CAT 2025 Slot 3

Question Paper with Solutions

SECTION I – VERBAL ABILITY & READING COMPREHENSION (VARC)

Q1. Five jumbled sentences (labelled 1, 2, 3, 4, and 5), related to a topic, are given below. Four of them can be put together to form a coherent paragraph. Identify the odd sentence out and key in the number of that sentence as your answer.

1. About half of all the oxygen we breathe is made near the surface of the ocean by phytoplankton that photosynthesize just like land-dwelling plants.
2. A team of scientists that includes Boston University experts has discovered they also produce oxygen on the seafloor.
3. The research team used deep-sea chambers that land on the seafloor and enclose the seawater, sediment, polymetallic nodules, and living organisms.
4. The discovery is a surprise considering oxygen is typically created by plants and organisms with help from the sun-not by rocks on the ocean floor.
5. The deep-sea rocks, called polymetallic nodules, don't only host a surprising number of sea critters.

Answer: 3

Solution:

Sentences 5, 2, 4, and 1 form a coherent sequence. Sentence 5 introduces polymetallic nodules by noting they do more than just host creatures. Sentence 2 follows directly with the key discovery: that these rocks also generate oxygen on the seafloor. Sentence 4 explains why this finding is surprising-oxygen production is normally associated with sunlight-driven photosynthesis, not deep-sea rocks. Sentence 1 then contextualizes this by noting that roughly half our breathable oxygen already comes from ocean phytoplankton, making the seafloor discovery even more striking.

Sentence 3, which describes the specific deep-sea chambers used in the experiment, is about research methodology rather than the discovery itself. It interrupts the logical flow from discovery to explanation, making it the odd sentence out.

Q2. The passage given below is followed by four summaries. Choose the option that best captures the essence of the passage.

The return to the tailor is the juxtaposition of three key things for the mindful Indian shopper. The first is the conscious shift away from the homogeneity of fast fashion, the idea of a hundred other people owning exactly the same Zara trench coat or H&M pleated skirt. The second is an actual understanding of the waste behind the fast fashion market, and wanting not to contribute to that anymore. The last is the shift toward customization and fit-the idea of having imaginations brought to life and to have them fit exactly; without paying exorbitant rates for that bespoke tailoring. For the individual with a keen fashion sense and a genuine desire to move away from the waste and

uniformity of fast fashion without paying the premium for it that indie brands would invariably demand, the tailor is the perfect crossover.

A) The mindful Indian shoppers are returning to the tailor with a genuine desire to wear clothes which are less expensive, fit them well and are yet fashionable.

B) The mindful Indian shopper is shifting away from convenience and uniformity of clothing, and waste in fashion, to customization and less exorbitantly priced clothing.

C) All Indian shoppers are opting for customization and a shift away from homogeneity over expensive clothing brands like Zara and H&M.

D) In the Indian retail market, people believe that expensive branded clothes are wasteful and, therefore, are returning to the neighborhood tailor.

Answer: B

Solution:

Option B best captures the three pillars the passage identifies: moving away from uniformity (the sameness of fast fashion), avoiding the waste it generates, and seeking customized, well-fitting clothes at reasonable prices-without having to pay the premium charged by indie brands.

Option A misses the waste and uniformity concerns entirely. Option C overstates the scope by saying 'all Indian shoppers' when the passage specifically discusses a 'mindful' subset. Option D reduces the argument to cost alone and mischaracterizes the motivation as simply rejecting expensive branded clothes.

Instructions for Questions 3–6: The passage below is accompanied by four questions. Based on the passage, choose the best answer for each question.

In 1982, a raging controversy broke out over a forest act drafted by the Government of India. This act sought to strengthen the already extensive powers enjoyed by the forest bureaucracy in controlling the extraction, disposal and sale of forest produce. It also gave forest officials greater powers to strictly regulate the entry of any person into reserved forest areas. While forest officials justified the act on the grounds that it was necessary to stop the continuing deforestation, it was bitterly opposed by representatives of grassroots organizations, who argued that it was a major violation of the rights of peasants and tribals living in and around forest areas.

The debate over the draft forest act fuelled a larger controversy over the orientation of state forest policy. It was pointed out, for example, that the draft act was closely modelled on its predecessor, the Forest Act of 1878. The earlier Act rested on a usurpation of rights of ownership by the colonial state which had little precedent in precolonial history. It was further argued that the system of forestry introduced by the British-and continued, with little modification, after 1947-emphasized revenue generation and commercial exploitation, while its policing orientation excluded villagers who

had the most longstanding claim on forest resources. Critics called for a complete overhaul of forest administration, pressing the government to formulate policy and legislation more appropriate to present needs.

That debate is not over yet. The draft act was shelved, though it has not as yet been formally withdrawn. Meanwhile, the 1878 Act (as modified by an amendment in 1927) continues to be in operation. In response to its critics, the government has made some important changes in forest policy, e.g., no longer treating forests as a source of revenue, and stopping ecologically hazardous practices such as the clearfelling of natural forests. At the same time, it has shown little inclination to meet the major demand of the critics of forest policy-namely, abandoning the principle of state monopoly over forest land by handing over areas of degraded forests to individuals and communities for afforestation.

[The] 1878 Forest Act itself was passed only after a bitter and prolonged debate within the colonial bureaucracy, in which protagonists put forward arguments strikingly similar to those being advanced today. As is well known, the Indian Forest Department owes its origin to the requirements of railway companies. The early years of the expansion of the railway network, c. 1853 onwards, led to tremendous deforestation in peninsular India owing to the railway's requirements of fuelwood and construction timber. Huge quantities of durable timbers were also needed for use as sleepers across the newly laid tracks. Inexperienced in forestry, the British called in German experts to commence systematic forest management. The Indian Forest Department was started in 1864, with Dietrich Brandis, formerly a Lecturer at Bonn, as the first Inspector General of Forests. The new department needed legislative backing to function effectively, and in the following year, 1865, the first forest act was passed.

Q3. Which one of the following best encapsulates the reason for the "raging controversy" developing into a "larger controversy"?

A) The 1982 draft forest act replicated colonial measures of control and regulation of forest resources.

B) The 1982 draft forest act was unjustifiably defended by forest officials in the face of bitter opposition by grassroots organizations.

C) The 1982 draft forest act violated the rights of tribals and peasants who lived in and around forest areas.

D) The 1982 draft forest act further enabled the commercial exploitation of forest resources by the forest bureaucracy.

Answer: A

Solution:

The controversy widened because the 1982 draft act was recognized as a direct continuation of its colonial predecessor, the 1878 Forest Act. Critics pointed out that the 1878 Act had been built on the colonial state's unilateral seizure of forest ownership rights-a seizure with very little precedent in precolonial India-and that the post-independence forestry system continued the same emphasis on revenue generation and commercial exploitation while shutting out villagers who had the most longstanding claim to those resources. When it became clear that the new draft act essentially replicated this colonial model, the debate expanded from the immediate provisions of the 1982 bill to a wholesale questioning of the entire historical direction of state forest policy. Options B and C describe why the act was opposed, but neither explains why the controversy grew into something larger and more historical in scope. Option D is incomplete because the larger controversy was not just about commercial exploitation but about the perpetuation of colonial control mechanisms more broadly.

Q4. All of the following, if true, would weaken the narrative presented in the passage EXCEPT that:

A) certain tribal groups in India are responsible for climate change because their sustenance has historically depended on mass scale deforestation.

B) before British rule, peasants and tribal groups were denied access to forest resources by Indian rulers and their administrations.

C) the timber requirement for railway works in nineteenth century India was met through import from China, in exchange for spices.

D) nineteenth century German forestry experts were infamous for violating the rights of indigenous communities that lived in forest regions.

Answer: D

Solution:

Options A, B, and C each undermine a core claim in the passage. Option A shifts deforestation blame onto tribal communities, contradicting the passage's portrayal of them as victims of colonial and state policy. Option B challenges the claim that precolonial rulers had not denied forest access to tribals, which the passage uses to make British usurpation seem historically novel. Option C removes the railway-timber demand narrative, which is the passage's stated reason for creating the Forest Department. Option D, however, actually supports the passage's critical stance toward colonial forest administration: if German experts were already known to violate indigenous rights, their introduction into India reinforces the argument that the system was inherently exclusionary. It therefore does not weaken the passage's narrative.

Q5. According to the passage, which one of the following is not common to the 1878 Forest Act and the 1982 draft forest act?

A) Both sparked controversy and debate among the various stakeholders.

B) Both reflect a colonial mindset.

C) Both resulted in large scale deforestation.

D) Both sought to establish the state's monopoly over forest resources.

Answer: C

Solution:

Options A, B, and D are explicitly supported by the passage. Both acts generated bitter controversy; the 1982 draft was closely modelled on the colonial 1878 Act, reflecting the same mindset; and both reinforced state control over forest land. Option C is not supported. The passage associates large-scale deforestation with the rapid expansion of the railway network in the 1850s, which preceded and motivated the creation of the Forest Department. The 1982 draft act was, in fact, justified partly as a means to stop continuing deforestation-making it incorrect to say that both acts caused deforestation.

Q6. According to the passage, which one of the following reforms is yet to happen in India's forest policies?

A) Recognising the state's claim to forest land use.

B) A ban on deforestation.

C) Recognising the significance of forests to ecology.

D) Involving local people in cultivating forests.

Answer: D

Solution:

The passage notes several changes already made: the state no longer treats forests as a revenue source (ruling out C as still pending), and it has stopped ecologically harmful practices such as clearfelling (ruling out B). The state's monopoly over forest land remains firmly in place, so A has already been achieved. The one demand the government has conspicuously refused to meet is handing over degraded forest areas to individuals and communities for afforestation-that is, actively involving local people in cultivating forests. This is explicitly identified as the major unaddressed demand of the critics.

Q7. The given sentence is missing in the paragraph below. Decide where it best fits among the options 1, 2, 3, or 4 indicated in the paragraph.

Sentence: In each of the affected males, the genetic defect was located to the X chromosome in the region of p11-12.

Paragraph: The first suggested evidence of a human genetic mutation associated with aggressive behaviour came from a study in 1993. _____(1)_____. Genetic and metabolic studies were conducted on a large Dutch family in which several of the males has a syndrome of borderline mental retardation and abnormal behaviour. _____(2)_____. The undesirable behaviour included impulsive aggression, arson and exhibitionism. _____(3)_____. A point mutation was identified in the eighth exon of the monoamine oxidase A (MAOA) structural gene which changes glutamine to a termination codon. _____(4)_____.

A) Option 3

B) Option 4

C) Option 2

D) Option 1

Answer: A

Solution:

The paragraph follows the logical sequence: study introduction → methodology → abnormal behaviours → chromosomal location → specific mutation. The missing sentence-identifying the chromosomal location at p11-12-belongs after the description of the undesirable behaviours (arson, exhibitionism, aggression) and before the specific point mutation in the MAOA gene is named. Placing it at position 3 keeps the narrative moving from the broad (chromosome region) to the precise (specific gene mutation), which mirrors the way scientific discoveries are typically reported. Positions 1, 2, or 4 would either pre-empt the behavioural description or awkwardly follow the mutation detail.

Q8. The four sentences (labelled 1, 2, 3, and 4) given below, when properly sequenced, would yield a coherent paragraph. Decide on the proper sequencing of the order of the sentences and key in the sequence of the four numbers as your answer.

1. The effigy of a candidate establishes a personal link between him and the voters; the candidate does not only offer a programme for judgement, he suggests a physical climate, a set of daily choices expressed in a morphology, a way of dressing, a posture.

2. Some candidates for Parliament adorn their electoral prospectus with a portrait; this presupposes that photography has a power to convert which must be analysed.

3. Inasmuch as photography is an ellipse of language and a condensation of an 'ineffable' social whole, it constitutes an anti-intellectual weapon and tends to spirit away 'politics' (that is to say a body of problems and solutions) to the advantage of a 'manner of being', a socio-moral status.

4. Photography tends to restore the paternalistic nature of elections, whose elitist essence has been disrupted by proportional representation and the rule of parties (the Right seems to use it more than the Left).

Answer: 2143

Solution:

The correct sequence is 2 → 1 → 4 → 3. Sentence 2 opens with the concrete observation that Parliamentary candidates include their portraits in electoral material, then states that photography must have some persuasive power worth examining. Sentence 1 picks up that thread by explaining how a candidate's image creates a personal rather than a programmatic connection with voters, conveying lifestyle and posture rather than policy. Sentence 4 extends this analysis to the political consequences, noting that photographic personalism revives a paternalistic electoral style that party-based proportional representation had eroded. Sentence 3 closes with the broadest theoretical claim: photography is an anti-intellectual weapon that replaces substantive politics with a 'manner of being'. The movement is from observation to mechanism to political effect to general theory.

Instructions for Questions 9–12: The passage below is accompanied by four questions. Based on the passage, choose the best answer for each question.

Once a society accepts a secular mode of creativity, within which the creator replaces God, imaginative transactions assume a self-conscious form. The tribal imagination, on the other hand, is still to a large extent dreamlike and hallucinatory. It admits fusion between various planes of existence and levels of time in a natural and artless manner. In tribal stories, oceans fly in the sky as birds, mountains swim in water as fish, animals speak as humans and stars grow like plants. Spatial order and temporal sequence do not restrict the narrative. This is not to say that tribal creations have no conventions or rules, but simply that they admit the principle of association between emotion and the narrative motif. Thus stars, seas, mountains, trees, men and animals can be angry, sad or happy.

It might be said that tribal artists work more on the basis of their racial and sensory memory than on the basis of a cultivated imagination. In order to understand this distinction, we must understand the difference between imagination and memory. In the animate world, consciousness meets two immediate material realities: space and time. We put meaning into space by perceiving it in terms of images. The image-making faculty is a genetic gift to the human mind-this power of imagination helps us understand the space that envelops us. With regard to time, we make connections with the help of memory; one remembers being the same person today as one was yesterday.

The tribal mind has a more acute sense of time than the sense of space. Somewhere along the history of human civilization, tribal communities seem to have realized that domination over territorial space was not their lot. Thus, they seem to have turned almost obsessively to gaining domination over time. This urge is substantiated in their ritual of conversing with their dead ancestors: year after year, tribals in many parts of India worship terracotta or carved-wood objects representing their ancestors, aspiring to enter a trance in which they can converse with the dead. Over the centuries, an amazingly sharp memory has helped tribals classify material and natural objects into a highly complex system of knowledge.

One of the main characteristics of the tribal arts is their distinct manner of constructing space and imagery, which might be described as 'hallucinatory'. In both oral and visual forms of representation,

tribal artists seem to interpret verbal or pictorial space as demarcated by an extremely flexible 'frame'. The boundaries between art and non-art become almost invisible. A tribal epic can begin its narration from a trivial everyday event; tribal paintings merge with living space as if the two were one and the same. And within the narrative itself, or within the painted imagery, there is no deliberate attempt to follow a sequence. The episodes retold and the images created take on the apparently chaotic shapes of dreams. In a way, the syntax of language and the grammar of painting are the same, as if literature were painted words and painting were a song of images.

Q9. Non-human living forms exhibit human emotions in tribal narratives because tribal narratives:

A) have a self-conscious form.

B) accommodate existential fluidity.

C) abandon all rules and regulations.

D) are rudimentary and underdeveloped.

Answer: B

Solution:

The passage explains that tribal imagination 'admits fusion between various planes of existence and levels of time in a natural and artless manner.' This means the boundaries between human and non-human, animate and inanimate, are permeable-what the question calls 'existential fluidity.' Stars, seas, mountains, and animals can all feel anger, sadness, or happiness because no rigid boundary separates these categories. Option A is wrong because self-consciousness characterises secular, not tribal, creativity. Option C is incorrect because the passage explicitly states tribal creations do have conventions and rules. Option D is refuted by the passage's respectful treatment of tribal art as possessing a distinct, sophisticated imagination.

Q10. On the basis of the passage, which one of the following explains the main difference between imagination and memory?

A) Imagination is a genetic gift to humans whereas memory is central to human consciousness.

B) Tribal groups value memory over imagination when it comes to creating art and literature.

C) Imagination needs to be cultivated whereas memory is more intuitive because it is racial and sensory.

D) Imagination helps humans make sense of space while memory helps them understand time.

Answer: D

Solution:

The passage explicitly frames the distinction in spatial and temporal terms. It states that we 'put meaning into space by perceiving it in terms of images,' and this image-making faculty is imagination. For time, we rely on memory-we remember being the same person across different moments. Option D captures this precisely. Option A is partially true (imagination is called a genetic gift) but mischaracterises memory as being 'central to human consciousness' in a way the passage does not state. Option C reverses the passage's logic: imagination is described as a genetic gift, not something that requires cultivation. Option B addresses tribal preferences, not the fundamental conceptual distinction.

Q11. Which one of the following best explains why tribals in India worship their dead ancestors?

A) For tribals, conversing with the dead becomes a way of seeking control over time.

B) Tribals show respect to their ancestors through terracotta and carved-wood objects.

C) Tribals possess a sophisticated knowledge system that is based on memory.

D) Tribals seek territorial domination over the spaces that they inhabit.

Answer: A

Solution:

The passage reasons that because tribal communities realised they could not dominate territorial space, they turned obsessively to dominating time instead. Ancestor worship-aspiring to enter a trance and converse with the dead-is the direct expression of this drive to transcend temporal limits. Option B describes only the ritual objects used, not the underlying reason. Option C is a consequence of tribal memory culture, not the motivation for ancestor worship specifically. Option D directly contradicts the passage, which says tribals abandoned the quest for territorial domination.

Q12. All of the following, if true, would weaken the passage's claims about the hallucinatory tribal imagination EXCEPT that:

A) tribal art excludes the depiction of the mundane reality of everyday life and objects.

B) tribal narratives exhibit a chronological beginning, middle, and end.

C) tribal stories depict the natural world in accordance with rational scientific knowledge.

D) shamanic rituals involving conversing with the dead often feature in tribal stories.

Answer: D

Solution:

Options A, B, and C all undercut specific claims in the passage. Option A contradicts the claim that tribal art starts from trivial everyday events and merges with living space. Option B contradicts the assertion that tribal narratives follow no deliberate sequence and take on 'the chaotic shapes of dreams.' Option C contradicts the hallucinatory imagery (oceans flying, mountains swimming) that the passage uses as its primary evidence. Option D, however, actually reinforces the passage: the text cites shamanic trances and conversations with dead ancestors as evidence of the tribal imagination's hallucinatory, time-transcending quality. Far from weakening the argument, it supports it.

Q13. Five jumbled sentences (labelled 1, 2, 3, 4, and 5), related to a topic, are given below. Four of them can be put together to form a coherent paragraph. Identify the odd sentence out and key in the number of that sentence as your answer.

1. The profound emotional impact of music has inspired ongoing research into its relationship with emotions.
2. Music is a universal phenomenon that utilizes a myriad brain resources.
3. This inherent connection to musical expression is deeply intertwined with human identity and experience.
4. The proclivity to create and appreciate music is ubiquitous among humans, permeating daily life across diverse societies.
5. Engaging with music is among the most cognitively demanding tasks a human can undergo, and it is identified across cultures.

Answer: 1

Solution:

Sentences 2, 5, 4, and 3 fit together to describe music as a universal, cognitively demanding, and culturally pervasive element of human life. Sentence 2 opens by calling music universal and noting its wide neural demands. Sentence 5 deepens the cognitive point by emphasising how demanding musical engagement is. Sentence 4 extends this universality to daily life across all societies. Sentence 3 concludes by grounding the whole argument in human identity. Sentence 1, by contrast, introduces a separate topic-ongoing research into the relationship between music and emotion-and does not develop the theme of universality or cognitive complexity. It is therefore the odd sentence out.

Q14. The four sentences (labelled 1, 2, 3, and 4) given below, when properly sequenced, would yield a coherent paragraph. Decide on the proper sequencing of the order of the sentences and key in the sequence of the four numbers as your answer.

1. When I ask the distinguished LGBTQ activist and writer Cherie Moraga whether she uses Latinx to refer to herself, she tells me, 'I worked too hard for the "a" in Latina to give it up! I refer to myself as Xicana.'
2. Of our accumulated ethnic population, only a third use Hispanic to identify themselves, a mere 14 percent use Latino, and less than 2 percent recognize Latinx.
3. They have done this, although gender in languages is grammatical, not sociological or sexual, and found in linguistic families throughout the world, from French to Russian to Japanese.
4. More recently, activists seeking to render our name gender neutral, out of respect for our LGBTQ members, have devised yet another name for us: Latinx.

Answer: 4312

Solution:

The correct order is 4 → 3 → 1 → 2. Sentence 4 introduces the newest development-activists coining the term Latinx to achieve gender neutrality. Sentence 3 immediately follows with the counterpoint that grammatical gender in languages is a structural, not a social or sexual, feature. Sentence 1 gives a personal voice to this pushback through Cherie Moraga's refusal to adopt Latinx. Sentence 2 closes the argument with statistical evidence showing how little the broader community has actually adopted Latinx. The sequence moves from the proposal, to the linguistic objection, to a personal example of resistance, to population-level data confirming that resistance.

Q15. The given sentence is missing in the paragraph below. Decide where it best fits among the options 1, 2, 3, or 4 indicated in the paragraph.

Sentence: Productivity gains, once expected to feed through to broader living standards, now primarily serve to enhance returns to wealth.

Paragraph: Economists now argue that inequality is no longer a by-product of growth but a condition of it. ____ (1) ____. Unlike wages, wealth reflects not just income but also access to assets, favourable institutional conditions - such as low interest rates - and public policies like low taxes and housing shortages. ____ (2) ____. In other words, wealth depends on political choices in ways that income currently does not. It's not just the inequality itself that is the issue but the erosion of mechanisms that once constrained it. ____ (3) ____. Wealth and income inequality are linked, but where wages have stagnated and collective bargaining has weakened, capital income - derived from profits, rents and interest - has been boosted by design. ____ (4) ____.

A) Option 1

B) Option 4

C) Option 3

D) Option 2

Answer: B

Solution:

The missing sentence states that productivity gains now flow primarily to wealth rather than to living standards. This is the logical conclusion of the preceding claim that capital income has been 'boosted by design' while wages have stagnated. It summarises the argument of the paragraph's final point, acting as a capstone observation. Position 4 is therefore the most natural placement. Inserting the sentence at position 1 would be premature because the distinction between wages and wealth has not yet been drawn. Position 2 would interrupt the explanation of what makes wealth different from income. Position 3 comes at a transition between the constraint argument and the mechanism of wage stagnation, making it a poor fit.

Instructions for Questions 16–19: The passage below is accompanied by four questions. Based on the passage, choose the best answer for each question.

Over the course of the twentieth century, humans built, on average, one large dam a day, hulking structures of steel and concrete designed to control flooding, facilitate irrigation, and generate electricity. Dams were also lucrative contracts, large-scale employers, and the physical instantiation of a messianic drive to conquer territories and control nature. Some of the results of that drive were charismatic mega-infrastructure-the Hoover on the Colorado River or the Aswan on the Nile-but most of the tens of thousands of dams that dot the Earth's landscape have drawn little attention. These are the smaller, though not inconsequential, barriers that today impede the flow of water on nearly two-thirds of the world's large waterways. Chances are, what your map calls a 'lake' is actually a reservoir, and that thin blue line that emerges from it once flowed very differently.

Damming a river is always a partisan act. Even when explicit infrastructure goals-irrigation, flood control, electrification-were met, other consequences were significant and often deleterious. Across the world, river control displaced millions of people, threatening livelihoods, foodways, and cultures. In the western United States, dams were often an instrument of colonialism, used to dispossess Indigenous people and subsidize settler agriculture. And as dams slowed the flow of water, inhibited the movement of nutrients, and increased the amount of toxic algae and other parasites, they snuffed out entire river ecologies. Declining fish populations are the most evident effect, but dams also threaten a host of other animals-from birds and reptiles to fungi and plants-with extinction. Every major dam, then, is also a sacrifice zone, a place where lives, livelihoods, and ways of life are eliminated so that new sorts of landscapes can support water-intensive agriculture and cities that sprout downstream of new reservoirs.

Such sacrifices have been justified as offerings at the temples of modernity. Justified by-and for-whom, though? Over the course of the twentieth century, rarely were the costs and benefits weighed thoughtfully and decided democratically. As Kader Asmal, chair of the landmark 2000 World Commission on Dams, concluded, 'There have been precious few, if any, comprehensive, independent analyses as to why dams came about, how dams perform over time, and whether we are getting a fair return from our $2 trillion investment.' A quarter-century later, Asmal's words ring ever truer. A litany of dams built in the mid-twentieth century are approaching the end of their expected lives, with worrying prospects for their durability. Droughts, magnified and multiplied by the effects of climate change, have forced more and more to run below capacity. If ever there were a time to rethink the mania for dams, it would be now.

There is some evidence that a combination of opposition, alternative energy sources, and a lack of viable projects has slowed the construction of major dams. But a wave of recent and ongoing

construction, from India and China to Ethiopia and Canada, continues to tilt the global balance firmly in favor of water impoundment.

Q16. Which one of the following sets of terms is closest to mapping the key arguments of the passage?

A) Partisan act - Threatened livelihoods - Toxic algae - Quarter century

B) Lucrative contracts - Sacrifice zone - Expected lives - Global balance

C) Mega-infrastructure - Sacrifice zone - Worshipping modernity - Water impoundment

D) Physical instantiation - Partisan act - Decided democratically - Alternative energy

Answer: C

Solution:

The passage follows a clear argumentative arc: the construction of mega-infrastructure driven by a quasi-religious faith in modernity, the severe human and ecological cost of every dam (sacrifice zone), the critique that these costs were never democratically weighed and were justified as worship at the temples of modernity, and the persistent global trend toward water impoundment despite growing evidence of harm. Option C maps all four stages of this argument. Option A picks some important phrases but misses the macro structure. Option B includes 'lucrative contracts' and 'expected lives' which are peripheral details. Option D leaves out the sacrifice and modernity-worship themes that are central to the passage's moral argument.

Q17. What does the author wish to communicate by referring to the Hoover and Aswan dams in the first paragraph?

A) The Colorado and Nile rivers may be seen as thin blue lines on a map.

B) By building dams like the Hoover and Aswan dams, large-scale employers became messianic figures.

C) The designers and builders of these mega-structures were highly charismatic individuals.

D) The drive to control nature is evident not only in mega-infrastructures like the Hoover and Aswan dams, but in smaller dams as well.

Answer: D

Solution:

The author cites the Hoover and Aswan dams as famous examples of the messianic drive to conquer nature, then immediately points out that most dams 'have drawn little attention.' The rhetorical move is to use well-known mega-dams as a recognisable anchor, and then argue that the same controlling impulse operates at every scale-including the tens of thousands of smaller dams that block water on two-thirds of the world's large waterways. Option D captures this precisely. Option A misreads 'thin blue line' as a reference to those specific rivers. Options B and C misplace agency onto employers and individual builders rather than the structural drive the author is describing.

Q18. The word "instantiation" is used in the first paragraph. Which one of the following pairs of terms would be the best substitute for it in the context of its usage in the paragraph?

A) Exemplification and manifestation

B) Concreteness and viability

C) Durability and timeliness

D) Development and construction

Answer: A

Solution:

In the passage, dams are called 'the physical instantiation of a messianic drive to conquer territories and control nature.' Instantiation here means the act of giving concrete, tangible form to an abstract idea or impulse. The best substitutes are 'exemplification' (the dams exemplify this drive) and 'manifestation' (they make the drive visible in a physical form). Option B (concreteness and viability) focuses on material properties rather than on the relationship between an abstract drive and its real-world expression. Options C and D refer to physical characteristics or construction processes, missing the meaning of embodying an idea.

Q19. All of the following statements may be considered valid inferences from the passage EXCEPT that:

A) despite increasing evidence of opposition to dams as well as alternatives to them, they continue to be built.

B) smaller, though not inconsequential, dams are safer than large dam projects.

C) processes of colonisation have used dam-building to make people vacate their territories.

D) dam-building has proved to be an extremely costly enterprise that may not be justifiable.

Answer: B

Solution:

Options A, C, and D are all inferrable from the passage. Option A is directly supported by the final paragraph, which acknowledges slowing construction but notes ongoing dam-building globally. Option C is supported by the specific mention of western US dams used to dispossess Indigenous people. Option D is supported by Asmal's question about whether we are getting 'a fair return from our $2 trillion investment' and the passage's description of dams as sacrifice zones. Option B, however, cannot be inferred. The passage describes smaller dams as 'not inconsequential' precisely to emphasise their cumulative harm, not their relative safety. It makes no comparison of risk levels between large and small dam projects.

Q20. The passage given below is followed by four summaries. Choose the option that best captures the essence of the passage.

In investigating memory-beliefs, there are certain points which must be borne in mind. In the first place, everything constituting a memory-belief is happening now, not in that past time to which the belief is said to refer. It is not logically necessary to the existence of a memory-belief that the event remembered should have occurred, or even that the past should have existed at all. There is no logical impossibility in the hypothesis that the world sprang into being five minutes ago, exactly as it then was, with a population that 'remembered' a wholly unreal past. There is no logically necessary connection between events at different times; therefore nothing that is happening now or will happen in the future can disprove the hypothesis that the world began five minutes ago. Hence the occurrences which are CALLED knowledge of the past are logically independent of the past; they are wholly analysable into present contents, which might, theoretically, be just what they are even if no past had existed.

A) When we discuss the concept of memory-beliefs, we must understand that it is not logically impossible for the event remembered to have never happened at all; it could just be a figment of our imagination.

B) Memory-beliefs depend wholly on what is remembered in the present, and not on anything else; just as it is not logically impossible that the world came into being five minutes ago, and that everyone now just remembers a wholly imaginary past for it.

C) When investigating memory beliefs, we must keep in mind that an actual past event is not a prerequisite for a memory-belief to exist, and that what we know of the past could theoretically not need a past at all.

D) That which we call 'knowledge of the past' is logically independent of the past, since the act of remembering which forms memory-beliefs happens in the present, and does not need to be based in real past occurrences, or even need a past at all.

Answer: D

Solution:

Option D best encapsulates all three interdependent claims of the passage: that memory-beliefs exist only in the present moment, that they are logically independent of whether any actual past existed, and that what we call knowledge of the past can be fully analysed in terms of present contents alone. Option A is too narrow-it only addresses whether a specific remembered event occurred, not the broader claim about logical independence from the past. Option B focuses on what memory depends on in the present but does not explicitly state the key conclusion that knowledge of the past is logically independent of the past itself. Option C comes close but leaves out the crucial point about the logical independence of so-called past knowledge.

Instructions for Questions 21–24: The passage below is accompanied by four questions. Based on the passage, choose the best answer for each question.

Imagine a world in which artificial intelligence is entrusted with the highest moral responsibilities: sentencing criminals, allocating medical resources, and even mediating conflicts between nations. This might seem like the pinnacle of human progress: an entity unburdened by emotion, prejudice or inconsistency, making ethical decisions with impeccable precision.

Yet beneath this vision of an idealised moral arbiter lies a fundamental question: can a machine understand morality as humans do, or is it confined to a simulacrum of ethical reasoning? AI might replicate human decisions without improving on them, carrying forward the same biases, blind spots and cultural distortions from human moral judgment. In trying to emulate us, it might only reproduce our limitations, not transcend them. But there is a deeper concern. Moral judgment draws on intuition, historical awareness and context - qualities that resist formalisation. Ethics may be so embedded in lived experience that any attempt to encode it into formal structures risks flattening its most essential features. If so, AI would not merely reflect human shortcomings; it would strip morality of the very depth that makes ethical reflection possible in the first place.

Still, many have tried to formalise ethics, by treating certain moral claims not as conclusions, but as starting points. A classic example comes from utilitarianism, which often takes as a foundational axiom the principle that one should act to maximise overall wellbeing. From this, more specific principles can be derived, for example, that it is right to benefit the greatest number, or that actions should be judged by their consequences for total happiness. As computational resources increase, AI becomes increasingly well-suited to the task of starting from fixed ethical assumptions and reasoning through their implications in complex situations.

But what, exactly, does it mean to formalise something like ethics? The question is easier to grasp by looking at fields in which formal systems have long played a central role. Physics, for instance, has relied on formalisation for centuries. There is no single physical theory that explains everything. Instead, we have many physical theories, each designed to describe specific aspects of the Universe: from the behaviour of quarks and electrons to the motion of galaxies. These theories often diverge. Aristotelian physics, for instance, explained falling objects in terms of natural motion toward Earth's centre; Newtonian mechanics replaced this with a universal force of gravity. These explanations are not just different; they are incompatible. Yet both share a common structure: they begin with basic postulates - assumptions about motion, force or mass - and derive increasingly complex consequences.

Ethical theories have a similar structure. Like physical theories, they attempt to describe a domain - in this case, the moral landscape. They aim to answer questions about which actions are right or wrong, and why. These theories also diverge and, even when they recommend similar actions, such as giving to charity, they justify them in different ways. Ethical theories also often begin with a small set of foundational principles or claims, from which they reason about more complex moral problems.

Q21. Choose the one option below that comes closest to being the opposite of "utilitarianism".

A) The committee adopted a non-egoist framework, ranking policies by their contribution to overall social welfare and treating self-interest as a derivative concern within institutional evaluation.

B) The authors advocated an absolutist stance, following exceptionless rules regardless of outcomes and evaluating choices by broadest societal benefit.

C) The council followed a prioritarian approach, assigning greater moral weight to improvements for the worst-off rather than to maximising total welfare across the affected population.

D) The policy was cast as deontological ethics, selecting the option that delivered the highest total benefit to citizens while presenting duty as a secondary consideration in public decision-making.

Answer: C

Solution:

The passage defines utilitarianism as maximising total or overall wellbeing-the aggregate matters most, regardless of how it is distributed. A prioritarian approach directly challenges this by assigning greater moral weight to helping the worst-off rather than maximising total welfare. If lifting the poorest slightly generates more moral value than a larger aggregate gain spread across better-off people, the prioritarian view diverges from utilitarianism in a fundamental way. Option A still uses 'overall social welfare' as its criterion, which is essentially utilitarian. Option B claims to follow 'exceptionless rules' but then evaluates by 'broadest societal benefit'-still an aggregate outcome measure. Option D explicitly seeks 'highest total benefit,' which is utilitarianism under a different label.

Q22. Which one of the options below best summarises the passage?

A) The passage rejects formal methods in principle. It holds that moral judgement cannot be expressed in disciplined terms and concludes that AI should not serve in courts, medicine, or diplomacy under any conditions.

B) The passage weighs the appeal of an impersonal AI judge against doubts about moral grasp. It claims codified schemes retain case nuance at scale and uses a physics analogy to predict convergence on a unified framework.

C) The passage weighs the appeal of an impersonal AI judge against doubts about moral grasp. It warns that codification can erode case-sensitive judgement, allow axiom-led reasoning at scale, and use a physics analogy to model structured plurality.

D) The passage highlights administrative gains from automation. It treats reproducing human moral judgement as progress and argues that, as computational resources increase, AI can be responsible for decision-making across varied institutional settings.

Answer: C

Solution:

Option C correctly identifies the three-part structure of the passage: the appeal of an impartial AI moral arbiter, the serious doubts about whether formalised ethics can capture the depth of genuine moral reasoning, and the physics analogy which is used to argue that, like physics, ethics has multiple formal frameworks that can coexist without merging into a single master theory. Option A overstates the case-the passage does not categorically reject formal methods or declare AI unsuitable; it merely raises serious questions. Option B misreads the physics analogy as predicting convergence, when the passage uses it to illustrate structured plurality and persistent divergence. Option D ignores the critical dimension of the argument entirely and presents only the optimistic framing.

Q23. The passage compares ethics to physics, where different theories apply to different aspects of a domain and says AI can reason from fixed starting points in complex cases. Which one of the assumptions below must hold for that comparison to guide practice?

A) There is a principled way to decide which ethical framework applies to which class of cases, so the system can select the relevant starting points before deriving a recommendation.

B) Real cases never straddle different areas, so a case always fits exactly one framework without any overlap whatsoever.

C) A single master framework replaces all others after translation into one code, so domain boundaries disappear in application.

D) Once formalised, all ethical frameworks yield the same recommendation in every case, so selection among them is unnecessary.

Answer: A

Solution:

For the physics analogy to be practically useful in guiding AI ethical reasoning, there must be some principled procedure for selecting the relevant framework before reasoning begins-just as physicists know to apply quantum mechanics to subatomic particles and general relativity to large-scale gravity. Without such a selection criterion, an AI system would not know which ethical starting points to employ for a given case. Option A captures this necessary assumption. Option B claims cases never overlap across frameworks, which is implausibly strong and the passage does not assume. Option C predicts convergence on one master theory, which the passage explicitly denies through its emphasis on persistent theoretical divergence. Option D assumes all frameworks give the same answer, making selection unnecessary-again, directly contradicted by the passage's statement that ethical theories diverge even when recommending similar actions.

Q24. All of the following can reasonably be inferred from the passage EXCEPT:

A) by analogy with physics, compact postulates can yield broad predictions across incompatible theories and ethics can likewise share structure while continuing to diverge rather than close on a single comprehensive framework.

B) encoding ethics into fixed structures risks stripping away intuition, history, and context and, if that occurs, the depth that enables reflective judgement disappears. So, machines would mirror our limits rather than exceed them.

C) the appeal of an AI judge rests on immunity to bribery, partiality, and fatigue; yet the text questions whether procedural cleanliness amounts to moral understanding without lived context and interpretive depth.

D) with fixed moral starting points and expanding computational resources, the argument forecasts convergence on one ethical system and treats contextual judgement as unnecessary once formal reasoning scales across domains and cultures.

Answer: D

Solution:

Options A, B, and C are all supported by the passage. Option A follows from the physics analogy, which demonstrates that even incompatible theories can share structural form while remaining distinct. Option B is directly stated when the passage warns that formalising ethics may flatten its most essential features and that AI might merely reproduce human limitations. Option C is supported by the opening description of AI as 'unburdened by emotion, prejudice or inconsistency,' which the passage immediately complicates by questioning whether procedural neutrality equals genuine moral understanding. Option D, however, cannot be inferred. The passage never predicts convergence on a single ethical system; in fact, it uses the physics analogy precisely to argue that multiple incompatible frameworks can coexist. It also consistently stresses the importance of context, rather than treating it as dispensable once formal reasoning scales up.

SECTION II – DATA INTERPRETATION & LOGICAL REASONING (DILR)

Instructions for Questions 25–28:
Seven children, Aarav, Bina, Chirag, Diya, Eshan, Farhan, and Gaurav, are sitting in a circle facing inside (not necessarily in the same order) and playing a game of 'Passing the Buck'.
The game is played over 10 rounds. In each round, the child holding the Buck must pass it directly to a child sitting in one of the following positions:

- Immediately to the left;
- Immediately to the right;
- Second to the left;
- or Second to the right.

The game starts with Bina passing the Buck and ends with Chirag receiving the Buck. The table below provides some information about the pass types and the child receiving the Buck. Some information is missing and labelled as '?'.

Round	Pass Type	Received by
1	Immediately to the left	Aarav
2	Second to the right	?
3	Immediately to the right	Diya
4	?	?
5	?	Aarav
6	Second to the left	?
7	Immediately to the left	Gaurav
8	Immediately to the left	?
9	?	Farhan
10	?	Chirag

Q25. Who is sitting immediately to the right of Bina?

A) Aarav

B) Eshan

C) Farhan

D) Chirag

Answer: B

Solution:

Place Bina at position 1 and number positions 1–7 clockwise. Round 1: Bina passes immediately to the left (clockwise), so Aarav is at position 2. Round 2: Aarav passes second to the right (anti-clockwise), placing the buck at position 7. Round 3: from position 7, the buck goes immediately to the right (anti-clockwise), landing at position 6 - received by Diya. So Diya is at position 6.

Round 6: Aarav (position 2) passes second to the left, reaching position 4. Round 7: from position 4, immediately to the left gives position 5 - Gaurav. So Gaurav is at position 5.

Round 8: Gaurav (position 5) passes immediately to the left → position 6 = Diya. Rounds 9–10: from position 6 (Diya), the buck reaches Farhan in round 9 and Chirag in round 10. The only reachable unassigned positions from 6 are 4 and 7. Since the buck must go from Farhan's position to Chirag's position in one move, and the only adjacency that works is 4 → 3, Farhan is at position 4 and Chirag is at position 3. The only remaining person is Eshan, who takes position 7.

The person immediately to the right (anti-clockwise from 1) of Bina at position 1 is position 7 = Eshan.

Q26. Who is sitting third to the left of Eshan?

A) Gaurav

B) Divya

C) Chirag

D) Aarav

Answer: C

Solution:

From the seating arrangement established in Q25: Bina (1), Aarav (2), Chirag (3), Farhan (4), Gaurav (5), Diya (6), Eshan (7). Counting three positions to the left (clockwise) from Eshan at position 7 gives position 4, 3, … three steps clockwise from 7: 7→1→2→3. Position 3 = Chirag.

Q27. For which of the following pass types can the total number of occurrences be uniquely determined?

A) Immediately to the left

B) Second to the right

C) Immediately to the right

D) Second to the left

Answer: C

Solution:

Rounds 4 and 5 have unknown pass types. Three scenarios are possible for those two rounds: (1) second-to-right then second-to-right; (2) second-to-left then immediately-to-left; (3) immediately-to-left then second-to-left. In scenarios 1, 2, and 3 the count of 'immediately to the right' never appears in rounds 4–5, because none of those scenarios use it. Across all ten rounds, 'immediately to the right' appears only in round 3, giving a unique count of 1. The counts of the other three pass types each depend on which scenario (1, 2, or 3) actually applies to rounds 4 and 5, so they cannot be uniquely determined.

Q28. For which of the following children is it possible to determine how many times they received the Buck?

A) Farhan

B) Eshan

C) Bina

D) Gaurav

Answer: D

Solution:

In rounds 4 and 5, the three possible scenarios send the buck to Farhan, Bina, or Eshan in round 4, respectively, so the reception count for each of those children is ambiguous. Gaurav, however, receives the buck only in round 7 regardless of which scenario applies to rounds 4 and 5. His count is therefore uniquely and unambiguously 1.

Instructions for Questions 29–33:

Aurevia, Brelosia, Cyrenia and Zerathania are four countries with their currencies being Aurels, Brins, Crowns, and Zentars, respectively. The currencies have
different exchange values. Crown's currency exchange rate with Zentars = 0.5, i.e., 1 Crown is worth 0.5 Zentars.

Three travelers, Jano, Kira, and Lian set out from Zerathania visiting exactly two of the countries. Each country is visited by exactly two travelers. Each traveler has a unique Flight Cost, which represents the total cost of airfare in traveling to both the countries and back to Zerathania. The Flight Cost of Jano was 4000 Zentars, while that of the other two travelers were 5000 and 6000 Zentars, not necessarily in that order. When visiting a country, a traveler spent either 1000, 2000 or 3000 in the country's local currency. Each traveler had different spends (in the country's local currency) in the two countries he/she visited. Across all the visits, there were exactly two spends of 1000 and exactly one spend of 3000 (in the country's local currency).

The total “Travel Cost” for a traveler is the sum of his/her Flight Cost and the money spent in the countries visited.

The citizens of the four countries with knowledge of these travels made a few observations, with spends measured in their respective local currencies:

i. Aurevia citizen: Jano and Kira visited our country, and their Travel Costs were 3500 and 8000, respectively.

ii. Brelosia citizen: Kira and Lian visited our country, spending 2000 and 3000, respectively. Kira's Travel Cost was 4000.

iii. Cyrenia citizen: Lian visited our country and her Travel Cost was 36000.

Q29. What is the sum of Travel Costs for all travelers in Zentars?

Answer: 41000

Solution:

Since 1 Crown = 0.5 Zentars, Lian's travel cost = 36000 C × 0.5 = 18000 Z. Equating Kira's travel cost: 8000 A = 4000 B gives B = 2A. From Brelosia: Kira's travel cost 4000 B = 8000 A (consistent). Trying Flight Cost of Kira = 6000 Z: 8000 A = 5000 A + 6000 Z → A = 2 Z.

Check Lian: spending cost = 6000 A (Brelosia) + 1000 Z (Cyrenia) = 12000 Z + 1000 Z = 13000 Z. Flight Cost = 18000 Z – 13000 Z = 5000 Z ✓. Jano's spending = 3500 A – 4000 Z flight cost → need spending = 7000 Z – 4000 Z = 3000 Z = 2000 Z + 1000 Z (Aurevia + Cyrenia).

Total Travel Costs = Jano (7000 Z) + Kira (5000 Z + 6000 Z [flight] + 5000 A spending = 16000 Z) + Lian (18000 Z) = 7000 + 16000 + 18000 = 41000 Z.

Q30. How many Zentars did Lian spend in the two countries he visited?

Answer: 13000

Solution:

From the solution to Q29: Lian visited Brelosia and Cyrenia. He spent 3000 B = 6000 Z in Brelosia (since B = 2A = 4Z and 1 B = 4 Z… wait, B = 2A and A = 2Z so B = 4Z; 3000 B = 12000 Z) and 1000 C = 500 Z in Cyrenia (since C = 0.5 Z; 1000 C = 500 Z). Total = 12000 + 1000 = 13000 Z.

Q31. What was Jano's total spend in the two countries he visited, in Aurels?

Answer: 1500

Solution:

Jano visited Aurevia and Cyrenia. In Zentars, Jano spent 2000 Z in Aurevia and 1000 Z in Cyrenia, totalling 3000 Z. Since A = 2Z, we have 1 A = 2 Z, so 1 Z = 0.5 A. Therefore 3000 Z = 1500 A.

Q32. One Brin is equivalent to how many Crowns?

A) 8
B) 0.125
C) 0.5
D) 4

Answer: A

Solution:

From the derivations: A = 2Z, B = 2A = 4Z, C = 0.5Z. Therefore B/C = 4Z / 0.5Z = 8. One Brin equals 8 Crowns.

Q33. Which of the following statements is NOT true about money spent in the local currency?

A) Jano spent 2000 in Aurevia

B) Lian spent 2000 in Cyrenia

C) Jano spent 2000 in Cyrenia

D) Kira spent 1000 in Aurevia

Answer: A

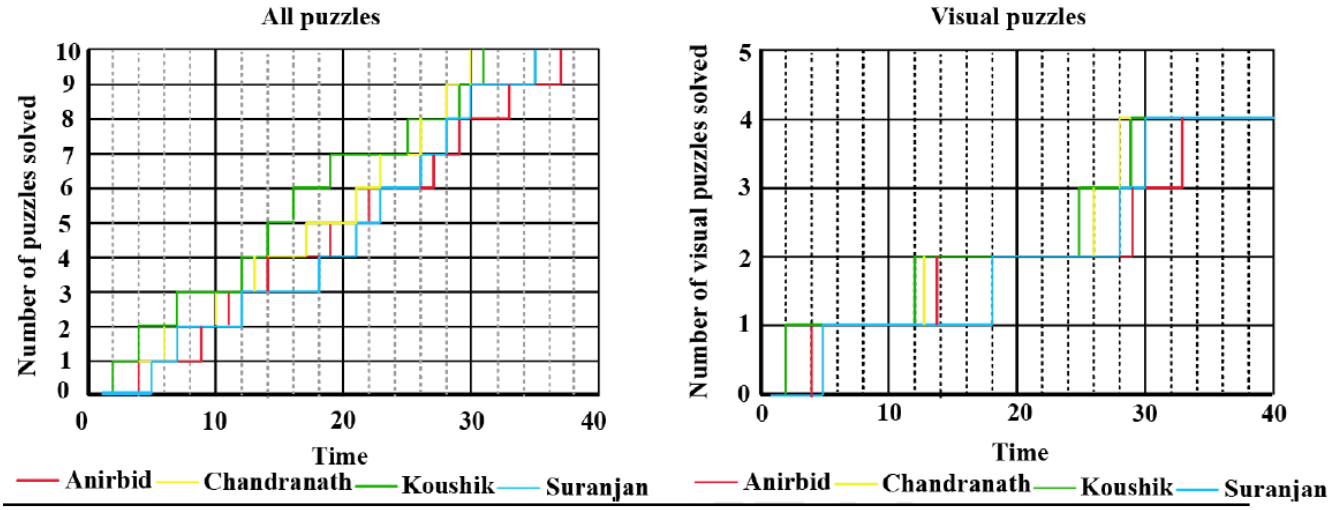
Solution:

From the final table: Jano spent 2000 Z in Aurevia = 1000 A (not 2000 A). So Option A is false. Lian spent 2000 C in Cyrenia (1000 Z = 2000 C since 1 C = 0.5 Z) - true. Jano spent 1000 Z in Cyrenia = 2000 C - true. Kira spent 2000 Z in Aurevia = 1000 A - true. Option A is the false statement.

Instructions for Questions 34–37:

Anirbid, Chandranath, Koushik, and Suranjan participated in a puzzle solving competition. The competition comprised 10 puzzles that had to be solved in the same sequence, i.e., a competitor got access to a puzzle as soon as they solved the previous puzzle. Some of the puzzles were visual puzzles and the others were number-based puzzles. The winner of the competition was the one who solved all puzzles in the least time.

The following charts describe their progress in the competition. The chart on the left shows the number of puzzles solved by each competitor at a given time (in minutes) after the start of the competition. The chart on the right shows the number of visual puzzles solved by each competitor at a given time (in minutes) after the start of the competition.



Q34. Who had solved the largest number of puzzles by the 20th minute from the start of the competition?

A) Chandranath

B) Koushik

C) Suranjan

D) Anirbid

Answer: B

Solution:

Reading the left (all puzzles) chart at t = 20 minutes: Koushik's staircase (green line) sits at the highest horizontal level of all four competitors at that point. Chandranath (yellow) and Anirbid (red) are lower, and Suranjan (blue) is the lowest. Koushik has therefore solved the most puzzles by the 20th minute.

Q35. How many minutes did Suranjan take to solve the third visual puzzle in the competition?

Answer: 2

Solution:

Cross-referencing the two charts using Koushik's (green) line as the reference for puzzle sequence: the 3rd visual puzzle corresponds to the 8th puzzle overall (puzzles 1, 4, 8, and 9 are visual). Reading Suranjan's (blue) line in the left chart around the 8th puzzle: it steps up at t = 28 from the level it was at t = 26. The time taken to solve the 8th puzzle = 28 – 26 = 2 minutes.

Q36. At what number in the sequence was the fourth number-based puzzle?

Answer: 6

Solution:

Using Koushik's green lines to identify which puzzles are visual: the 4 visual puzzles are puzzles 1, 4, 8, and 9 in the overall sequence of 10. The remaining puzzles (2, 3, 5, 6, 7, 10) are number-based. Counting through them in order: 1st number-based = 2, 2nd = 3, 3rd = 5, 4th = 6. The fourth number-based puzzle is at sequence position 6.

Q37. Which of the following is the closest to the average time taken by Anirbid to solve the number-based puzzles in the competition?

A) 3.3 minutes
B) 2.5 minutes
C) 3.8 minutes
D) 4.0 minutes

Answer: D

Solution:

Anirbid's (red) individual times for the six number-based puzzles, read from the left chart: puzzle 2 = 5 min, puzzle 3 = 2 min, puzzle 5 = 5 min, puzzle 6 = 3 min, puzzle 7 = 5 min, puzzle 10 = 4 min. Total = 24 minutes over 6 puzzles. Average = 24 ÷ 6 = 4 minutes. Option D is closest.

Instructions for Questions 38–42:
Three countries — Pumpland (P), Xiland (X) and Cheeseland (C) — trade among themselves and with the (other countries in) Rest of World (ROW). All trade volumes are given in IC (international currency). The following terminology is used:

- Trade balance = Exports - Imports
- Total trade = Exports + Imports
- Normalized trade balance = Trade balance / Total trade, expressed in percentage terms

The following information is known.

1. The normalized trade balances of P, X and C are 0%, 10%, and -20%, respectively.
2. 40% of exports of X are to P. 22% of imports of P are from X.
3. 90% of exports of C are to P; 4% are to ROW.
4. 12% of exports of ROW are to X, 40% are to P.
5. The export volumes of P, in IC, to X and C are 600 and 1200, respectively. P is the only country that exports to C.

Q38. How much is exported from C to X, in IC?

Answer: 48

Solution:

Since C's normalised balance = –20%, exports:imports = 2:3. Imports of C come only from P = 1200 IC, so total imports of C = 1200 IC means 3c = 1200, c = 400, exports of C = 800 IC. Of these, 90% go to P (720 IC) and 4% to ROW (32 IC). The remainder (800 – 720 – 32 = 48 IC) goes to X.

Q39. How much is exported from P to ROW, in IC?

Answer: 200

Solution:

P's normalised balance = 0%, so P's total exports = P's total imports. Using the relationships between X's exports/imports (ratio 11:9) and the linkage between Xiland and Pumpland trade, solving the simultaneous equations yields b = 100 (where 11b = X's exports). P's total exports = 20b = 2000 IC. P exports 600 to X and 1200 to C, leaving 2000 – 600 – 1200 = 200 IC exported to ROW.

Q40. How much is exported from ROW to ROW, in IC?

Answer: 1008

Solution:

From the full trade table solved in Q38–39: ROW's total exports (n) = 2100 IC. ROW exports 840 IC to P (40% of 2100) and 252 IC to X (12% of 2100). ROW exports 0 to C and 32 IC from C to ROW is an inflow. ROW exports to ROW = 2100 – 840 – 252 – 0 = 1008 IC (internal trade within ROW).

Q41. What is the trade balance of ROW?

A) 0
B) –200
C) 100
D) 200

Answer: D

Solution:

From the full table: ROW's total exports = 2100 IC; total imports = 200 (from P) + 660 (from X) + 32 (from C) + 1008 (internal) = 1900 IC. Trade balance = Exports – Imports = 2100 – 1900 = 200 IC.

Q42. Which among the countries P, X, and C has/have the least total trade?

A) Only X
B) Only C
C) Both X and C
D) Only P

Answer: C

Solution:

From the complete trade table: P's total trade = 2000 + 2000 = 4000 IC; X's total trade = 900 + 1100 = 2000 IC; C's total trade = 1200 + 800 = 2000 IC. Both X and C tie for the least total trade at 2000 IC each.

Instructions for Questions 43–46:
Anu, Bijay, Chetan, Deepak, Eshan, and Faruq are six friends. Each of them uses a mobile number from exactly one of the two mobile operators - Xitel and Yocel. During the last month, the six friends made several calls to each other. Each call was made by one of these six friends to another. The table below summarizes the number of minutes of calls that each of the six made to (outgoing minutes) and received from (incoming minutes) these friends, grouped by the operators. Some of the entries are missing.

Friend	Operator	Outgoing minutes to		Incoming minutes from	
		Operator Xitel	Operator Yocel	Operator Xitel	Operator Yocel
Anu	Xitel	100		50	225
Bijay	Xitel		200		125
Chetan	Yocel	50	175	250	150
Deepak	Yocel	100	150	275	100
Esthan	Yocel		100	100	375
Faruq	Yocel	0		100	150

It is known that the duration of calls from Faruq to Eshan was 200 minutes. Also, there were no calls from:

i. Bijay to Eshan,
ii. Chetan to Anu and Chetan to Deepak,
iii. Deepak to Bijay and Deepak to Faruq,
iv. Eshan to Chetan and Eshan to Deepak.

Q43. What was the duration of calls (in minutes) from Bijay to Anu?

Answer: 50

Solution:

Since Anu and Bijay are the only Xitel users, every Xitel-to-Xitel call is between them. Anu's outgoing to Xitel = 100 min = Bijay's incoming from Xitel. Bijay's outgoing to Xitel = Anu's incoming from Xitel = 50 min. Therefore, Bijay made 50 minutes of calls to Anu.

Q44. What was the total duration of calls (in minutes) made by Anu to friends having mobile numbers from Operator Yocel?

Answer: 525

Solution:

The sum of outgoing from Anu and Bijay to Yocel must equal the total incoming from Xitel for all four Yocel users: 250 + 275 + 100 + 100 = 725 min. Bijay's outgoing to Yocel = 200 min. Therefore, Anu's outgoing to Yocel = 725 – 200 = 525 min.

Q45. What was the total duration of calls (in minutes) made by Faruq to friends having mobile numbers from Operator Yocel?

Answer: 350

Solution:

Total outgoing from Yocel users to Yocel must equal total incoming from Yocel for Yocel users: 150 + 100 + 375 + 150 = 775 min.

Known Yocel-to-Yocel outgoing: Chetan 175, Deepak 150, Eshan 100. Faruq's outgoing (e) satisfies 175 + 150 + 100 + e = 775, giving e = 350 min.

Q46. What was the duration of calls (in minutes) from Deepak to Chetan?

A) 100

B) 125

C) 50

D) 0

Answer: A

Solution:

Chetan's incoming from Yocel = 150 min. The only Yocel users who can call Chetan are Deepak and Faruq (Eshan→Chetan = 0 given).

Faruq's 350 min go to Chetan, Deepak, and Eshan: Faruq→Eshan = 200 min (given); Faruq→Deepak = 100 min (equals Deepak's incoming from Yocel = 100 min, since only Faruq can call Deepak among Yocel users).

So Faruq→Chetan = 350 – 200 – 100 = 50 min. Therefore Deepak→Chetan = 150 – 50 = 100 min.

SECTION III – QUANTITATIVE ABILITY (QA)

Q47. The monthly sales of a product from January to April were 120, 135, 150 and 165 units, respectively. The cost price of the product was Rs. 240 per unit, and a fixed marked price was used for the product in all the four months. Discounts of 20%, 10% and 5% were given on the marked price per unit in January, February and March, respectively, while no discounts were given in April. If the total profit from January to April was Rs. 138825, then the marked price per unit, in rupees, was

A) 520

B) 525

C) 510

D) 515

Answer: B

Solution:

Total units sold = 120 + 135 + 150 + 165 = 570. Total cost = 570 × 240 = 136800.

Let the marked price = X. Selling prices: Jan = 0.8X, Feb = 0.9X, Mar = 0.95X, Apr = X.

Total revenue = 120(0.8X) + 135(0.9X) + 150(0.95X) + 165X = 96X + 121.5X + 142.5X + 165X = 525X.

Profit = 525X – 136800 = 138825, so 525X = 275625, X = 525.

Q48. Teams A, B, and C consist of five, eight, and ten members, respectively, such that every member within a team is equally productive. Working separately, teams A, B, and C can complete a certain job in 40 hours, 50 hours, and 4 hours, respectively. Two members from team A, three members from team B, and one member from team C together start the job, and the member from team C leaves after 23 hours. The number of additional member(s) from team B, that would be required to replace the member from team C, to finish the job in the next one hour, is

A) 4

B) 2

C) 1

D) 3

Answer: B

Solution:

Let total work = W. Per-member rates: a = W/200, b = W/400, c = W/40.

Combined rate of initial group = 2(W/200) + 3(W/400) + W/40 = W/100 + 3W/400 + 10W/400 = 17W/400.

Work done in 23 hours = 23 × 17W/400 = 391W/400. Remaining = W – 391W/400 = 9W/400.

After C leaves, A+B rate = 2(W/200) + 3(W/400) = 7W/400. In 1 hour this covers 7W/400, leaving 9W/400 – 7W/400 = 2W/400 = W/200.

Additional members from B needed = (W/200) ÷ (W/400) = 2.

Q49. In a school with 1500 students, each student chooses any one of the streams out of science, arts, and commerce, by paying a fee of Rs 1100, Rs 1000, and Rs 800, respectively. The total fee paid by all the students is Rs 15,50,000. If the number of science students is not more than the number of arts students, then the maximum possible number of science students in the school is

Answer: 700

Solution:

Let S, A, C be the number of science, arts, and commerce students. S + A + C = 1500, and 1100S + 1000A + 800C = 1550000.

Substituting C = 1500 – S – A into the fee equation: 1100S + 1000A + 800(1500 – S – A) = 1550000 → 300S + 200A = 350000 → 3S + 2A = 3500.

To maximise S subject to S ≤ A: at S = A, 5S = 3500 gives S = 700. Checking: A = 700, C = 100; all positive and S ≤ A. Maximum science students = 700.

Q50. In an arithmetic progression, if the sum of fourth, seventh and tenth terms is 99, and the sum of the first fourteen terms is 497, then the sum of first five terms is

Answer: 65

Solution:

Let first term = a and common difference = d.

Sum of 4th + 7th + 10th = (a+3d) + (a+6d) + (a+9d) = 3a + 18d = 99, so a + 6d = 33.

Sum of first 14 terms = (14/2)(2a + 13d) = 7(2a + 13d) = 497, so 2a + 13d = 71.

Solving: from a + 6d = 33 and 2a + 13d = 71, we get a = 3 and d = 5.

Sum of first 5 terms = (5/2)(2×3 + 4×5) = (5/2)(26) = 65.

Q51. Ankita walks from A to C through B, and runs back through the same route at a speed that is 40% more than her walking speed. She takes exactly 3 hours 30 minutes to walk from B to C as well as to run from B to A. The total time, in minutes, she would take to walk from A to B and run from B to C, is

Answer: 444

Solution:

Let walking speed = 5x and running speed = 7x (40% more).

Time ratio walk:run for any fixed distance = 7:5.

She walks B→C in 3.5 hrs. Running B→C takes (5/7) × 3.5 = 2.5 hrs.

She runs A→B in 3.5 hrs. Walking A→B takes (7/5) × 3.5 = 4.9 hrs.

Total time = 4.9 + 2.5 = 7.4 hrs = 7.4 × 60 = 444 minutes.

Q52. For a 4-digit number (greater than 1000), sum of the digits in the thousands, hundreds, and tens places is 15. Sum of the digits in the hundreds, tens, and units places is 16. Also, the digit in the tens place is 6 more than the digit in the units place. The difference between the largest and smallest possible value of the number is

A) 811
B) 3289
C) 735
D) 4078

Answer: A

Solution:

Let thousands = a, hundreds = b, tens = c, units = d.

From the two sum conditions: (a+b+c) – (b+c+d) = 15 – 16, so d = a + 1. Also, c = d + 6 = a + 7.

Substituting into a+b+c = 15: a + b + (a+7) = 15, so b = 8 – 2a.

For all digits 0–9 with a ≥ 1: b = 8–2a ≥ 0 means a ≤ 4; c = a+7 ≤ 9 means a ≤ 2.

So, a can be 1 or 2. When a=1: 1,6,8,2 → 1682. When a=2: 2,4,9,3 → 2493. Difference = 2493 – 1682 = 811.

Q53. Rahul starts on his journey at 5 pm at a constant speed so that he reaches his destination at 11 pm the same day. However, on his way, he stops for 20 minutes, and after that, increases his speed by 3 km per hour to reach on time. If he had stopped for 10 minutes more, he would have had to increase his speed by 5 km per hour to reach on time. His initial speed, in km per hour, was

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

Answer: B

Solution:

Total journey time = 6 hours; total distance = 6x km where x is initial speed.

Let k = distance covered before the stop.

Scenario 1 (20-min stop, speed increases by 3): $k/x + 1/3 + (6x – k)/(x+3) = 6$.

Scenario 2 (30-min stop, speed increases by 5): $k/x + 1/2 + (6x – k)/(x+5) = 6$.

Subtracting the two equations and simplifying eliminates k, giving 4x = k, and substituting back yields $x^2 = 51x – 36x = 15x$, so x = 15. Initial speed = 15 km/h.

Q54. The rate of water flow through three pipes A, B and C are in the ratio 4 : 9 : 36. An empty tank can be filled up completely by pipe A in 15 hours. If all the three pipes are used simultaneously to fill up this empty tank, the time, in minutes, required to fill up the entire tank completely is nearest to

A) 73
B) 78
C) 76
D) 71

Answer: A

Solution:

Let pipe A's flow rate = 4u units/hr. Pipe A fills the tank in 15 hrs, so tank capacity = 60u.

Pipe B rate = 9u, pipe C rate = 36u. Combined rate = 4u + 9u + 36u = 49u per hour.

Time to fill = 60u ÷ 49u = 60/49 hrs = (60/49) × 60 ≈ 73.47 minutes. Nearest answer = 73.

Q55. If $f(x) = (x^2 + 3x)(x^2 + 3x + 2)$, then the sum of all real roots of the equation $\sqrt{f(x) + 1} = 9701$, is

A) –6

B) 6

C) 3

D) –3

Answer: D

Solution:

Let $k = x^2 + 3x$. Then $f(x) = k(k+2) = k^2 + 2k$. So $f(x) + 1 = k^2 + 2k + 1 = (k+1)^2$.

Therefore $\sqrt{f(x)+1} = |k+1| = k+1$ (taking positive root since it equals 9701 > 0).

So $k + 1 = 9701$, giving $k = 9700$.

Thus $x^2 + 3x = 9700$, i.e., $x^2 + 3x – 9700 = 0$.

The discriminant = 9 + 4(9700) > 0, so real roots exist.

By Vieta's formulas, sum of roots = –3/1 = –3.

Q56. For real values of x, the range of the function $f(x) = (2x – 3) / (2x^2 + 4x – 6)$ is

A) $(–\infty, 1/8] \cup [1, \infty)$

B) $(–\infty, 1/4] \cup [1, \infty)$

C) $(–\infty, 1/8] \cup [1/2, \infty)$

D) $(–\infty, 1/4] \cup [1/2, \infty)$

Answer: C

Solution:

Set $y = (2x – 3)/(2x^2 + 4x – 6)$.

Cross-multiplying: $2yx^2 + 4yx – 6y = 2x – 3$, giving $2yx^2 + (4y – 2)x + (3 – 6y) = 0$.

For real x, the discriminant must be ≥ 0: $(4y – 2)^2 – 4(2y)(3 – 6y) ≥ 0$.

Expanding: $16y^2 – 16y + 4 – 24y + 48y^2 ≥ 0 \rightarrow 64y^2 – 40y + 4 ≥ 0 \rightarrow 16y^2 – 10y + 1 ≥ 0$.

Roots of $16y^2 – 10y + 1 = 0$: $y = (10 \pm 6)/32 = 1/2$ or $1/8$.

Since coefficient of y^2 is positive, the quadratic is ≤ 0 for $y \in (1/8, 1/2)$.

So the range (where ≥ 0) is $(–\infty, 1/8] \cup [1/2, \infty)$.

Q57. The sum of all the digits of the number ($10^{50} + 10^{25} - 123$), is

A) 212

B) 221

C) 324

D) 255

Answer: B

Solution:

Note that $10^n - 123$ for $n \geq 3$ gives a number with (n–3) nines, followed by 877. For example: 1000 – 123 = 877; 10000 – 123 = 9877; 100000 – 123 = 99877.

So $10^{25} - 123$ is a 25-digit number: 22 nines followed by 877.

Adding 10^{50}: the result has 25 digits of the '$10^{25} - 123$' form placed in the lower 25 positions, and a 1 in position 51 (the 10^{50} term). The leading 1 at position 51 contributes 1 to the digit sum. The $10^{25} - 123$ block contributes: $22 \times 9 + 8 + 7 + 7 = 198 + 22 = 220$. The remaining 25 zeros in positions 26–50 contribute 0.

Total digit sum = 1 + 220 = 221.

Q58. A triangle ABC is formed with AB = AC = 50 cm and BC = 80 cm. Then, the sum of the lengths, in cm, of all three altitudes of the triangle ABC is

Answer: 126

Solution:

Since AB = AC = 50, the triangle is isosceles with BC = 80.

Drop perpendicular from A to BC: $AO^2 = 50^2 - 40^2 = 2500 - 1600 = 900$, so AO = 30 cm.

The altitude from A = 30 cm. Altitudes from B and C are equal (by symmetry) = BN = CM.

In a triangle, altitude ratios equal the inverse of side ratios. Area = $(1/2) \times 80 \times 30 = 1200$ cm².

Altitude from B to AC: $h_B = 2 \times \text{Area} / AC = 2400/50 = 48$ cm. Similarly $h_C = 48$ cm.

Sum = 30 + 48 + 48 = 126 cm.

Q59. If $(x^2 + 1/x^2) = 25$ and $x > 0$, then the value of $(x^7 + 1/x^7)$ is

A) $44853\sqrt{3}$

B) $44856\sqrt{3}$

C) $44859\sqrt{3}$

D) $44850\sqrt{3}$

Answer: A

Solution:

$(x + 1/x)^2 = x^2 + 2 + 1/x^2 = 25 + 2 = 27$, so $x + 1/x = 3\sqrt{3}$.

$(x + 1/x)^3 = x^3 + 3(x + 1/x) + 1/x^3$, so $x^3 + 1/x^3 = (3\sqrt{3})^3 - 3(3\sqrt{3}) = 81\sqrt{3} - 9\sqrt{3} = 72\sqrt{3}$.

$(x^2 + 1/x^2)^2 = x^4 + 2 + 1/x^4 = 625$, so $x^4 + 1/x^4 = 623$.

$(x^4 + 1/x^4)(x^3 + 1/x^3) = x^7 + x + 1/x + 1/x^7$, so $x^7 + 1/x^7 = 623(72\sqrt{3}) - 3\sqrt{3} = 44856\sqrt{3} - 3\sqrt{3} = 44853\sqrt{3}$.

Q60. In a class of 150 students, 75 students chose physics, 111 students chose mathematics and 40 students chose chemistry. All students chose at least one of the three subjects and at least one student

chose all three subjects. The number of students who chose both physics and chemistry is equal to the number of students who chose both chemistry and mathematics, and this is half the number of students who chose both physics and mathematics. The maximum possible number of students who chose physics but not mathematics, is

A) 30

B) 35

C) 40

D) 55

Answer: B

Solution:

Let k = number who chose both physics and chemistry = both chemistry and maths, and 2k = both physics and maths (as per condition).

Let x = all three subjects (x ≥ 1). Setting up the inclusion-exclusion: 111 + 75 – 2k + 40 – (k – x) – k + 0 = 150 gives 76 = 4k – x, so x = 4k – 76 with x ≥ 1 meaning k ≥ 20 (approximately).

Students choosing physics but not maths = 75 – 2k.

To maximise this, minimise k.

Since x must be a positive integer, k = 19 + x/4 - for x divisible by 4, minimum x = 4 gives k = 20. Then physics-only-not-maths = 75 – 2(20) = 35.

Q61. The sum of all possible real values of x for which $\log_{x-3}(x^2 - 9) = \log_{x-3}(x + 1) + 2$, is

A) –3

B) √33

C) 3

D) (3 + √33) / 2

Answer: D

Solution:

The base x – 3 must be > 0 and ≠ 1, so x > 3 and x ≠ 4. Also $x^2 – 9 > 0$ means x > 3 (satisfied).

Rewriting: log_{x–3}[(x²–9)/(x+1)] = 2, so $(x^2–9)/(x+1) = (x–3)^2$.

Simplifying: $(x+3)(x–3)/(x+1) = (x–3)^2$. Since x > 3, divide both sides by (x–3): (x+3)/(x+1) = x–3.

Cross-multiplying: $x+3 = (x–3)(x+1) = x^2 – 2x – 3$, giving $x^2 – 3x – 6 = 0$.

Roots: x = (3 ± √33)/2. Only the positive root (3 + √33)/2 ≈ 4.37 satisfies x > 3 and x ≠ 4.

Sum of valid roots = (3 + √33)/2.

Q62. The average salary of 5 managers and 25 engineers in a company is 60000 rupees. If each of the managers received 20% salary increase while the salary of the engineers remained unchanged, the average salary of all 30 employees would have increased by 5%. The average salary, in rupees, of the engineers is

A) 45000

B) 50000

C) 54000

D) 40000

Answer: C

Solution:

Total salary = 30 × 60000 = 1800000. So 5M + 25E = 1800000, where M and E are average manager and engineer salaries.

After 20% increase for managers, new average = 60000 × 1.05 = 63000, so new total = 30 × 63000 = 1890000.

Increase = 90000 = 5M × 0.2 = M. So M = 90000. Then 25E = 1800000 – 5 × 90000 = 1350000, E = 54000.

Q63. ABCD is a trapezium in which AB is parallel to DC, AD is perpendicular to AB, and AB = 3DC. If a circle inscribed in the trapezium touching all the sides has a radius of 3 cm, then the area, in sq. cm, of the trapezium is

A) 48

B) $30\sqrt{3}$

C) $36\sqrt{2}$

D) 54

Answer: A

Solution:

Let DC = x, so AB = 3x and AD = diameter of inscribed circle = 6 cm (since the circle touches both parallel sides, AD = 2r = 6).

The circle touches all four sides. For a tangential trapezium, AB + CD = AD + BC.

So 3x + x = 6 + BC, giving BC = 4x – 6.

Using the right angle at A: in triangle formed by extending, $BC^2 = (AB - DC)^2 + AD^2 = (2x)^2 + 36$.

Also BC = 4x – 6, so $(4x–6)^2 = 4x^2 + 36 \rightarrow 16x^2 – 48x + 36 = 4x^2 + 36 \rightarrow 12x^2 – 48x = 0 \rightarrow x(x – 4) = 0$, so x = 4.

Thus DC = 4, AB = 12, AD = 6.

Area = (1/2)(DC + AB) × AD = (1/2)(4 + 12) × 6 = 48 sq cm.

Q64. If $12^{12x} \times 4^{24x+12} \times 5^{2y} = 8^{4z} \times 20^{12x} \times 243^{3x-6}$, where x, y and z are natural numbers, then x + y + z equals

Answer: 112

Solution:

Prime factorise both sides. LHS: $12^{(12x)} = 2^{(24x)} \times 3^{(12x)}$; $4^{(24x+12)} = 2^{(48x+24)}$; $5^{(2y)}$.

RHS: $8^{(4z)} = 2^{(12z)}$; $20^{(12x)} = 2^{(24x)} \times 5^{(12x)}$; $243^{(3x-6)} = 3^{(15x-30)}$.

Equating powers of 3: 12x = 15x – 30, so x = 10.

Equating powers of 5: 2y = 12x = 120, so y = 60.

Equating powers of 2: 24x + 48x + 24 = 12z + 24x → 48x + 24 = 12z → z = 4x + 2 = 42.

Therefore x + y + z = 10 + 60 + 42 = 112.

Q65. In △ABC, AB = AC = 12 cm and D is a point on side BC such that AD = 8 cm. If AD is extended to a point E such that ∠ACB = ∠AEB, then the length, in cm, of AE is

A) 20

B) 16

C) 18

D) 14

Answer: C

Solution:

Since ∠ACB = ∠AEB, points A, B, C, E are concyclic (∠ACB and ∠AEB subtend the same arc AB from the same side).

By the power of a point / similar triangles: ∠BAE = ∠DAB and ∠AEB = ∠ABD (angles in same segment), so △ABE ~ △ADB.

Therefore AB/AD = AE/AB, giving AE = AB^2/AD = 144/8 = 18 cm.

Q66. Vessels A and B contain 60 litres of alcohol and 60 litres of water, respectively. A certain volume is taken out from A and poured into B. After stirring, the same volume is taken out from B and poured into A. If the resultant ratio of alcohol and water in A is 15 : 4, then the volume, in litres, initially taken out from A is

Answer: 16

Solution:

Let x litres be removed from A.

After step 1: A has (60 – x) litres alcohol; B has 60 litres water + x litres alcohol = (60 + x) litres total with alcohol fraction x/(60+x).

Step 2: x litres taken from B contains x × [x/(60+x)] = $x^2/(60+x)$ litres alcohol.

Alcohol returned to A = $x^2/(60+x)$.

Alcohol in A after step 2 = $(60 – x) + x^2/(60+x) = [3600 – 60x – x^2 + 60x + x^2]/(60+x) = 3600/(60+x)$.

Water in A = $60 – 3600/(60+x) = [60(60+x) – 3600]/(60+x) = 60x/(60+x)$.

Ratio = $[3600/(60+x)] : [60x/(60+x)] = 60 : x = 15 : 4$, giving x = 16.

Q67. The ratio of the number of coins in boxes A and B was 17:7. After 108 coins were shifted from box A to box B, this ratio became 37:20. The number of coins that needs to be shifted further from A to B, to make this ratio 1:1, is

Answer: 272

Solution:

Let coins in A = 17k and B = 7k. After shifting 108: (17k – 108)/(7k + 108) = 37/20.

Cross-multiplying: 340k – 2160 = 259k + 3996, so 81k = 6156, k = 76.

Total coins = 24 × 76 = 1824; half = 912. After the first shift, B has 7(76) + 108 = 640.

Coins needed to equalise = 912 – 640 = 272.

Q68. Let p, q and r be three natural numbers such that their sum is 900, and r is a perfect square whose value lies between 150 and 500. If p is not less than 0.3q and not more than 0.7q, then the sum of the maximum and minimum possible values of p is

Answer: 397

Solution:

We have $p + q + r = 900$ and $150 < r < 500$ with r a perfect square. So $r \in \{169, 196, 225, 256, 289, 324, 361, 400, 441, 484\}$. Also $0.3q \le p \le 0.7q$.

From $p + q \le 900 - 150 = 750$ and $1.3q \le p + q \le 1.7q$, we get $1.3q \le 900 - r \le 1.7q$.

To maximise p: use maximum $p = 0.7q$ when r is minimised. Minimum $r = 169$: $1.7q = 900 - 169 = 731$, $q = 430$, max $p = 0.7 \times 430 = 301$.

To minimise p: use minimum $p = 0.3q$ when r is maximised. Maximum $r = 484$: $1.3q = 900 - 484 = 416$, $q = 320$, min $p = 0.3 \times 320 = 96$.

Sum of max and min $p = 301 + 96 = 397$.