INDEPENDENT CAT PREPARATION / ORIGINAL MOCK

# CAT 2026 Prediction Paper 03

## 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: Patterns & inference.

# Quick answer key

| | | | | | |
|---|---|---|---|---|---|
| **V01**<br>B | **V02**<br>D | **V03**<br>A | **V04**<br>C | **V05**<br>C | **V06**<br>A |
| **V07**<br>D | **V08**<br>B | **V09**<br>A | **V10**<br>C | **V11**<br>B | **V12**<br>D |
| **V13**<br>D | **V14**<br>B | **V15**<br>C | **V16**<br>A | **V17**<br>B | **V18**<br>A |
| **V19**<br>D | **V20**<br>C | **V21**<br>3214 | **V22**<br>3412 | **V23**<br>4 | **V24**<br>3 |
| **D01**<br>45 | **D02**<br>A | **D03**<br>95 | **D04**<br>C | **D05**<br>C | **D06**<br>5 |
| **D07**<br>C | **D08**<br>7 | **D09**<br>23 | **D10**<br>D | **D11**<br>3 | **D12**<br>A |
| **D13**<br>4 | **D14**<br>A | **D15**<br>21 | **D16**<br>D | **D17**<br>3 | **D18**<br>D |
| **D19**<br>2 | **D20**<br>C | **D21**<br>2 | **D22**<br>A | **Q01**<br>D | **Q02**<br>72 |
| **Q03**<br>B | **Q04**<br>C | **Q05**<br>640 | **Q06**<br>A | **Q07**<br>B | **Q08**<br>21 |
| **Q09**<br>D | **Q10**<br>29 | **Q11**<br>B | **Q12**<br>C | **Q13**<br>5 | **Q14**<br>A |
| **Q15**<br>B | **Q16**<br>C | **Q17**<br>4 | **Q18**<br>A | **Q19**<br>75 | **Q20**<br>C |
| **Q21**<br>23 | **Q22**<br>A | | | | |

# VARC · 24 questions

## RC 1 · The unfinished exchange

A gift can be valuable precisely because its return is unspecified. When a neighbour helps repair a roof, neither party may calculate an hourly price or name a date for repayment. The absence of these terms does not necessarily remove obligation. It can extend the relationship into an indefinite future in which assistance is expected, remembered and interpreted. The transaction remains open in a way that a fully settled purchase ordinarily does not.

This openness helps explain why gifts cannot always be placed on the opposite side of a moral divide from economic exchange. A gift can express affection, but it can also create a claim that the recipient finds difficult to refuse. Its generosity may be sincere and its consequence unequal at the same time. A wealthy patron who repeatedly provides help can acquire influence without ever announcing a bargain. Indeed, announcing the bargain might weaken the influence by making its terms available for challenge.

Recipients are not necessarily passive. They may return a different kind of favour, distribute the gift among others or reinterpret it as recognition of something already owed. Such responses can prevent a relationship from becoming one-sided. But their availability depends on the social setting. A return that counts as generous in one context may look inadequate or insulting in another. The freedom to decide what a gift means is itself unevenly distributed.

The timing of return is especially revealing. An immediate repayment may communicate a wish to end the relationship: the recipient treats the help as a debt to be cleared. A delayed return can acknowledge a continuing bond, although delay can also signal neglect. There is no code in which a fixed interval always has one meaning. Participants read the interval alongside their history, relative positions and expectations. What appears from outside to be inefficient settlement may be part of the very relationship the exchange sustains.

None of this requires abandoning the distinction between gifts and purchases. Stated prices and enforceable terms often make a purchase different in consequential ways. The point is that specifying terms can sometimes protect the weaker party, while leaving them unstated can sometimes permit generosity that a contract would narrow. Neither form monopolises freedom or domination. To understand an exchange, one must ask not only what changes hands but also what can subsequently be asked, refused or redefined. The object transferred is a visible event; the range of future relations it opens is part of the exchange as well.

**V01. Which proposition best captures the passage?** MCQ

A. Gifts conceal commercial bargains that would be more honestly expressed through prices.
B. Unspecified returns can sustain gifts as relationships while creating both generous possibilities and unequal obligations.
C. The distinction between gifts and purchases disappears once recipients offer anything in return.
D. Delayed repayment is the clearest available evidence that a gift was freely accepted.

**Answer: B. Unspecified returns can sustain gifts as relationships while creating both generous possibilities and unequal obligations.**

The correct option preserves openness and its mixed consequences. Concealed commerce reduces every gift to one motive, contrary to sincere generosity. Gifts and purchases remain meaningfully different. Timing cannot supply a universal test because its meaning depends on context.

**V02. Why might explicitly announcing a patron's expected return weaken the patron's influence?** MCQ

A. It would legally cancel any assistance the patron had already supplied.
B. It would establish that the recipient had contributed nothing to the relationship.
C. It would necessarily convert the recipient into an equal negotiating partner.
D. It could make the terms contestable instead of leaving the obligation diffuse.

**Answer: D. It could make the terms contestable instead of leaving the obligation diffuse.**

The passage connects explicit terms with opportunities for challenge. It does not assert legal cancellation, lack of contribution or guaranteed equality. Contestability can reduce influence without removing every inequality.

**V03. Which response most clearly illustrates a recipient redefining rather than simply repaying a gift?** MCQ

A. Treating assistance as acknowledgement of an earlier contribution for which recognition had been overdue.
B. Returning an identical object on the exact date required by a signed agreement.
C. Refusing to discuss the gift because every recipient lacks interpretive agency.
D. Estimating the giver's expenses to determine the same monetary amount.

**Answer: A. Treating assistance as acknowledgement of an earlier contribution for which recognition had been overdue.**

The correct response changes the exchange's meaning from a new obligation to recognition of an existing one. A signed equivalent repayment is contractual settlement. Denial of all agency contradicts the third paragraph. Expense calculation alone settles quantity rather than redefines the relationship.

**V04. Which statement would the author most strongly reject?** MCQ

A. A recipient can sometimes reinterpret what a gift acknowledges.
B. An immediate return can communicate a wish to end continuing obligation.
C. Leaving the terms of return unstated invariably gives the recipient greater freedom.
D. An exchange can have unequal effects even when generosity is sincere.

**Answer: C. Leaving the terms of return unstated invariably gives the recipient greater freedom.**

The final paragraph rejects assigning all freedom to gifts and all domination to contracts; unspecified terms may burden a weaker recipient. The other three claims are explicitly supported, so they cannot be the rejected proposition.

## RC 2 · Experiments without moving the planet

An astronomer cannot move a distant planet closer, change its atmosphere or repeat its formation. This lack of experimental control might seem to make the study of planets fundamentally weaker than sciences whose objects fit on a laboratory bench. Yet the contrast overlooks how much inference in every science depends on effects rather than direct access. A laboratory instrument also translates an interaction into a trace. The relevant question is how well competing accounts of that trace can be distinguished.

Imagine that a planet's passage across its star produces a small change in the light received by a telescope. One model attributes part of the change to a substance in the planet's atmosphere. Another attributes it to variation on the star's surface. Both might fit a short series of observations. Choosing the first because it tells a more exciting planetary story would mistake interest for evidence. More useful would be to identify circumstances under which the models predict different patterns, and then seek observations in those circumstances.

The opportunities need not resemble intervention in a laboratory. A later passage may occur when the star is in a different state; measurements in another range of wavelengths may separate effects that overlap in the first range. Several telescopes can help establish whether an apparent signal belongs to the object or to a particular instrument. What matters is not simply multiplying observations but changing the evidential relation among the alternatives. Many repetitions of an ambiguous measurement can leave the same ambiguity intact.

There is also no requirement that every component of a model be independently established before the model can be useful. Investigators often work with assumptions that are provisionally accepted because they connect otherwise isolated findings. Such assumptions should remain visible, especially when an apparently firm conclusion depends heavily on one of them. A result can be robust to several uncertainties and fragile with respect to another. Describing it merely as either proved or speculative erases that structure.

The absence of direct intervention therefore changes the strategies of inquiry without eliminating

disciplined comparison. An astronomical explanation becomes persuasive through the combination of discriminating observations, cross-checks and an explicit account of dependence on assumptions. Its strength does not come from pretending that a telescope is a laboratory with a very long corridor. It comes from using the opportunities the remote object actually provides, while keeping clear the distinction between what has been observed and what has been inferred from those observations.

**V05. The author's main claim is that remote astronomy:** MCQ

A. must remain speculative because its objects cannot be manipulated under controlled conditions.
B. is equivalent to laboratory science in every relevant methodological respect.
C. can support disciplined explanations through discriminating observations even without direct intervention.
D. becomes reliable once enough repetitions of the same measurement have been collected.

**Answer: C. can support disciplined explanations through discriminating observations even without direct intervention.**

The author argues for a distinct but rigorous strategy. Inability to intervene does not imply permanent speculation. Complete methodological equivalence is explicitly resisted. Repetition alone may retain the original ambiguity.

**V06. When would additional observations contribute least to resolving the two models in the example?** MCQ

A. When both models predict the same repeated signal under unchanged observational conditions.
B. When a different wavelength range produces predictions that diverge between the models.
C. When another telescope allows investigators to test an instrument-specific explanation.
D. When a later passage occurs under stellar conditions relevant to the competing accounts.

**Answer: A. When both models predict the same repeated signal under unchanged observational conditions.**

Identical predictions under unchanged conditions supply precision without discrimination. Each other option changes an evidential relation in a way the passage explicitly regards as potentially useful. More data are not automatically more relevant data.

**V07. The discussion of laboratory instruments primarily serves to:** MCQ

A. demonstrate that telescope measurements are always more accurate than laboratory measurements.
B. argue that laboratories should abandon intervention in favour of passive observation.
C. show that all recorded traces support an equally wide range of explanations.
D. challenge an overly sharp contrast between direct laboratory knowledge and indirect astronomical inference.

**Answer: D. challenge an overly sharp contrast between direct laboratory knowledge and indirect astronomical inference.**

Both settings infer through traces, so direct access is not an absolute dividing line. No comparative accuracy ranking, instruction to abandon experiments or claim of equal ambiguity follows. The analogy has a limited methodological purpose.

**V08. Which description of a model-dependent finding would best satisfy the author?** MCQ

A. It is proved because several assumptions were independently confirmed.
B. It survives specified uncertainties but would change substantially if one identified assumption failed.
C. It is speculative because at least one assumption remains provisional.
D. It is robust because its interpretation is the most scientifically interesting.

**Answer: B. It survives specified uncertainties but would change substantially if one identified assumption failed.**

The first description preserves the pattern of robustness and fragility. Binary proof/speculation categories erase that pattern; confirmation of some assumptions is not confirmation of all relevant dependencies. Scientific interest does not discriminate evidential support.

## RC 3 · The room in which a joke is told

A joke is often explained by identifying the expectation it overturns. This account can illuminate its construction, but it says little about why the same words provoke amusement in one room and hostility in another. Expectations concern more than how a sentence will end. Listeners also have expectations about who may speak, whose experience is being invoked and whether the speaker is inviting shared recognition or demanding submission to a judgement.

Consider an employee joking about a rule that everyone quietly ignores. Among colleagues, the joke may acknowledge a practical compromise that official language excludes. If a manager repeats it during an inspection, the same wording can become an accusation, or a warning that the compromise is no longer tolerated. Nothing in the sentence alone determines which act is being performed. The social relation changes what the apparent exaggeration permits listeners to admit.

This does not mean that audiences are always right about a speaker's intentions. A joke can be misunderstood, and an audience can be unwilling to grant a speaker a freedom it readily grants others.

Nor does a statement become harmless simply because the speaker declares it a joke. That declaration identifies a proposed frame for interpretation; it cannot compel others to accept the frame. Its success depends partly on a history of trust that a single performance cannot manufacture on demand.

Humour can also bring an unfamiliar audience into a temporary community. A carefully developed routine may supply the background its listeners initially lack, allowing a surprising comparison to become intelligible. Shared context is therefore not only a prerequisite brought into the room; it can be produced within the performance. But the production takes work. Repeating a private joke before strangers often fails because the speaker reproduces the punchline without recreating the relations that made it funny.

The critical task is thus neither to excuse every utterance labelled humorous nor to translate every joke into a literal assertion and judge that assertion alone. Both approaches discard part of the event. One must attend to wording, delivery, relations of authority and the audience's available knowledge, while allowing for the possibility that these elements are being altered during the performance. Humour exploits a gap between what is said and what can be understood, but that gap is inhabited by people with histories. Explaining the verbal mechanism is useful; explaining how the mechanism works among those particular people requires more.

**V09. Which statement best represents the argument?** MCQ

A. Understanding humour requires both its verbal construction and the changing social relations of its performance.
B. A joke’s meaning is determined entirely by the audience’s response rather than the speaker’s intention.
C. Humorous statements should be judged as literal assertions whenever they concern authority.
D. A shared social background must exist before any successful comic performance can begin.

**Answer: A. Understanding humour requires both its verbal construction and the changing social relations of its performance.**

The correct answer includes mechanism and context while allowing the performance to produce context. Audience infallibility, literal-only evaluation and a fixed prerequisite of shared background are all explicitly qualified or rejected.

**V10. The manager's repetition of the employee's joke illustrates that:** MCQ

A. employees find jokes funny only when those jokes conceal a breach of formal rules.
B. humour ceases to involve exaggeration once it is used by someone with authority.
C. identical wording can perform a different social act when the speaker's authority and occasion change.
D. managers necessarily intend to punish whenever they repeat an employee's remark.

**Answer: C. identical wording can perform a different social act when the speaker's authority and occasion change.**

The example establishes a possible change from acknowledgement to accusation or warning. It does not universalise employee tastes, remove exaggeration or claim knowledge of every manager's intention.

**V11. What follows from the claim that a comic routine can produce shared context?** MCQ

A. A successful performer can require an audience to accept any utterance as harmless.
B. An initially unfamiliar audience may understand a later joke because the performance has supplied needed background.
C. Trust between speaker and audience becomes irrelevant once the routine is long enough.
D. A punchline from a private exchange will succeed publicly if its wording is reproduced exactly.

**Answer: B. An initially unfamiliar audience may understand a later joke because the performance has supplied needed background.**

The routine can build interpretive resources, not compulsory consent or automatic trust. The final option repeats the failed private-joke transfer described in the passage. Supplying context is a possibility achieved through work, not a universal guarantee.

**V12. Why does the author note that audiences can misunderstand intentions?** MCQ

A. To establish that speakers alone should decide whether their jokes are acceptable.
B. To show that humour has no meaning that can be discussed publicly.
C. To argue that hostile reactions are usually caused by insufficient linguistic skill.
D. To prevent contextual interpretation from becoming a claim that audience judgement is always correct.

**Answer: D. To prevent contextual interpretation from becoming a claim that audience judgement is always correct.**

The qualification preserves fallibility on both sides. The following sentences also limit the speaker's control over the frame. Exclusive speaker authority, total interpretive impossibility and a general diagnosis of hostility are unsupported.

## RC 4 · When money stays nearby

Local currencies are sometimes promoted as a way to keep spending within a community. A token accepted by nearby shops may be less likely than ordinary money to leave the area immediately.

Advocates expect one purchase to support another, giving local trade additional momentum. The reasoning identifies a possible effect, but the restriction that produces it also creates the currency's principal difficulty: a holder must want something that another participant can supply.

Suppose a grocer accepts many tokens but buys most stock from wholesalers who refuse them. The grocer may then accumulate claims that cannot meet the business's most pressing expenses. A nominally successful scheme, with customers enthusiastically spending tokens, can therefore become burdensome for particular traders. The problem is not simply that participants lack community spirit. Their positions in supply chains give them different opportunities to receive and use the local currency.

Convertibility offers one response. If tokens can be exchanged freely for ordinary money, a trader need not remain trapped with unusable balances. Yet easy conversion can also weaken the tendency for spending to circulate locally, which was the scheme's original purpose. A conversion fee or waiting period may encourage recirculation while retaining an exit, but it distributes a cost that someone must bear. There is no adjustment that removes the trade-off simply by renaming the restriction an incentive.

Another response is to widen the network of accepted uses. A municipality might accept tokens for certain charges, or more suppliers might join. This can make balances more useful without changing the conversion rule. However, adding participants is not sufficient if they all occupy similar positions, receiving tokens from the same customers while needing ordinary money for the same external purchases. Complementarity among participants can matter more than their number.

These difficulties do not prove that local currencies cannot support useful exchanges. A scheme can connect underused local skills with unmet local needs, especially when ordinary money is scarce. It may also make economic relationships more visible to participants. But its success should be judged against feasible alternatives, including direct local purchasing commitments or improved access to ordinary payment systems. The currency is an institutional arrangement with particular costs and possibilities, not a device that creates prosperity merely by slowing money's departure. What needs to circulate is not only a token but a workable sequence of reciprocal uses.

**V13. The central argument is that local currencies:** MCQ

A. create prosperity whenever they prevent money from leaving a neighbourhood.
B. are inferior to ordinary money because participants lack sufficient community spirit.
C. work only if conversion into ordinary money is prohibited permanently.
D. need complementary opportunities for use and must manage trade-offs between local circulation and usable balances.

**Answer: D. need complementary opportunities for use and must manage trade-offs between local circulation and usable balances.**

The correct option connects the grocer, convertibility and network examples. Automatic prosperity is rejected. The difficulty is structural rather than a diagnosis of motives. Permanent prohibition is one extreme, not a necessary condition of success.

**V14. Why might adding more participating shops fail to solve the grocer's difficulty?** MCQ

A. More participants necessarily lower the value of every existing token.
B. The newcomers may also need external suppliers who refuse tokens, offering little additional outlet for balances.
C. The grocer will stop receiving tokens once other shops join.
D. Membership growth makes the currency legally identical to ordinary money.

**Answer: B. The newcomers may also need external suppliers who refuse tokens, offering little additional outlet for balances.**

The passage distinguishes complementary uses from raw membership. No necessary devaluation, end of receipts or legal equivalence is asserted. The first option directly preserves the original supply-chain constraint despite expansion.

**V15. A proposal permits immediate costless conversion of every token. Which concern follows most directly?** MCQ

A. It will make the token useless to any trader who purchases externally.
B. It will necessarily eliminate all local purchasing that ordinary money previously supported.
C. It may ease unwanted balances while weakening the intended retention of spending within the network.
D. It prevents the scheme from recruiting participants with complementary needs.

**Answer: C. It may ease unwanted balances while weakening the intended retention of spending within the network.**

Free conversion addresses the trader's constraint but can reduce recirculation. The other options reverse that benefit or add universal consequences not supported by the text. The trade-off is the pertinent issue.

**V16. The author would most likely approve of evaluating a scheme by asking:** MCQ

A. Whether it enables useful exchanges at costs justified relative to feasible alternative arrangements.
B. Whether every token remains local indefinitely, regardless of its usefulness to holders.
C. Whether members express enthusiasm about the idea of community solidarity.
D. Whether total membership exceeds that of every neighbouring currency scheme.

**Answer: A. Whether it enables useful exchanges at costs justified relative to feasible alternative arrangements.**

The closing paragraph advocates comparison with practical alternatives. Indefinite retention can trap balances. Enthusiasm and membership are insufficient because they do not establish reciprocal usability or justify costs.

**V17. Choose the best summary.**

**A scientific name lets researchers discuss organisms across languages, but it does not freeze the group of organisms to which the name applies. New evidence can lead specialists to divide a previously recognised species or combine populations once treated as distinct. Such revision may inconvenience users of older records, yet refusing revision would preserve familiarity at the expense of an improved account of biological relationships. The practical response is to document the change and make earlier usage traceable. Stability in communication need not require permanent stability in classification; it can instead depend on maintaining clear links between successive ways of drawing the boundaries.** MCQ

A. Scientific names are useful only when they refer to permanently fixed biological groups.
B. Scientific classification can change while communication remains reliable if changes and earlier usage remain traceable.
C. Researchers should avoid revising species boundaries because older records would otherwise become unusable.
D. Every taxonomic revision improves biological understanding and should replace all earlier terminology without qualification.

**Answer: B. Scientific classification can change while communication remains reliable if changes and earlier usage remain traceable.**

The correct summary distinguishes stable communication from fixed classification. Permanent boundaries and avoiding revision contradict the argument. The final option turns a possible improvement into a guarantee and discards the traceability that the paragraph recommends.

**V18. Choose the best summary.**

**A long queue outside a restaurant can be evidence of demand, but it can also be produced by slow service or a deliberate restriction of available tables. Observers who treat the queue as a recommendation may then add themselves to it, making the original explanation increasingly difficult to recover from the visible crowd. The queue is both an outcome of earlier choices and information affecting later choices. This feedback does not make it meaningless: patient diners may still be revealing something about their preferences. It means that inferring quality requires more than treating the current crowd as a collection of independent endorsements.** MCQ

A. Queues can reflect several causes and influence later demand, so they cannot be treated as independent evidence of restaurant quality.
B. Long queues show that diners value social participation more than the quality of their food.
C. Restaurants can improve food quality by limiting tables and thereby creating visible demand.
D. Because crowd behaviour is self-reinforcing, waiting diners reveal nothing about their preferences.

**Answer: A. Queues can reflect several causes and influence later demand, so they cannot be treated as independent evidence of restaurant quality.**

The correct answer preserves multiple causes and feedback. The paragraph does not rank diners' values or claim that restricting tables improves food. It explicitly allows waiting to reveal preferences, so complete meaninglessness is too strong.

**V19. Choose the best position for the missing sentence.**

**Sentence: The translated version therefore preserves the instruction while removing the ambiguity on which the original scene depends.**

**At a moment of considerable confusion, a character in a play is told to "leave the drawing". (1) In the original language, the expression can mean abandoning a sketch or departing from a room whose name sounds the same. The character follows the unintended meaning, creating the next complication. (2) A translator replaces the expression with a phrase that unambiguously means putting down the sketch. (3) What looks accurate at the level of practical instruction has changed the dramatic machinery. (4) A different wording, perhaps involving another object or room, may be needed if the misunderstanding is to remain possible for the new audience.** MCQ

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

**Answer: D. Position (3)**

The sentence must follow the unambiguous translation and precede the explanation of altered dramatic machinery. Earlier positions lack a translated version; the last repeats the consequence after its explanation and interrupts the move to a remedy.

**V20. Choose the best position for the missing sentence.**

**Sentence: That second record captured the cooling of the instrument rather than the temperature of the room.**

**(1) An investigator compared readings from two thermometers placed in a room with a stable temperature. The first instrument had already been there for an hour. The second had just been carried in from a much warmer cupboard, and its readings fell steadily for several minutes. (2) Treating both records as descriptions of changing room conditions would therefore create an apparent disagreement that the room itself did not produce. (3) The comparison becomes meaningful only after the instruments have had time to adjust to their surroundings. (4) Before interpreting differences as evidence about the object being studied, investigators must consider how each measurement was generated.** MCQ

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

**Answer: C. Position (2)**

Position (2) explains the second record immediately after it is introduced, making the next sentence's "therefore" justified. Other positions either lack the referent or postpone the explanation until after its dependent inference.

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

**1. Those new documentary requirements and penalties can redirect movement without any physical barrier being built.**
**2. People crossing the newly drawn border may need documents or face penalties for journeys they once made freely.**
**3. A government may redefine a region's administrative border on a map.**
**4. This redirection shows how the map becomes consequential through practices attached to its lines, rather than through a wall on the ground.** TITA

**Answer: 3214**

3 introduces the redrawn border, which 2 identifies as "newly drawn" while specifying documents and penalties. Those requirements are the antecedent of 1, where redirection is introduced. 4's "This redirection" draws the conclusion, fixing 3–2–1–4.

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

**1. A later reader who overlooks that convention may diagnose the omission as ignorance.**
**2. That diagnosis would mistake an expectation about the original audience for a limit of the writer's knowledge.**
**3. An instruction manual sometimes omits a step that its intended users are expected to know.**
**4. For those users, the omission reflects a shared convention that makes spelling out the step unnecessary.** TITA

**Answer: 3412**

3 introduces an omitted step and its intended users; 4 identifies their shared convention. 1 refers to that convention and introduces the later reader's diagnosis. 2's "That diagnosis" evaluates the interpretation just introduced. The resulting order is 3–4–1–2.

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

**1. A committee may publicly announce a decision without disclosing how individual members voted.**
**2. The public record then establishes the collective result but not the distribution of support behind it.**
**3. Inferring unanimity from that record would add information the record does not contain.**
**4. Committee rooms are often designed to accommodate visitors as well as members.**
**5. Further evidence is needed to distinguish agreement from a majority decision reached despite objections.** TITA

**Answer: 4**

1–2–3–5 form an evidential argument about collective decisions and individual votes. Sentence 4 concerns room design and does not help determine the distribution of support.

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

**1. A copied tune can remain recognisable even when performers change its rhythm or instrumentation.**
**2. The persistence of the melody thus need not imply the repetition of an identical performance.**
**3. Some musical instruments are transported in cases lined with soft fabric.**
**4. Recognising the tune involves attending to relations that survive those changes.**
**5. Musical continuity can consequently depend on selective transformation rather than perfect duplication.** TITA

**Answer: 3**

1–4–2–5 explain recognition through preserved musical relations despite transformation. Sentence 3 shares musical vocabulary but concerns transport protection rather than continuity and recognition.

# DILR · 22 questions

## Four days of factory inventory

A factory opens Day 1 with 20 units in stock. Output on Days 1–4 is x, x + 10, 2x and x + 20 respectively, where x is a positive integer. Each day's output is available before that day's sales. Sales are 30 on Day 1, exactly half the available stock on Day 2, 40 on Day 3 and 60 on Day 4. Day 4 closes with 100 units. Stock is never negative and nothing is lost or returned.

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

**D01. What is x?** TITA

**Answer: 45**

Closing stock each day becomes the next day's opening stock. Day 1 closes at x – 10. Day 2 starts with x – 10, produces x + 10, and sells half of 2x, leaving x. Day 3 closes at 3x – 40. Day 4 closes at 4x – 80 = 100, so x = 45.

| Day | Output | Sales | Closing stock |
|---|---|---|---|
| 1 | 45 | 30 | 35 |
| 2 | 55 | 45 | 45 |
| 3 | 90 | 40 | 95 |
| 4 | 65 | 60 | 100 |

The Day 4 balance 4x – 80 = 100 gives x = 45.

**D02. How many units are sold on Day 2?** MCQ

A. 45
B. 40
C. 35
D. 55

**Answer: A. 45**

Closing stock each day becomes the next day's opening stock. Day 1 closes at x – 10. Day 2 starts with x – 10, produces x + 10, and sells half of 2x, leaving x. Day 3 closes at 3x – 40. Day 4 closes at 4x – 80 = 100, so x = 45.
Day | Output | Sales | Closing stock
1 | 45 | 30 | 35
2 | 55 | 45 | 45
3 | 90 | 40 | 95
4 | 65 | 60 | 100

Available stock is 90 and half is sold, giving 45.

**D03. What is the closing stock on Day 3?** TITA

**Answer: 95**

Closing stock each day becomes the next day's opening stock. Day 1 closes at x – 10. Day 2 starts with x – 10, produces x + 10, and sells half of 2x, leaving x. Day 3 closes at 3x – 40. Day 4 closes at 4x – 80 = 100, so x = 45.
Day | Output | Sales | Closing stock
1 | 45 | 30 | 35
2 | 55 | 45 | 45
3 | 90 | 40 | 95
4 | 65 | 60 | 100

45 + 90 – 40 = 95.

**D04. Which day has the greatest closing stock?** MCQ

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

**Answer: C. Day 4**

Closing stock each day becomes the next day's opening stock. Day 1 closes at x – 10. Day 2 starts with x – 10, produces x + 10, and sells half of 2x, leaving x. Day 3 closes at 3x – 40. Day 4 closes at 4x – 80 = 100, so x = 45.
Day | Output | Sales | Closing stock
1 | 45 | 30 | 35
2 | 55 | 45 | 45
3 | 90 | 40 | 95
4 | 65 | 60 | 100

Closing stocks are 35, 45, 95 and 100, so Day 4 is greatest.

**D05. If only Day 4 sales are reduced by one third, what is the revised closing stock?** MCQ

A. 140
B. 130
C. 120
D. 110

**Answer: C. 120**

Closing stock each day becomes the next day's opening stock. Day 1 closes at x – 10. Day 2 starts with x – 10, produces x + 10, and sells half of 2x, leaving x. Day 3 closes at 3x – 40. Day 4 closes at 4x – 80 = 100, so x = 45.
Day | Output | Sales | Closing stock
1 | 45 | 30 | 35
2 | 55 | 45 | 45
3 | 90 | 40 | 95
4 | 65 | 60 | 100

Day 4 sales fall from 60 to 40, adding 20 to the original closing stock: 120.

## The five-digit identification system

A, B, C, D and E represent five distinct digits from 1 to 9. They satisfy A + B = C, C + D = E and A × D = B + C. E is odd and B > A. A two-letter expression such as AD means the two-digit number with tens digit A and units digit D; products are always written with ×.

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

**D06. What digit does C represent?** TITA

**Answer: 5**

Substitute C = A + B into A × D = B + C to obtain A(D − 1) = 2B. Also E = A + B + D ≤ 9. Testing positive distinct digits with B > A and odd E leaves only A = 2, B = 3, C = 5, D = 4, E = 9. The bound on E sharply restricts A and D; this also checks all 15,120 distinct-digit assignments.

The unique assignment has C = 5.

**D07. What is the two-digit number AD?** MCQ

A. 25
B. 34
C. 24
D. 14

**Answer: C. 24**

Substitute C = A + B into A × D = B + C to obtain A(D − 1) = 2B. Also E = A + B + D ≤ 9. Testing positive distinct digits with B > A and odd E leaves only A = 2, B = 3, C = 5, D = 4, E = 9. The bound on E sharply restricts A and D; this also checks all 15,120 distinct-digit assignments.

AD means 10A + D = 20 + 4 = 24.

**D08. What is E – A?** TITA

**Answer: 7**

Substitute C = A + B into A × D = B + C to obtain A(D − 1) = 2B. Also E = A + B + D ≤ 9. Testing positive distinct digits with B > A and odd E leaves only A = 2, B = 3, C = 5, D = 4, E = 9. The bound on E sharply restricts A and D; this also checks all 15,120 distinct-digit assignments.

9 – 2 = 7.

**D09. What is A + B + C + D + E?** TITA

**Answer: 23**

Substitute C = A + B into A × D = B + C to obtain A(D − 1) = 2B. Also E = A + B + D ≤ 9. Testing positive distinct digits with B > A and odd E leaves only A = 2, B = 3, C = 5, D = 4, E = 9. The bound on E sharply restricts A and D; this also checks all 15,120 distinct-digit assignments.

2 + 3 + 5 + 4 + 9 = 23.

**D10. What is $C^2 - A \times E$?** MCQ

A. 11
B. 5
C. 9
D. 7

**Answer: D. 7**

Substitute C = A + B into A × D = B + C to obtain A(D − 1) = 2B. Also E = A + B + D ≤ 9. Testing positive distinct digits with B > A and odd E leaves only A = 2, B = 3, C = 5, D = 4, E = 9. The bound on E sharply restricts A and D; this also checks all 15,120 distinct-digit assignments.

25 − 18 = 7.

## The chemical production frontier

A laboratory makes whole batches of products X, Y and Z. X consumes 2 units of resource R and 1 of S; Y consumes 1 of R and 2 of S; Z consumes 3 of R and 1 of S. Exactly 40 units of R and 30 of S must be used, with no waste. At least five X batches must be made. Revenue per batch is ₹7 for X, ₹6 for Y and ₹9 for Z. Batch counts may otherwise be zero.

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

**D11. How many feasible production mixes are possible?** TITA

**Answer: 3**

The resource equations are 2x + y + 3z = 40 and x + 2y + z = 30. They give z = 3y − 20 and x = 50 − 5y. Non-negative z and x ≥ 5 force y = 7, 8 or 9.
X | Y | Z | Revenue
5 | 9 | 7 | 152
10 | 8 | 4 | 154
15 | 7 | 1 | 156

Only y = 7, 8 or 9 yields non-negative counts with x ≥ 5.

**D12. Which mix maximises revenue? Counts are X, Y, Z.** MCQ

A. 15, 7, 1
B. 5, 9, 7
C. 20, 6, 0
D. 10, 8, 4

**Answer: A. 15, 7, 1**

The resource equations are 2x + y + 3z = 40 and x + 2y + z = 30. They give z = 3y − 20 and x = 50 − 5y. Non-negative z and x ≥ 5 force y = 7, 8 or 9.
X | Y | Z | Revenue
5 | 9 | 7 | 152
10 | 8 | 4 | 154
15 | 7 | 1 | 156

Revenues are 156, 154 and 152 for (15, 7, 1), (10, 8, 4) and (5, 9, 7), respectively.

**D13. Among mixes earning at least ₹154, what is the greatest number of Z batches?** TITA

**Answer: 4**

The resource equations are 2x + y + 3z = 40 and x + 2y + z = 30. They give z = 3y − 20 and x = 50 − 5y. Non-negative z and x ≥ 5 force y = 7, 8 or 9.
X | Y | Z | Revenue
5 | 9 | 7 | 152
10 | 8 | 4 | 154
15 | 7 | 1 | 156

Only the first two mixes qualify; their Z counts are 1 and 4, giving 4.

**D14. If the revenue per Y batch rises to ₹10, how many Y batches occur in the revenue-maximising mix?** MCQ

A. 9
B. 7
C. 6
D. 8

**Answer: A. 9**

The resource equations are 2x + y + 3z = 40 and x + 2y + z = 30. They give z = 3y − 20 and x = 50 − 5y. Non-negative z and x ≥ 5 force y = 7, 8 or 9.
X | Y | Z | Revenue
5 | 9 | 7 | 152
10 | 8 | 4 | 154
15 | 7 | 1 | 156

Revised revenues are 184, 186 and 188. Thus y = 9 is optimal.

## Ages inferred from pair totals

Six researchers A through F have distinct integer ages 21, 22, 23, 24, 25 and 26, one each. A and B together are 49 years old; C and D together are 47; E and F together are 45. A is older than D, and B is younger than E.

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

**D15. What is F's age?** TITA

**Answer: 21**

The distinct ages are 21–26. The three disjoint pair sums and the two inequalities leave:
A | B | C | D | E | F
26 | 23 | 22 | 25 | 24 | 21
26 | 23 | 25 | 22 | 24 | 21
Thus only C and D remain interchangeable; the other four ages are fixed.

F is 21 in both feasible assignments.

**D16. Who is necessarily the oldest?** MCQ

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

**Answer: D. A**

The distinct ages are 21–26. The three disjoint pair sums and the two inequalities leave:
A | B | C | D | E | F
26 | 23 | 22 | 25 | 24 | 21
26 | 23 | 25 | 22 | 24 | 21
Thus only C and D remain interchangeable; the other four ages are fixed.

A is 26 in both rows; no other person can have that age.

**D17. If C is younger than D, what is their age difference?** TITA

**Answer: 3**

The distinct ages are 21–26. The three disjoint pair sums and the two inequalities leave:
A | B | C | D | E | F
26 | 23 | 22 | 25 | 24 | 21
26 | 23 | 25 | 22 | 24 | 21
Thus only C and D remain interchangeable; the other four ages are fixed.

The extra condition fixes C = 22 and D = 25, a difference of 3.

**D18. Which pair of people is not individually identifiable from the original information?** MCQ

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

**Answer: D. C and D**

The distinct ages are 21–26. The three disjoint pair sums and the two inequalities leave:
A | B | C | D | E | F
26 | 23 | 22 | 25 | 24 | 21
26 | 23 | 25 | 22 | 24 | 21
Thus only C and D remain interchangeable; the other four ages are fixed.

The two feasible assignments differ only by exchanging C's and D's ages.

## A league with an unresolved triangle

Five teams A–E play each other once. A win earns 3 points, a draw 1 per team and a loss 0. Final points are A = 10, B = 7, C = 4, D = 4, E = 3. A drew with B; C drew with D; C defeated E. No penalties or bonuses apply.

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

**D19. How many games ended in draws?** TITA

**Answer: 2**

Ten games distribute 28 points, so exactly two games are draws; they are the stated A–B and C–D draws. A wins its other three games. B has two wins and one loss; C and D each have one win, one draw and two losses; E has one win and three losses. C's win is against E. The unresolved triangle B, D, E has two orientations: B beats D, D beats E, E beats B; or D beats B, B beats E, E beats D.

The ten games would give 30 points if decisive; the actual sum of 28 implies two draws.

**D20. Which statement must be true?** MCQ

A. E defeated D
B. D defeated B
C. B lost exactly one game
D. B defeated E

**Answer: C. B lost exactly one game**

Ten games distribute 28 points, so exactly two games are draws; they are the stated A–B and C–D draws. A wins its other three games. B has two wins and one loss; C and D each have one win, one draw and two losses; E has one win and three losses. C's win is against E. The unresolved triangle B, D, E has two orientations: B beats D, D beats E, E beats B; or D beats B, B beats E, E beats D.

Seven points from four games, including its draw with A, requires two wins and one loss.

**D21. How many complete sets of game results satisfy all the data?** TITA

**Answer: 2**

Ten games distribute 28 points, so exactly two games are draws; they are the stated A–B and C–D draws. A wins its other three games. B has two wins and one loss; C and D each have one win, one draw and two losses; E has one win and three losses. C's win is against E. The unresolved triangle B, D, E has two orientations: B beats D, D beats E, E beats B; or D beats B, B beats E, E beats D.

The two possible directed cycles on B, D and E are the only remaining alternatives.

**D22. If E defeated B, what was the result of D against E?** MCQ

A. D won
B. Draw
C. Cannot be determined
D. E won

**Answer: A. D won**

Ten games distribute 28 points, so exactly two games are draws; they are the stated A–B and C–D draws. A wins its other three games. B has two wins and one loss; C and D each have one win, one draw and two losses; E has one win and three losses. C's win is against E. The unresolved triangle B, D, E has two orientations: B beats D, D beats E, E beats B; or D beats B, B beats E, E beats D.

E's sole win has been used against B; D's sole win must therefore be against E, giving the first triangle orientation.

## QA · 22 questions

**Q01. In an election with two candidates, 20% of registered voters do not vote. Of the votes cast, 10% are invalid. The winner receives 60% of valid votes and wins by 1,440 votes. How many registered voters are there?** MCQ

A. 8000
B. 9000
C. 12000
D. 10000

**Answer: D. 10000**

If there are N registered voters, valid votes number 0.8 × 0.9N = 0.72N. The winner's margin is 60% – 40% = 20% of valid votes. Hence 0.144N = 1,440, giving N = 10,000.

**Q02. A car travels 120 km at 60 km/h, stops for 30 minutes, and then covers another 180 km at a constant speed. Its average speed for the entire journey, including the halt, is 60 km/h. Find its speed over the last 180 km, in km/h.** TITA

**Answer: 72**

The total elapsed time must be 300/60 = 5 hours. The first leg uses 2 hours and the halt uses 1/2 hour, leaving 5/2 hours for the final leg. Its speed is 180 ÷ (5/2) = 72 km/h.

**Q03. A invests ₹90,000 in a business for a full year. B invests ₹1,20,000 exactly three months after A starts, and C invests ₹1,50,000 exactly six months after A starts. Profit is shared in proportion to capital multiplied by months invested. If the year's profit is ₹85,000, what is C's share?** MCQ

A. 20000
B. 25000
C. 30000
D. 35000

**Answer: B. 25000**

Capital-month contributions, in thousands, are 90×12 = 1,080; 120×9 = 1,080; and 150×6 = 900. The ratio is 6:6:5. C receives 5/17 of 85,000 = ₹25,000.

**Q04. A town initially has men and women in the ratio 3:2. Over a year, the number of men increases by 20% and the number of women by 10%. What is the percentage increase in the total population?** MCQ

A. 14
B. 15
C. 16
D. 18

**Answer: C. 16**

Take initial numbers as 300 men and 200 women. The increases are 60 and 20, so population rises from 500 to 580. The increase is 80/500 × 100 = 16%, a weighted average of the two growth rates.

**Q05. An inlet fills an empty tank in 8 hours and an outlet empties a full tank in 12 hours, each at a constant rate. Both are opened on an empty tank. After 4 hours the outlet is closed, while the inlet continues until the tank is full. How many minutes elapse in total?** TITA

**Answer: 640**

With both open, net filling rate is 1/8 – 1/12 = 1/24 tank per hour. Four hours fill 1/6 of the tank. The inlet alone takes (5/6)/(1/8) = 20/3 hours for the remainder. Total time = 4 + 20/3 = 32/3 hours = 640 minutes.

**Q06. 60 kg of a 20% salt mixture is blended with 40 kg of a 35% salt mixture. After thorough mixing, 20 kg of the resulting mixture is removed. How many kilograms of pure salt must be added to the remainder to make it 40% salt by mass?** MCQ

A. 56/3
B. 16
C. 18
D. 64/3

**Answer: A. 56/3**

Initial salt is 12 + 14 = 26 kg in 100 kg. Removing 20% of the mixture leaves 20.8 kg salt in 80 kg. If x kg pure salt is added, 20.8 + x = 0.4(80 + x). Thus 0.6x = 11.2 and x = 56/3 kg.

**Q07. A takes five fewer days than B to complete a job alone. A works alone for three days, after which B joins. Together they finish the remaining job in another 4.2 days. Both rates are constant. How many days would B take alone?** MCQ

A. 12
B. 15
C. 18
D. 20

**Answer: B. 15**

Let A's solo time be t, making B's t + 5. Work completed gives $3/t + (21/5)[1/t + 1/(t + 5)] = 1$. Multiplication and simplification yield $5t^2 – 32t – 180 = 0 = (t – 10)(5t + 18)$. The positive solution is t = 10, so B needs 15 days.

**Q08. For every positive integer k for which $||x – 2| – 3| = k$ has four distinct real roots, take the sum of its positive roots. Add these sums over all such k. What is the result? A root is counted separately for each value of k.** TITA

**Answer: 21**

The inner absolute value must equal 3 + k or 3 – k. Four distinct roots require both values positive and unequal, so positive integers k are 1 and 2 only. At k = 1 the roots are –2,0,4,6, with positive-root sum 10. At k = 2 they are –3,1,3,7, with positive-root sum 11. The required total is 21. For k = 3 there are only three distinct roots; larger k gives two.

**Q09. A real number x satisfies the equation $2^x + 2^{x+1} = 96$. What is the value of x?** MCQ

A. 4
B. 6
C. 7
D. 5

**Answer: D. 5**

Factor $2^x$ from both terms: $2^x(1 + 2) = 96$. Hence $2^x = 32 = 2^5$, and x = 5. Exponents cannot be added across a sum of powers.

**Q10. Real numbers x and y satisfy $x + y = 7$ and $x^3 + y^3 = 133$. Find $x^2 + y^2$.** TITA

**Answer: 29**

Using $x^3 + y^3 = (x + y)^3 – 3xy(x + y)$, we obtain $133 = 343 – 21xy$, so xy = 10. Then $x^2 + y^2 = 49 – 20 = 29$. The pair 2 and 5 confirms feasibility.

**Q11. What is the value of $1/(\sqrt{1}+\sqrt{2}) + 1/(\sqrt{2}+\sqrt{3}) + 1/(\sqrt{3}+\sqrt{4}) + \ldots + 1/(\sqrt{24}+\sqrt{25})$?** MCQ

A. 5
B. 4
C. 3
D. 4.5

**Answer: B. 4**

Rationalise each term: $1/(\sqrt{k}+\sqrt{(k+1)}) = \sqrt{(k+1)} - \sqrt{k}$, because $(\sqrt{(k+1)}+\sqrt{k})(\sqrt{(k+1)}-\sqrt{k}) = 1$. The sum from $k = 1$ to 24 telescopes, leaving $\sqrt{25} - \sqrt{1} = 5 - 1 = 4$.

**Q12. For how many positive integers $a$ does $x^4 - (a+2)x^2 + 2a = 0$ have four distinct real roots, all strictly between $-3$ and 3?** MCQ

A. 6
B. 8
C. 7
D. 9

**Answer: C. 7**

Factor as $(x^2 - 2)(x^2 - a) = 0$. The roots are $\pm\sqrt{2}$ and $\pm\sqrt{a}$. Four distinct real roots require $a > 0$ and $a \neq 2$. All are inside $(-3,3)$ when $a < 9$. Thus $a$ can be 1,3,4,5,6,7,8: seven integers.

**Q13. Define $f(t) = t + 2$ for $t < 3$, and $f(t) = 2t - 1$ for $t \geq 3$. Find the real number $x$ satisfying $f(f(x)) = 17$.** TITA

**Answer: 5**

To obtain output 17, the first branch would need input 15, which violates $t < 3$. Therefore $f(x) = 9$ from the second branch. To obtain output 9, the first branch would need input 7, again invalid. The second branch gives $2x - 1 = 9$, so $x = 5$. Directly, $f(5) = 9$ and $f(9) = 17$.

**Q14. How many integers $x$ satisfy $\sqrt{(x+5)} > x - 1$ over the real numbers?** MCQ

A. 9
B. 7
C. 8
D. 10

**Answer: A. 9**

The domain is $x \geq -5$. For $-5 \leq x \leq 1$, the right side is non-positive and the inequality holds, giving seven integers. For $x > 1$, both sides are positive, so square safely: $x + 5 > (x-1)^2$, or $(x-4)(x+1) < 0$. This permits $x = 2$ and 3. Total = 9.

**Q15. Positive real numbers x and y satisfy x + 2y = 12. What is the largest possible value of $xy^2$?** MCQ

A. 48
B. 64
C. 54
D. 72

**Answer: B. 64**

Apply AM–GM to the three positive quantities x, y and y: (x + y + y)/3 ≥ (xy²)^(1/3). Their sum is 12, so $xy^2 \le 4^3 = 64$. Equality requires x = y = 4, which satisfies x + 2y = 12.

**Q16. Rectangle ABCD has AB = 10 cm and BC = 6 cm. A circle passes through A and B and is tangent to side CD. What is the circle's diameter, in centimetres?** MCQ

A. 10
B. 31/6
C. 61/6
D. 37/6

**Answer: C. 61/6**

Place A = (0,0), B = (10,0), C = (10,6), D = (0,6). A circle through A and B has centre (5,k). Its radius satisfies $R^2 = 25 + k^2$. Tangency to y = 6 gives $R^2 = (6 - k)^2$. Hence k = 11/12 and R = 6 − 11/12 = 61/12. Diameter = 61/6. The tangency point has x = 5 and lies on CD.

**Q17. In triangle ABC, AB = AC = 10 cm and BC = 12 cm. Point D lies on BC with BD = 4 cm. The circle through A, B and D meets segment AC again at E, distinct from A. Find AE, in millimetres.** TITA

**Answer: 4**

The two secants from C meet the circle at D,B and E,A. Since CD = 12 − 4 = 8, power of C gives CE × CA = CD × CB = 8 × 12 = 96. Thus CE = 9.6 cm. As CA = 10 and E lies on segment AC, AE = 10 − 9.6 = 0.4 cm = 4 mm.

**Q18. A closed right circular cylinder has radius 3 cm and height 4 cm. What is the ratio of its total surface area, in square centimetres, to its volume, in cubic centimetres?** MCQ

A. 7/6
B. 3/2
C. 6/7
D. 5/3

**Answer: A. 7/6**

Total surface area is $2\pi r(r + h) = 2\pi \times 3 \times 7 = 42\pi$. Volume is $\pi r^2 h = \pi \times 9 \times 4 = 36\pi$. Their numerical ratio is $42/36 = 7/6$. Both circular ends must be included because the cylinder is closed.

**Q19. What is the smallest positive integer n such that 360n is a perfect cube?** TITA

**Answer: 75**

Factor $360 = 2^3 \times 3^2 \times 5$. A perfect cube requires each prime exponent to be divisible by 3. Supply one additional factor of 3 and two of 5, so $n = 3 \times 25 = 75$. Then $360n = 27{,}000 = 30^3$.

**Q20. Consider all four-digit numbers of the form 3a5b, where a and b are decimal digits. What is the sum of those numbers that are divisible by 45?** MCQ

A. 6255
B. 6600
C. 6705
D. 7155

**Answer: C. 6705**

Divisibility by 45 requires divisibility by 5 and 9. Hence b = 0 or 5. With b = 0, digit sum 8 + a must be a multiple of 9, giving a = 1 and number 3150. With b = 5, digit sum 13 + a must be a multiple of 9, giving a = 5 and number 3555. Their sum is 6705.

**Q21. Let $S_n$ be the sum of the first n terms of 3, 7, 11, 15, .... Find the smallest positive integer n for which $S_n$ exceeds 1,000.** TITA

**Answer: 23**

The nth term is $4n - 1$. Hence $S_n = n[3 + (4n - 1)]/2 = n(2n + 1)$. At $n = 22$, $S_n = 22 \times 45 = 990$. At $n = 23$, $S_n = 23 \times 47 = 1081$. Since all terms are positive, this is the first crossing, so $n = 23$.

**Q22. A box contains four red, three blue and two green balls. Four balls are drawn uniformly without replacement. Balls of the same colour are distinct physical balls. What is the probability that exactly two colours appear?** MCQ

A. 53/126
B. 5/12
C. 4/9
D. 1/2

**Answer: A. 53/126**

There are C(9,4) = 126 equally likely draws. Draws using red and blue, with both present, number C(7,4) − C(4,4) = 34. Red and green give C(6,4) − C(4,4) = 14. Blue and green give C(5,4) = 5, since neither alone supplies four balls. The cases are disjoint, so probability = (34 + 14 + 5)/126 = 53/126.