility of the system, not the uselessness of the removed component.

Different cues can also perform different jobs. One might establish a rough compass direction, another identify a familiar region, and a third guide the final approach to a site. Asking which cue is the true navigational mechanism can therefore be like asking whether a journey depends on choosing the right road or recognising the correct doorway. Both may matter, but at different stages. An experiment conducted near the destination may say little about the information required far from it.

Researchers can explore these roles by creating conflicts between cues. If an animal follows one source when two disagree, the result provides evidence about their relative influence under those conditions. It does not establish an unchanging hierarchy. Experience, weather, location or the degree of disagreement may alter what information the animal trusts. A cue that is ignored in a dramatic experimental conflict might still contribute when several sources broadly agree.

Displacement experiments introduce another distinction. An animal that flies in its customary seasonal direction after being moved elsewhere displays a directional programme, but not necessarily knowledge of its position relative to the destination. One that adjusts its route in a destination-appropriate way supplies stronger evidence of positional compensation. Even then, the researcher must consider whether familiar landmarks, prior experience or an unintended experimental cue can explain the adjustment. The behavioural result constrains explanations without automatically naming the sensory system responsible.

This approach replaces a hunt for a single extraordinary sense with questions about information use. Which uncertainties does each cue reduce? Under what conditions are cues combined, and when does one override another? How does an inexperienced traveller differ from an experienced one? Answering these questions requires comparing failures as well as successes across carefully varied situations. Navigation is impressive not simply because an animal possesses accurate information, but because it can often act when information is incomplete, partly conflicting or temporarily unavailable. Its competence may reside in managing such limitations rather than in possessing an infallible internal map.

V13. The passage recommends explaining animal navigation by studying: MCQ

A. which single sensory system remains infallible throughout every migration.
B. how multiple sources of information serve different roles and are combined under changing conditions.
C. successful arrivals alone, since failures reveal no navigational capacities.
D. the compass directions animals prefer without examining their starting locations.

Answer: B. how multiple sources of information serve different roles and are combined under changing conditions.

The conclusion favours information roles, combination and limitations. A single infallible sense is rejected; failures and displacement-sensitive behaviour are important evidence.

V14. An animal arrives successfully after a directional cue is removed. Which conclusion is warranted by the passage? MCQ

A. The removed cue must be the animal's least informative cue under all natural conditions.
B. No information about navigation can ever be obtained by disrupting cues.
C. The animal must possess a perfectly accurate positional map.
D. The result is compatible with compensation and does not by itself prove the cue normally plays no role.

Answer: D. The result is compatible with compensation and does not by itself prove the cue normally plays no role.

Redundancy makes ordinary relevance compatible with removal success. Neither a universal ranking nor a perfect map follows. Manipulations remain informative when interpreted with appropriate limitations.

V15. Which observation most directly distinguishes positional compensation from simply following a customary seasonal direction? MCQ

A. After displacement, an animal changes its direction in a way appropriate to reaching the original destination.
B. An animal retains its usual seasonal heading after being moved to an unfamiliar starting point.
C. Two undisplaced animals depart on the same day.
D. An animal pauses when several familiar cues agree.

Answer: A. After displacement, an animal changes its direction in a way appropriate to reaching the original destination.

Destination-appropriate correction after a changed starting location supports positional compensation. A retained heading illustrates a directional programme; departure timing and pausing with agreeing cues do not establish position-sensitive correction.

V16. Why does choosing one cue in a conflict experiment not establish a permanent cue hierarchy? MCQ

A. Conflicting information makes all observed movements random.
B. Cues followed during experiments cannot operate outside laboratories.
C. The relative use of cues may change with context, experience and the size of the disagreement.
D. Any animal able to combine cues must assign them equal weight.

Answer: C. The relative use of cues may change with context, experience and the size of the disagreement.

The author explicitly lists contextual determinants. Conflict need not produce randomness, experiments can reveal natural processes, and combining information does not require equal weights.

V17. Choose the option that best summarises the paragraph.

A translation of a joke can reproduce every referential detail and still fail to be funny. The effect may depend on a familiar expression, a delayed recognition or a social expectation unavailable to the new audience. A translator sometimes preserves the joke's operation by changing its literal materials. That choice is not automatically a betrayal, but neither does any amusing replacement count as a faithful translation. The new version must answer to some intelligible feature of the original: its target, reversal, voice or position in the scene. Fidelity is therefore a relationship that requires explanation, rather than a rule that can be settled by counting unchanged words. MCQ

A. Joke translation may require changing literal materials to preserve an identifiable operation, so fidelity cannot be equated with unchanged wording.
B. Any replacement that makes readers laugh is a faithful translation of a joke.
C. Because humour depends on social expectations, jokes cannot be translated meaningfully.
D. A joke is faithfully translated only when all its referential details remain unchanged.

Answer: A. Joke translation may require changing literal materials to preserve an identifiable operation, so fidelity cannot be equated with unchanged wording.

The paragraph endorses accountable adaptation: preserving a relevant operation while allowing material change. Mere amusement is explicitly insufficient; impossibility and compulsory literalism deny the available middle position.

V18. Choose the option that best summarises the paragraph.

Specialisation allows workers to become proficient at particular tasks, but it also changes who can recognise a failure. When a process is divided into narrow stages, each person may complete an assigned operation correctly while the combined product remains defective. The problem need not be laziness or inadequate individual training. It can arise because no role includes responsibility for the connections between stages. Adding more detailed instructions to each isolated task may leave that gap untouched. Effective coordination requires occasions or roles through which participants examine how their contributions fit together. Such integration does not abolish specialisation; it supplies a capacity that specialisation alone does not guarantee. MCQ

A. The defects of specialised production show that every worker should perform the whole process alone.
B. More detailed instructions for individual tasks necessarily eliminate all coordination failures.
C. Defective combined products generally prove that specialised workers lack commitment or training.
D. Specialisation can leave failures between correctly performed tasks undetected unless coordination explicitly addresses their connections.

Answer: D. Specialisation can leave failures between correctly performed tasks undetected unless coordination explicitly addresses their connections.

The key is the missing integrative responsibility, not rejection of specialisation. Instructions alone may not repair it, and individual blame is precisely the premature explanation the paragraph challenges.

V19. Choose the best position for the missing sentence.
Missing sentence: "The apparent contradiction disappears once the two measurements are recognised as answering different questions."

A material can be hard to scratch yet easy to shatter. (1) Hardness describes resistance to a local indentation or scratch, whereas toughness concerns the energy a material can absorb before fracturing. A surface test and an impact test may therefore rank the same pair of materials differently. (2) A designer choosing a protective covering must consider the damage the covering is expected to face during use. (3) A component that resists everyday abrasion may still need support against a sudden blow. Selecting it from a single flattering test result would conceal a vulnerability rather than resolve it. (4) The useful comparison starts with the demands of the intended application. MCQ

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

Answer: C. Position 2

The missing sentence resolves the seeming contradiction after both properties and the different test rankings have been explained. Position 1 precedes the explanation of the measurements; positions 3 and 4 interrupt the subsequent application-focused argument.

V20. Choose the best position for the missing sentence.
Missing sentence: "Only after that distinction was made could the two historians discover that they were not making competing claims."

Two historians disagreed about when a town had become a port. One cited the first recorded visit by a trading vessel; the other pointed to the construction of permanent facilities many years later. (1) Their documents seemed incompatible until a discussion clarified what each historian meant by the word. (2) The first was dating maritime contact, while the second was dating an organised institution capable of supporting regular trade. (3) They could retain their respective dates and state precisely which development each date described. (4) This did not make definitions a substitute for evidence; it made clear which evidence was relevant to each historical question.
MCQ

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

Answer: B. Position 3

"That distinction" refers to the contrast between contact and an organised institution, immediately before position 3. The following sentence explains how the reconciliation works. Earlier positions lack the specified distinction; position 4 places recognition after its practical consequence.

V21. Arrange the four sentences into a coherent paragraph. Enter the four-digit sequence.
1. The researcher independently verified that evaporation was negligible in the sealed sample during the observation period.
2. To distinguish the two explanations, the researcher prepared identical samples in open and sealed containers.
3. A decline in liquid level might reflect either evaporation or absorption by the material immersed in it.
4. If the liquid level nevertheless declined in this verified low-evaporation condition, absorption would remain a plausible explanation. TITA

Answer: 3214

Sentence 3 introduces the two explanations; 2 designs the comparison; 1 verifies negligible evaporation in one condition. Sentence 4's "this verified low-evaporation condition" requires that verification. Merely sealing a container is not treated as proof that no liquid can evaporate into its headspace.

V22. Arrange the four sentences into a coherent paragraph. Enter the four-digit sequence.
1. Their disappearance creates an audible distinction between those permitted to speak and those expected to listen.
2. A radio drama may represent a crowded room through overlapping background voices.
3. When a central character enters, those voices can suddenly fall silent.
4. This distinction between permitted speakers and expected listeners gives the entrance an authority that the character's words alone might not establish. TITA

Answer: 2314

Sentence 2 establishes the background voices; 3 removes them at an entrance. Sentence 1 requires their disappearance and introduces the distinction between permitted speakers and expected listeners. Sentence 4 explicitly refers to this distinction, fixing 2–3–1–4 rather than allowing the two concluding sentences to be interchanged.

V23. Five sentences are given. Four form a coherent paragraph. Enter the number of the sentence that does not belong.
1. A standard unit allows measurements made in different places to be compared.
2. Its usefulness depends on procedures through which instruments can be checked against a shared reference.
3. Instruments can be decorated to indicate the prestige of the people who own them.
4. Without those procedures, two devices labelled with the same unit may still produce incompatible readings.
5. Standardisation therefore involves maintaining comparability, not merely agreeing on the name of a unit. TITA

Answer: 3

Sentences 1–2–4–5 develop standards, calibration procedures and comparability. Sentence 3 changes to ownership prestige and decoration without explaining the measurement relationship.

V24. Five sentences are given. Four form a coherent paragraph. Enter the number of the sentence that does not belong.
1. A character who conceals a fact from another character need not conceal it from the reader.
2. The resulting gap in knowledge can make an apparently harmless conversation tense.
3. Readers recognise implications that one participant is unable to hear.
4. Bookshops often separate novels into genres to simplify browsing.
5. Suspense can thus arise from unequal knowledge rather than from uncertainty about what the hidden fact is. TITA

Answer: 4

Sentences 1–2–3–5 explain dramatic tension produced by unequal knowledge. Bookshop genre organisation addresses distribution and browsing, not the narrative mechanism.

DILR · 22 questions

The incomplete number panel

A 3 by 3 panel contains each integer from 1 to 9 exactly once. The totals of its top, middle and bottom rows are 12, 15 and 18 respectively. The totals of its left, middle and right columns are 14, 17 and 14 respectively. The main diagonal, from the top-left cell through the centre to the bottom-right cell, totals 14. The top-middle cell contains an odd number. There are no other conditions.

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

D01. How many complete grids satisfy all the conditions? TITA

Answer: 3

The row totals sum to 45, exactly the sum of 1 through 9. Select a distinct-digit top row summing to 12 with an odd middle, then a disjoint middle row summing to 15. Each column total determines its bottom entry. Reject repeated or missing digits and test the main diagonal. The complete list is:
Top row | Middle row | Bottom row
1 9 2 | 6 5 4 | 7 3 8
2 9 1 | 4 5 6 | 8 3 7
3 1 8 | 6 7 2 | 5 9 4
Thus there are three, and only three, feasible grids. Rows and columns refer to their displayed positions; rotations are not identified.

There are three distinct grids in the complete list.

D02. Which statement must be true? MCQ

A. The centre contains an odd number
B. The top-middle contains 9
C. The bottom-left is the largest entry in its row
D. The centre contains 5

Answer: A. The centre contains an odd number

The row totals sum to 45, exactly the sum of 1 through 9. Select a distinct-digit top row summing to 12 with an odd middle, then a disjoint middle row summing to 15. Each column total determines its bottom entry. Reject repeated or missing digits and test the main diagonal. The complete list is:
Top row | Middle row | Bottom row
1 9 2 | 6 5 4 | 7 3 8
2 9 1 | 4 5 6 | 8 3 7
3 1 8 | 6 7 2 | 5 9 4
Thus there are three, and only three, feasible grids. Rows and columns refer to their displayed positions; rotations are not identified.

The centre is 5, 5 or 7, so it is always odd. It need not be 5; the top-middle need not be 9. In the third grid, the bottom-left entry 5 is not the largest in its row.

D03. If the top-left entry is 2, what is the bottom-middle entry? TITA

Answer: 3

The row totals sum to 45, exactly the sum of 1 through 9. Select a distinct-digit top row summing to 12 with an odd middle, then a disjoint middle row summing to 15. Each column total determines its bottom entry. Reject repeated or missing digits and test the main diagonal. The complete list is:
Top row | Middle row | Bottom row
1 9 2 | 6 5 4 | 7 3 8
2 9 1 | 4 5 6 | 8 3 7
3 1 8 | 6 7 2 | 5 9 4
Thus there are three, and only three, feasible grids. Rows and columns refer to their displayed positions; rotations are not identified.

Only the second grid has top-left entry 2. Its bottom row is 8, 3, 7, giving bottom-middle 3.

D04. What is the largest possible sum of the top-left and bottom-right entries? MCQ

A. 9
B. 7
C. 11
D. 10

Answer: A. 9

The row totals sum to 45, exactly the sum of 1 through 9. Select a distinct-digit top row summing to 12 with an odd middle, then a disjoint middle row summing to 15. Each column total determines its bottom entry. Reject repeated or missing digits and test the main diagonal. The complete list is:
Top row | Middle row | Bottom row
1 9 2 | 6 5 4 | 7 3 8
2 9 1 | 4 5 6 | 8 3 7
3 1 8 | 6 7 2 | 5 9 4
Thus there are three, and only three, feasible grids. Rows and columns refer to their displayed positions; rotations are not identified.

The three corner sums are 1+8=9, 2+7=9 and 3+4=7. The maximum is 9.

D05. If the centre contains 7, what is the top-right entry? MCQ

A. 8
B. 9
C. 4
D. 1

Answer: A. 8

The row totals sum to 45, exactly the sum of 1 through 9. Select a distinct-digit top row summing to 12 with an odd middle, then a disjoint middle row summing to 15. Each column total determines its bottom entry. Reject repeated or missing digits and test the main diagonal. The complete list is:
Top row | Middle row | Bottom row
1 9 2 | 6 5 4 | 7 3 8
2 9 1 | 4 5 6 | 8 3 7
3 1 8 | 6 7 2 | 5 9 4
Thus there are three, and only three, feasible grids. Rows and columns refer to their displayed positions; rotations are not identified.

The third grid is the only one with centre 7. Its top-right entry is 8.

When the partners invested

Partners A, B, C and D invest ₹40,000, ₹60,000, ₹80,000 and ₹100,000 respectively. Each makes one investment, unchanged until a common year-end. Their investment durations are 6, 8, 10 and 12 months,

one each. Profit is divided in proportion to capital multiplied by months invested. A:B profit shares are 4:3 and C and D receive equal shares. The total profit is ₹244,000.

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

D06. How much profit, in rupees, does B receive? TITA

Answer: 36000

Measure capital in thousands. The A:B condition gives 40m_A/(60m_B) = 4/3, hence m_A = 2m_B. The available durations force m_A = 12 and m_B = 6. Equal C and D shares require 80m_C = 100m_D, fixing m_C = 10 and m_D = 8.
Partner | Months | Capital-month weight | Profit (₹)
A | 12 | 480 | 48000
B | 6 | 360 | 36000
C | 10 | 800 | 80000
D | 8 | 800 | 80000

Weights total 2440, so each weight unit receives ₹100; B receives 360 × 100 = ₹36,000.

D07. Which pair receives equal amounts? MCQ

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

Answer: C. C and D

Measure capital in thousands. The A:B condition gives 40m_A/(60m_B) = 4/3, hence m_A = 2m_B. The available durations force m_A = 12 and m_B = 6. Equal C and D shares require 80m_C = 100m_D, fixing m_C = 10 and m_D = 8.
Partner | Months | Capital-month weight | Profit (₹)
A | 12 | 480 | 48000
B | 6 | 360 | 36000
C | 10 | 800 | 80000
D | 8 | 800 | 80000

Both have capital-month weight 800 and receive ₹80,000.

D08. For how many months was B's original investment active? TITA

Answer: 6

Measure capital in thousands. The A:B condition gives 40m_A/(60m_B) = 4/3, hence m_A = 2m_B. The available durations force m_A = 12 and m_B = 6. Equal C and D shares require 80m_C = 100m_D, fixing m_C = 10 and m_D = 8.
Partner | Months | Capital-month weight | Profit (₹)
A | 12 | 480 | 48000
B | 6 | 360 | 36000
C | 10 | 800 | 80000
D | 8 | 800 | 80000

The ratio and duration list force B's duration to 6 months.

D09. Instead, suppose B doubles its capital only for the final two months of its six-month investment. Other investments are unchanged and the profit pool is ₹256,000. What is B's revised profit in rupees? TITA

Answer: 48000

Measure capital in thousands. The A:B condition gives 40m_A/(60m_B) = 4/3, hence m_A = 2m_B. The available durations force m_A = 12 and m_B = 6. Equal C and D shares require 80m_C = 100m_D, fixing m_C = 10 and m_D = 8.
Partner | Months | Capital-month weight | Profit (₹)
A | 12 | 480 | 48000
B | 6 | 360 | 36000
C | 10 | 800 | 80000
D | 8 | 800 | 80000

B's weight rises from 360 to 480; total weight rises from 2440 to 2560. Its share is 480/2560 × 256000 = ₹48,000.

D10. What fraction of the original profit pool belongs to A? MCQ

A. 12/61
B. 20/61
C. 9/61
D. 1/4

Answer: A. 12/61

Measure capital in thousands. The A:B condition gives 40m_A/(60m_B) = 4/3, hence m_A = 2m_B. The available durations force m_A = 12 and m_B = 6. Equal C and D shares require 80m_C = 100m_D, fixing m_C = 10 and m_D = 8.
Partner | Months | Capital-month weight | Profit (₹)
A | 12 | 480 | 48000
B | 6 | 360 | 36000
C | 10 | 800 | 80000
D | 8 | 800 | 80000

A's fraction 480/2440 reduces to 12/61.

Returns across two sales channels

A retailer sells 120 units online at ₹200 each and 80 units in shops at ₹250 each. Later, exactly 38 of these units are returned, for full refunds at the original channel price. The total refund is ₹8,000. There are no taxes, discounts, exchanges or other transactions. Each unit is returned at most once.

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

D11. What percentage of online units is returned? TITA

Answer: 25

Let x be online returns; shop returns are 38 – x. The refund equation 200x + 250(38 – x) = 8000 gives x = 30 and shop returns 8. Retained units are 90 online and 72 in shops. Original revenue is ₹44,000 and retained revenue is ₹36,000.

30/120 × 100 = 25%.

D12. How much revenue is retained from shop sales? MCQ

A. 18000
B. 17500
C. 16000
D. 20000

Answer: A. 18000

Let x be online returns; shop returns are 38 – x. The refund equation 200x + 250(38 – x) = 8000 gives x = 30 and shop returns 8. Retained units are 90 online and 72 in shops. Original revenue is ₹44,000 and retained revenue is ₹36,000.

(80 – 8) × 250 = ₹18,000.

D13. How many sold units are retained by customers overall? TITA

Answer: 162

Let x be online returns; shop returns are 38 – x. The refund equation 200x + 250(38 – x) = 8000 gives x = 30 and shop returns 8. Retained units are 90 online and 72 in shops. Original revenue is ₹44,000 and retained revenue is ₹36,000.

200 – 38 = 162 units are not returned.

D14. If the online selling price had been 10% higher, with the same numbers sold and returned in both channels and full refunds at that revised price, what total revenue would be retained? MCQ

A. 36800
B. 38000
C. 38800
D. 37800

Answer: D. 37800

Let x be online returns; shop returns are 38 – x. The refund equation 200x + 250(38 – x) = 8000 gives x = 30 and shop returns 8. Retained units are 90 online and 72 in shops. Original revenue is ₹44,000 and retained revenue is ₹36,000.

Online net revenue becomes 90 × 220 = ₹19,800; shop net revenue remains ₹18,000. Total: ₹37,800.

The priced switchboard

Five lamps numbered 1 to 5 are initially OFF. Six buttons are available. Pressing a button toggles exactly the two lamps listed below: an OFF lamp becomes ON and an ON lamp becomes OFF. Each button may be pressed at most once.

Button | Lamps toggled | Cost
A | 1 and 2 | 1
B | 2 and 3 | 4
C | 1 and 3 | 6
D | 3 and 4 | 2
E | 4 and 5 | 3
F | 3 and 5 | 7
A valid plan ends with lamps 1 and 5 ON and lamps 2, 3 and 4 OFF. A plan is a set of buttons; different orders of pressing the same set do not count as different plans. Total cost is the sum of costs of the buttons pressed.

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

D15. How many valid plans are there? TITA

Answer: 4

Let a,b,c,d,e,f be 0 or 1 according to whether each button is pressed. Lamp 2 must remain OFF, so a=b. Lamp 4 must remain OFF, so d=e. Lamp 1 must be ON, so c=1–a; lamp 5 must be ON, so f=1–d. With these substitutions, lamp 3 receives an even number of toggles automatically. Thus the independent choices of a and d yield four plans:
Buttons pressed | Number of presses | Total cost
CF | 2 | 13
CDE | 3 | 11
ABF | 3 | 12
ABDE | 4 | 10
This also shows why the minimum-press plan need not be the cheapest plan.

The four possibilities are CF, CDE, ABF and ABDE.

D16. Which valid plan has the least total cost? MCQ

A. CDE
B. CF
C. ABF
D. ABDE

Answer: D. ABDE

Let a,b,c,d,e,f be 0 or 1 according to whether each button is pressed. Lamp 2 must remain OFF, so a=b. Lamp 4 must remain OFF, so d=e. Lamp 1 must be ON, so c=1–a; lamp 5 must be ON, so f=1–d. With these substitutions, lamp 3 receives an even number of toggles automatically. Thus the independent choices of a and d yield four plans:
Buttons pressed | Number of presses | Total cost
CF | 2 | 13
CDE | 3 | 11
ABF | 3 | 12
ABDE | 4 | 10
This also shows why the minimum-press plan need not be the cheapest plan.

ABDE costs 1+4+2+3=10. The alternatives CDE, ABF and CF cost 11, 12 and 13 respectively.

D17. What is the smallest number of button presses in any valid plan? TITA

Answer: 2

Let a,b,c,d,e,f be 0 or 1 according to whether each button is pressed. Lamp 2 must remain OFF, so a=b. Lamp 4 must remain OFF, so d=e. Lamp 1 must be ON, so c=1–a; lamp 5 must be ON, so f=1–d. With these substitutions, lamp 3 receives an even number of toggles automatically. Thus the independent choices of a and d yield four plans:
Buttons pressed | Number of presses | Total cost
CF | 2 | 13
CDE | 3 | 11
ABF | 3 | 12
ABDE | 4 | 10
This also shows why the minimum-press plan need not be the cheapest plan.

CF needs two presses: lamp 3 is toggled twice, while lamps 1 and 5 are each toggled once. No single button toggles exactly lamps 1 and 5.

D18. If total cost cannot exceed 11, what is the smallest possible number of button presses? MCQ

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

Answer: B. 3

Let a,b,c,d,e,f be 0 or 1 according to whether each button is pressed. Lamp 2 must remain OFF, so a=b. Lamp 4 must remain OFF, so d=e. Lamp 1 must be ON, so c=1–a; lamp 5 must be ON, so f=1–d. With these substitutions, lamp 3 receives an even number of toggles automatically. Thus the independent choices of a and d yield four plans:
Buttons pressed | Number of presses | Total cost
CF | 2 | 13
CDE | 3 | 11
ABF | 3 | 12
ABDE | 4 | 10
This also shows why the minimum-press plan need not be the cheapest plan.

The affordable valid plans are ABDE (cost 10, four presses) and CDE (cost 11, three presses). CF has fewer presses but exceeds the budget. Hence the required minimum is 3.

The dual-quota review committee

A four-person committee must be selected from eight staff. It must contain exactly two analysts, exactly two engineers and exactly two certified people. The table also gives each person's participation cost, in the same units.
Person | Role | Certified? | Cost
A | Analyst | Yes | 5
B | Analyst | No | 3
C | Analyst | Yes | 4
D | Analyst | No | 6
E | Engineer | No | 4
F | Engineer | Yes | 7
G | Engineer | No | 2
H | Engineer | Yes | 5
A and E cannot both be selected. B is selected if and only if G is selected: either both are selected or neither is selected. C and H cannot both be selected. There are no other restrictions unless a question adds one. The committee's total cost is the sum of its members' costs.

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

D19. How many committees satisfy all the original conditions? TITA

Answer: 4

Start with the 6 possible pairs of analysts and 6 pairs of engineers. Keep exactly two certified people, enforce the exclusions AE and CH, and enforce that B and G either both occur or both do not. The complete feasible committees are:
Committee | Cost
ABFG | 17
ABGH | 15
BCFG | 16
CDEF | 21
When B and G are selected, the remaining analyst and engineer must both be certified: AF, AH or CF works, while CH is excluded. When B and G are both absent, the only feasible committee is CDEF. This split proves completeness without listing all 70 four-person subsets.

The possibilities are ABFG, ABGH, BCFG and CDEF: four committees.

D20. What is the minimum possible committee cost? MCQ

A. 17
B. 16
C. 14
D. 15

Answer: D. 15

Start with the 6 possible pairs of analysts and 6 pairs of engineers. Keep exactly two certified people, enforce the exclusions AE and CH, and enforce that B and G either both occur or both do not. The complete feasible committees are:
Committee | Cost
ABFG | 17
ABGH | 15
BCFG | 16
CDEF | 21
When B and G are selected, the remaining analyst and engineer must both be certified: AF, AH or CF works, while CH is excluded. When B and G are both absent, the only feasible committee is CDEF. This split proves completeness without listing all 70 four-person subsets.

ABGH costs 5+3+2+5=15. The remaining feasible costs are 17, 16 and 21, all larger.

D21. If C must be selected, what is the maximum possible committee cost? TITA

Answer: 21

Start with the 6 possible pairs of analysts and 6 pairs of engineers. Keep exactly two certified people, enforce the exclusions AE and CH, and enforce that B and G either both occur or both do not. The complete feasible committees are:
Committee | Cost
ABFG | 17
ABGH | 15
BCFG | 16
CDEF | 21
When B and G are selected, the remaining analyst and engineer must both be certified: AF, AH or CF works, while CH is excluded. When B and G are both absent, the only feasible committee is CDEF. This split proves completeness without listing all 70 four-person subsets.

With C selected the possible committees are BCFG (cost 16) and CDEF (cost 21). Therefore the maximum is 21.

D22. If total cost cannot exceed 16, which pair is present in every permissible committee? MCQ

A. B and G
B. A and H
C. F and G
D. C and F

Answer: A. B and G

Start with the 6 possible pairs of analysts and 6 pairs of engineers. Keep exactly two certified people, enforce the exclusions AE and CH, and enforce that B and G either both occur or both do not. The complete feasible committees are:
Committee | Cost
ABFG | 17
ABGH | 15
BCFG | 16
CDEF | 21
When B and G are selected, the remaining analyst and engineer must both be certified: AF, AH or CF works, while CH is excluded. When B and G are both absent, the only feasible committee is CDEF. This split proves completeness without listing all 70 four-person subsets.

The budget permits ABGH and BCFG only. Their common members are exactly B and G. Each other option contains someone absent from at least one of those committees.

QA · 22 questions

Q01. A bag contains ₹1, ₹2 and ₹5 coins in the ratio 3:2:1 by number. Their total value is ₹240. How many ₹2 coins are in the bag? MCQ

A. 20
B. 40
C. 30
D. 60

Answer: B. 40

Take the numbers of coins as 3k,2k,k. Total value is 3k + 4k + 5k = 12k = 240, giving k = 20. Therefore there are 2k = 40 two-rupee coins.

Q02. Three amounts A, B and C satisfy A:B = 2:3 and B:C = 4:5. C exceeds A by ₹700. Find B, in rupees. TITA

Answer: 1200

Make the two B terms equal: A:B:C = 8:12:15. The difference C – A is seven units, equal to 700, so one unit is 100. B is twelve units, or ₹1,200.

Q03. Two trains of lengths 200 m and 300 m move in opposite directions on parallel tracks at 54 km/h and 36 km/h. How many seconds elapse from their fronts meeting until they have completely crossed each other? MCQ

A. 15
B. 25
C. 30
D. 20

Answer: D. 20

The total distance that must be cleared is 200 + 300 = 500 m. Relative speed is 54 + 36 = 90 km/h, or 25 m/s. Thus the required crossing time is 500/25 = 20 seconds.

Q04. The price of a commodity rises by 25%. A household keeps its expenditure on that commodity unchanged. By what percentage must its purchased quantity decrease? MCQ

A. 20
B. 15
C. 25
D. 30

Answer: A. 20

If price was P and quantity Q, the original budget was PQ. At price 1.25P the affordable quantity is Q/1.25 = 0.8Q. This is a 20% reduction, not a 25% reduction.

Q05. Twelve identical machines working five hours per day can complete an order in eight days. After two days at that schedule, four machines break down. The other machines must finish the rest of the order in the next five days. How many hours per day must each remaining machine operate? TITA

Answer: 9

The order requires 12×5×8 = 480 machine-hours. The first two days supply 12×5×2 = 120, leaving 360. Eight machines over five days must therefore operate h hours daily with 8×5×h = 360. Thus h = 9 hours per day.

Q06. 20 litres of 60% alcohol solution is mixed with 10 litres of 30% alcohol solution. Some of the mixture is removed and replaced by an equal volume of water, reducing the alcohol concentration to 40%. How many litres are removed? Assume additive volumes. MCQ

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

Answer: C. 6

Initially alcohol is 20×0.6 + 10×0.3 = 15 litres in 30 litres, a 50% solution. The final alcohol quantity is 30×0.4 = 12 litres. Removing x litres of the 50% mixture removes x/2 litres of alcohol. Thus x/2 = 3, so x = 6 litres.

Q07. A factory makes 2,000 components at ₹20 each. 80% pass the first inspection. Every rejected component is reworked at an additional cost of ₹5, and 75% of reworked components then pass. Quality testing destroys 2% of all components that have passed. The remainder are sold for ₹30 each. What is the profit percentage on total production and rework cost? MCQ

A. 28
B. 30
C. 35
D. 33

Answer: D. 33

First-pass output is 1,600. Of 400 reworked components, 300 pass, giving 1,900 usable components before testing. Testing destroys 38, leaving 1,862 sold for ₹55,860. Cost is 2,000×20 + 400×5 = ₹42,000. Profit is 13,860, so profit percentage = 13,860/42,000×100 = 33%.

Q08. A vessel initially contains V litres of pure milk, where V is an integer greater than 20. Ten litres are removed and replaced with water, and this operation is repeated once after thorough mixing. Then 20 litres of the mixture are removed and replaced with pure milk. The final milk fraction is 25/32. Find V. TITA

Answer: 40

After the first two replacements, the milk fraction is $(1 - 10/V)^2$. The last operation makes it $(1 - 10/V)^2(1 - 20/V) + 20/V$. Equating to 25/32 and clearing denominators gives $(V - 40)(7V^2 - 360V + 1600) = 0$. The quadratic roots are $(180 \pm 20\sqrt{53})/7$, neither an integer. Hence the only allowed integer volume is V = 40 litres.

Q09. A real number x satisfies $9^{x-1} = 27^{x-2}$. What is x? MCQ

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

Answer: B. 4

Express both sides with base 3: 3^(2x – 2) = 3^(3x – 6). Equality of exponents gives 2x – 2 = 3x – 6, hence x = 4. Both original bases are positive and unequal to 1.

Q10. The polynomial $P(x) = x^3 + ax^2 + bx + 6$ is divisible by both x – 1 and x – 2. Find P(3). TITA

Answer: 12

P(1) = 0 gives a + b = –7. P(2) = 0 gives 4a + 2b = –14, or 2a + b = –7. Subtraction yields a = 0 and b = –7. Therefore P(3) = 27 – 21 + 6 = 12.

Q11. Positive real numbers x satisfying $x + 4/x = 5$ give different values of $x^2 - 1/x^2$. What is the sum of all these values? MCQ

A. 15
B. 63/4
C. 257/16
D. 255/16

Answer: D. 255/16

Multiplying by x gives $x^2 - 5x + 4 = 0$, so x = 1 or 4. At x = 1 the requested expression is 0; at x = 4 it is 16 − 1/16 = 255/16. Their sum is therefore 255/16.

Q12. How many ordered pairs of integers (x,y) satisfy $x^2 + y^2 \le 25$ and $|x| + |y| \ge 7$? MCQ

A. 8
B. 4
C. 12
D. 16

Answer: A. 8

Set a = |x| and b = |y|. Cauchy gives $(a + b)^2 \le 2(a^2 + b^2) \le 50$, so integer a + b must equal 7. Write b = 7 − a. The squared-sum bound becomes $a^2 + (7 - a)^2 \le 25$, which holds only for a = 3 or 4. Thus absolute-value pairs are (3,4) and (4,3), each with four independent sign choices. Total = 8.

Q13. For how many integers n does $x = n/10$ satisfy floor(x) + floor(2x) = 7? Here floor(t) denotes the greatest integer not exceeding t. TITA

Answer: 5

Let floor(x) = m. Then floor(2x) can only be 2m or 2m + 1, so the sum is 3m or 3m + 1. To obtain 7 we need m = 2 and floor(2x) = 5. Therefore $2.5 \le x < 3$. With x = n/10, the allowed integers are n = 25,26,27,28,29: five values.

Q14. How many integer values of x satisfy $x^2 - 5|x| + 6 \le 0$? MCQ

A. 2
B. 3
C. 4
D. 6

Answer: C. 4

Set t = |x|. The inequality becomes $t^2 - 5t + 6 = (t - 2)(t - 3) \le 0$, giving $2 \le t \le 3$. Integer x can therefore be −3,−2,2,3, four values in all.

Q15. Triangle ABC has area 84 cm². D is the midpoint of BC, G is the centroid, and E is the midpoint of AG. What is the area of triangle EBD, in cm²? MCQ

A. 14
B. 21
C. 42
D. 28

Answer: D. 28

Let the altitude from A to BC be h. The centroid is h/3 above BC, so E, halfway between A and G, is 2h/3 above BC. Also BD is half of BC. Thus area(EBD)/area(ABC) = (1/2)×(2/3) = 1/3, giving 28 cm².

Q16. Two tangents PA and PB are drawn to a circle of radius 6 cm, with ∠APB = 60°. What is PA², in cm²? MCQ

A. 108
B. 36
C. 72
D. 144

Answer: A. 108

The line joining P to the centre O bisects the angle between the tangents, so ∠APO = 30°. Radius OA is perpendicular to PA. In right triangle OAP, tan 30° = OA/PA = 6/PA, giving PA = $6\sqrt{3}$. Hence PA² = 108.

Q17. A solid cone has height 12 cm and base radius 6 cm. A plane parallel to its base cuts off a smaller cone of height 4 cm at the apex. The remaining frustum is melted into spheres of radius 2 cm without loss. How many complete spheres are formed? TITA

Answer: 13

By similarity, the removed cone has radius 6×4/12 = 2 cm. Original volume is 144π and removed volume is 16π/3. Frustum volume is 416π/3. Each sphere has volume (4/3)π×2³ = 32π/3. Their ratio is 416/32 = 13, so exactly 13 spheres are formed.

Q18. What is the smallest positive integer divisible by both 18 and 24 that leaves remainder 8 when divided by 10? MCQ

A. 144
B. 216
C. 288
D. 360

Answer: C. 288

A number divisible by 18 and 24 is a multiple of their LCM, 72. The first positive multiples are 72,144,216,288. The first ending in 8 is 288, satisfying the remainder condition.

Q19. How many integers n with 1 ≤ n ≤ 130 have the property that n! ends in exactly 24 zeros in decimal notation? TITA

Answer: 5

The number of trailing zeros is floor(n/5) + floor(n/25) + floor(n/125). At n = 100 it is 20 + 4 = 24, while at n = 99 it is only 19 + 3 = 22. The count remains 24 through n = 104, then becomes 25 at n = 105. Thus n = 100,101,102,103,104 are the five possibilities.

Q20. What is the largest three-digit integer that leaves remainders 1, 2 and 3 on division by 5, 7 and 9, respectively? MCQ

A. 786
B. 471
C. 681
D. 921

Answer: A. 786

A number satisfying all three conditions is 156. Since 5,7,9 are pairwise coprime, all solutions differ by 5×7×9 = 315. Thus the three-digit solutions are 156,471,786, followed by 1101. The largest is 786.

Q21. Three distinct integers are chosen from 1 through 9. No two chosen integers may be consecutive, and the smallest chosen integer must be odd. How many three-element sets satisfy these conditions? TITA

Answer: 22

If the smallest is 1, choose two nonconsecutive numbers from 3 through 9: C(6,2) = 15 ways. If it is 3, choose two nonconsecutive numbers from 5 through 9: C(4,2) = 6 ways. If it is 5, only {7,9} works, giving one way. Larger odd minima cannot leave room for two more nonconsecutive numbers. Total = 15 + 6 + 1 = 22.

Q22. For some real number x, the numbers x – 2, x + 1 and x + 7 are the first three terms of a geometric progression. What is its fourth term? MCQ

A. 18
B. 21
C. 24
D. 30

Answer: C. 24

Three numbers are in geometric progression when the square of the middle one equals the product of the other two: $(x + 1)^2 = (x – 2)(x + 7)$. This gives $x^2 + 2x + 1 = x^2 + 5x – 14$, so $3x = 15$ and $x = 5$. The terms are 3, 6 and 12, with ratio 2, so the fourth term is 24.