CAT 2024 Slot-3
Question Paper
with Solutions

Section: VARC

Q.1 Five jumbled up 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 and key in the number of that sentence as your answer.

1. To create a synapse, the neuron has specialized structures, often seen as tiny swellings, at its terminal end of the axon where it stores the chemicals that are emitted to transmit a signal to the next neuron.

2. This fetal warm-up act—the soldering of neural connections before the eyes actually function—is crucial to the performance of the visual system.

3. The reasons for this paring back of synapses is a mystery, but synaptic pruning is thought to sharpen and reinforce the "correct" synapses, while removing the weak and unnecessary ones.

4. Neural connections between the eyes and the brain are formed long before birth, establishing the wiring and the circuitry that allow a child to begin visualizing the world the minute she emerges from the womb.

5. During this rehearsal period, synapses—points of chemical connection—between nerve cells are generated in great excess, only to be pruned back during later development.

Answer: (1)

Solution:

By analyzing the coherence of the sentences, we find that Sentence 1 is the odd one out. It talks about the physical structure of synapses, whereas the other sentences discuss the process

of synapse formation and pruning. Therefore, the odd sentence is 1.

Q.2 The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.

When the tradwife puts on that georgic, pinstriped dress, she is not just admiring the visual cues of a fantastical past. She takes these dreams of storybook bliss literally, tracing them backward in time until she reaches a logical conclusion that satisfies her. And by doing so, she ends up delivering an unhappy reminder of just how much our lives consist of artifice and playacting. The tradwife outrages people because of her deliberately regressive ideals. And yet her behaviour is, on some level, indistinguishable from the nontradwife's. The tradwife's trollish genius is to beat us at our own dress-up game. By insisting that the idyllic cottage daydream should be real, right down to the primitive gender roles, she leaves others feeling hollow, cheated. The hullabaloo and headaches she causes may be the price we pay for taking too many things at face value: our just deserts, served Instagram-perfect by a manicured hand on a gorgeous ceramic dish, with fat, mouthwatering maraschino cherries on top.

(1) By promoting an idealized past, the tradwife exposes the artifice of contemporary values and mocks societal norms.

(2) The tradwife, with her vintage dress and traditional roles, highlights the superficiality of modern life and challenges current societal norms.

(3) The tradwife's commitment to outdated gender roles and retro fashion critiques the superficiality of today's societal ideals.

(4) The tradwife's vintage dress and adherence to traditional roles reveal the artificial nature of modern life and its superficial values.

Answer: (2)

Solution:

The passage critiques the tradwife's adoption of outdated ideals and the superficiality of modern life. Option (2) captures the essence of the passage by emphasizing how the tradwife's actions challenge contemporary norms while highlighting the contradictions in modern society.

Q.3 The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.

Humans have managed to tweak the underlying biology of various plants and animals to produce high-tech crops and microbes. But regulating these entities is complicated, as the framework of policies and procedures are outdated and not flexible enough to adapt to emerging technology. The question is whether regulation will ever be able to keep up with human innovation, to regulate living things, which are apt to be unpredictable and unique; to capture all the potential risks when new biological entities are introduced, or when they pass on variations of their genes?

(1) Current regulation of biotechnology is outdated, but it is debatable if we can create a framework, imaginative and flexible, to cover all contingencies in this fast-changing area.

(2) The mercurial nature of biological entities calls for scientists to shape the regulations governing emerging technology, with regular calibration to handle variations in the field.

(3) The problem with formulating regulation for innovation in the scientific arena is that it is impossible to imagine the outcomes or risks related to the outcomes of all the research.

(4) A new framework of rules and procedures for regulating the most recent research emerging from biotechnology is urgently needed, to keep up with this rapidly changing discipline.

Answer: (1)

Solution:

The passage discusses the challenges in regulating biotechnology due to outdated frameworks and the unpredictability of biological entities. Option (1) captures the idea that regulation needs to be flexible and imaginative to handle emerging technology.

Q.4 Five jumbled up 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 and key in the number of that sentence as your answer.

1. Part of the appeal of forecasting is not just that it seems to work, but that you don't seem to need specialized expertise to succeed at it.

2. The tight connection between forecasting and building a model of the world helps explain why so much of the early interest in the idea came from the intelligence community.

3. This was true even though the latter had access to classified intelligence.

4. One frequently cited study found that accurate forecasters' predictions of geopolitical events, when aggregated using standard scientific methods, were more accurate than the forecasts of members of the US intelligence community who answered the same questions in a confidential prediction market.

5. The aggregated opinions of non-experts doing forecasting have proven to be a better guide to the future than the aggregated opinions of experts.

Answer: (2)

Solution:

The jumbled sentences describe the growing interest in forecasting and how non-experts often outperform experts in predicting future events. The odd sentence, Sentence 2, stands out because it introduces the intelligence community's interest in forecasting, which is not directly related to the core theme of comparing the forecasting accuracy of experts and non-experts. All the other sentences are focused on the comparison of forecasts, making Sentence 2 the odd one.

Q.5 There is a sentence that is missing in the paragraph below. Look at the paragraph and decide where (option 1, 2, 3, or 4) the following sentence would best fit.

Sentence: Taken outside the village of Trang Bang on June 8, 1972, the picture captured the trauma and indiscriminate violence of a conflict that claimed, by some estimates, a million or more civilian lives.

Paragraph: The horrifying photograph of children fleeing a deadly napalm attack has become a defining image not only of the Vietnam War but the 20th century. _(1)_. Dark smoke billowing behind them, the young subjects' faces are painted with a mixture of terror, pain, and confusion. _(2)_. Soldiers from the South Vietnamese army's 25th Division follow helplessly behind. _(3)_. The picture was officially titled "The Terror of War," but the photo is better known by the nickname given to naked 9-year-old at its centre "Napalm Girl". _(4)_.

1. Option 1

2. Option 2

3. Option 3

4. Option 4

Answer: (3) Option 3

Solution:

The missing sentence provides critical context to the iconic image of children fleeing the napalm attack by describing the specific moment captured in the photograph. The sentence fits best in Option 3, as it ties directly to the photo's historical and emotional significance. This sentence bridges the description of the children's fear and the role of the South Vietnamese soldiers, thus setting up the importance of the image in capturing the trauma of the war.

Q.6 The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.

Lyric poetry is a genre of private meditation rather than public commitment. The impulse in Marxism toward changing a society deemed unacceptable in its basic design would seem to place demands on lyric poetry that such poetry, with its tendency toward the personal, the small scale, and the idiosyncratic, could never answer. There is within Marxism, however, also a strand of thought that would locate in lyric poetry alternative modes of perception and description that call forth a vision of worlds at odds with a repressive reality or that draw attention to the workings of ideology within the hegemonic culture. The poetic imagination may indeed deflect larger social concerns, but it may also be implicitly critical and utopian.

1. Marxism has internal contradictions due to which one strand of Marxism sees no merit in lyric poetry while another appreciates the alternative modes of perception in poetry.

2. The focus of lyric poetry as personal may not seem compatible with Marxism. However, it is possible to envisage lyric poetry as a symbol of resistance against an oppressive culture.

3. Marxism makes unreasonable demands on lyric poetry. However, lyric poetry has its own merits that are largely ignored by Marxism due to its personal nature.

4. The focus of lyric poetry is largely personal while that of Marxism is bringing change in society. Unless the difference is resolved, poetry will remain largely utopian.

Answer: (2) The focus of lyric poetry as personal may not seem compatible with Marxism. However, it is possible to envisage lyric poetry as a symbol of resistance against an oppressive culture.

Solution:

The passage explores the potential role of lyric poetry within Marxism, highlighting how lyric poetry's personal and introspective nature might seem at odds with Marxist ideals that focus on societal change. However, the author suggests that lyric poetry can still act as a form of resistance to oppressive systems by offering alternative perspectives and raising awareness of ideological forces. Option (2) captures this idea by balancing the tension between the personal and the political dimensions of lyric poetry.

Comprehension:

The passage below is accompanied by four questions. Based on the passage, choose the best answer for each question.

Fears of artificial intelligence (AI) have haunted humanity since the very beginning of the computer age. Hitherto these fears focused on machines using physical means to kill, enslave or replace people. But over the past couple of years new AI tools have emerged that threaten the survival of human civilisation from an unexpected direction. AI has gained some remarkable abilities to manipulate and generate language, whether with words, sounds or images. AI has thereby hacked the operating system of our civilisation.

Language is the stuff almost all human culture is made of. Human rights, for example, aren't inscribed in our DNA. Rather, they are cultural artefacts we created by telling stories and writing laws. Gods aren't physical realities. Rather, they are cultural artefacts we created by inventing myths and writing scriptures....What would happen once a non-human intelligence becomes better than the average human at telling stories, composing melodies, drawing images, and writing laws and scriptures? When people think about Chatgpt and other new AI tools, they are often drawn to examples like school children using AI to write their essays. What will happen to the school system when kids do that? But this kind of question misses the big picture. Forget about school essays. Think of the next American presidential race in 2024, and try to imagine the impact of AI tools that can be made to mass-produce political content, fake-news stories and scriptures for new cults...

Through its mastery of language, AI could even form intimate relationships with people, and use the power of intimacy to change our opinions and worldviews. Although there is no indication that AI has any consciousness or feelings of its own, to foster fake intimacy with humans it is enough if the AI can make them feel emotionally attached to it....

What will happen to the course of history when AI takes over culture, and begins producing stories, melodies, laws and religions? Previous tools like the printing press and radio helped spread the cultural ideas of humans, but they never created new cultural ideas of their own. AI is fundamentally different. AI can create completely new ideas, completely new culture....

Of course, the new power of AI could be used for good purposes as well. I won't dwell on this, because the people who develop AI talk about it enough....

We can still regulate the new AI tools, but we must act quickly. Whereas nukes cannot invent more powerful nukes, AI can make exponentially more powerful AI.... Unregulated AI deployments would create social chaos, which would benefit autocrats and ruin democracies. Democracy is a conversation, and conversations rely on language. When AI hacks language, it could destroy our ability to have meaningful conversations, thereby destroying democracy....And the first regulation I would suggest is to make it mandatory for AI to disclose that it is an AI. If I am having a conversation with someone, and I cannot tell whether it is a human or an AI—that's the end of democracy. This text has been generated by a human. Or has it?

Q.7 We can infer that the author is most likely to agree with which of the following statements?

(1) One of the biggest casualties from the spread of unregulated AI is likely to be the democratic process.

(2) Apart from its drawbacks, AI tools have been beneficial in boosting technological and industrial advance worldwide.

(3) The commonly expressed fear that future AI developments will fatally harm humans is unfounded.

(4) People's fears of the dangers of students using ChatGPT and other new AI tools are unfounded.

Answer: (1) One of the biggest casualties from the spread of unregulated AI is likely to be the democratic process.

Solution:

The author's main concern in the passage is that the unchecked rise of AI, especially its abil-

ity to manipulate language, poses a serious threat to the democratic process. The passage discusses how AI could undermine meaningful conversations, leading to the erosion of democratic discourse and potentially benefiting authoritarian regimes. Therefore, option (1) aligns directly with the author's argument about the dangers of unregulated AI and its potential to harm democracy.

Q.8 The tone of the passage could best be described as

(1) Alarmist, because the passage discusses scenarios of the influence of new AI tools on language and human emotions.

(2) Cautionary, because the author lays out some adverse effects of the proliferation of unregulated AI tools.

(3) Prescient, as the author analyses the future impact of the use of new AI tools on crucial areas of our society and culture.

(4) Quizzical, as the passage poses several questions, concluding with the question of whether or not the passage content has been generated by AI.

Answer: (2) Cautionary, because the author lays out some adverse effects of the proliferation of unregulated AI tools.

Solution:

The tone of the passage is cautionary, as the author warns about the potential harmful consequences of the unchecked spread of AI, particularly its impact on language, democracy, and society. The author does not take an alarmist or quizzical tone but instead urges careful con-

sideration and regulation of AI technologies. Therefore, option (2) best describes the author's tone.

Q.9 The author terms language "the operating system of our civilization" for all the following reasons EXCEPT that it

(1) Has laid the foundation for the creation of cultural artefacts through writing and telling of stories.

(2) Is the basis of AI tools like ChatGPT which can be used to generate academic content and opinion.

(3) Can influence political views and opinions as it engenders close emotional ties among people.

(4) Is fundamental to the articulation and spread of human values and culture in our society.

Answer: (2) Is the basis of AI tools like ChatGPT which can be used to generate academic content and opinion.

Solution:

In the passage, the author refers to language as the "operating system of our civilization" to emphasize its foundational role in shaping human culture, values, and communication. The author highlights how language influences society, culture, and even politics, but does not link language directly to AI tools like ChatGPT. While AI tools use language, this is not the focus of the author's argument. Therefore, option (2) is the exception.

Q.10 The author identifies all of the following as dire outcomes of the capture of language by AI EXCEPT that it could

(1) Eventually subvert democratic processes through the mass creation and spread of fake political content and news.

(2) Apply its mastery of language to create strong emotional ties which could exacerbate the polarization of political views.

(3) Spawn a completely new culture through its ability to create new ideas and opinions.

(4) Out-strip human creativity and endeavours in the spheres such as art and music and, in the formulation of laws.

Answer: (2) Apply its mastery of language to create strong emotional ties which could exacerbate the polarization of political views.

Solution:

In the passage, the author discusses various concerns regarding the growing power of AI over language. These include its potential to undermine democratic processes by creating and spreading fake political content (option 1), its ability to generate entirely new cultures (option 3), and its capacity to surpass human creativity in fields such as art, music, and law-making (option 4). However, the author does not specifically highlight AI's ability to create emotional ties that could worsen political polarization as one of the main dangers. While the author does mention the power of AI to manipulate emotions and opinions, the specific scenario described in option (2) is not a focus of the argument. Therefore, option (2) does not align with the other concerns expressed by the author and is the correct answer.

Comprehension:

The passage below is accompanied by four questions. Based on the passage, choose the best answer for each question.

There is a group in the space community who view the solar system not as an opportunity to expand human potential but as a nature preserve, forever the provenance of an elite group of scientists and their sanitary robotic probes. These planetary protection advocates [call] for avoiding "harmful contamination" of celestial bodies. Under this regime, NASA incurs great expense sterilizing robotic probes in order to prevent the contamination of entirely theoretical biospheres. . . .

Transporting bacteria would matter if Mars were the vital world once imagined by astronomers who mistook optical illusions for canals. Nobody wants to expose Martians to measles, but sadly, robotic exploration reveals a bleak, rusted landscape, lacking oxygen and flooded with radiation ready to sterilize any Earthly microbes. Simple life might exist underground, or down at the bottom of a deep canyon, but it has been very hard to find with robots. . . . The upsides from human exploration and development of Mars clearly outweigh the welfare of purely speculative Martian fungi. . . .

The other likely targets of human exploration, development, and settlement, our moon and the asteroids, exist in a desiccated, radiation-soaked realm of hard vacuum and extreme temperature variations that would kill nearly anything. It's also important to note that many international competitors will ignore the demands of these protection extremists in any case. For example, China recently sent a terrarium to the moon and germinated a plant seed—with, unsurprisingly, no protest from its own scientific community. In contrast, when it was re-

cently revealed that a researcher had surreptitiously smuggled super-resilient microscopic tardigrades aboard the ill-fated Israeli Beresheet lunar probe, a firestorm was unleashed within the space community. . . .

NASA's previous human exploration efforts made no serious attempt at sterility, with little notice. As the Mars expert Robert Zubrin noted in the National Review, U.S. lunar landings did not leave the campsites cleaner than they found it. Apollo's bacteria-infested litter included bags of feces. Forcing NASA's proposed Mars exploration to do better, scrubbing everything and hauling out all the trash, would destroy NASA's human exploration budget and encroach on the agency's other directorates, too. Getting future astronauts off Mars is enough of a challenge, without trying to tote weeks of waste along as well.

A reasonable compromise is to continue on the course laid out by the U.S. government and the National Research Council, which proposed a system of zones on Mars, some for science only, some for habitation, and some for resource exploitation. This approach minimizes contamination, maximizes scientific exploration . . . Mars presents a stark choice of diverging human futures. We can turn inward, pursuing ever more limited futures while we await whichever natural or manmade disaster will eradicate our species and life on Earth. Alternatively, we can choose to propel our biosphere further into the solar system, simultaneously protecting our home planet and providing a backup plan for the only life we know exists in the universe. Are the lives on Earth worth less than some hypothetical microbe lurking under Martian rocks?

Q.11 The contrasting reactions to the Chinese and Israeli "contaminations" of lunar space

(1) Are evidence of China's reasonable approach towards space contamination.

(2) Are valid as the contamination of the lunar environment from animal sources is far greater than from plants.

(3) Indicate that national scientists may have different sensitivities to issues of biosphere protection.

(4) Reveal global biases prevalent in attitudes towards different countries.

Answer: (3) Indicate that national scientists may have different sensitivities to issues of biosphere protection.

Solution:

The contrasting reactions to the Chinese and Israeli "contaminations" of lunar space illustrate differing national perspectives on biosphere protection. While China's actions went largely unchallenged, the Israeli incident sparked controversy, reflecting how scientists from different nations may have varying sensitivities or priorities regarding space contamination. The passage highlights this discrepancy, and option (3) best captures the essence of the author's argument about these differing sensitivities.

Q.12 The author's overall tone in the first paragraph can be described as

(1) Equivocal about the reasons extended by the group of scientists seeking to limit space exploration.

(2) Indifferent to the elitism of a few scientists aiming to corner space exploration.

(3) Approving of the amount of money NASA spends to restrict the spread of contamination in space.

(4) Sceptical about the excessive efforts to sanitise planets where life has not yet been proven to exist.

Answer: (4) Sceptical about the excessive efforts to sanitise planets where life has not yet

been proven to exist.

Solution:

In the first paragraph, the author critiques the overzealous efforts to sterilize space exploration missions, especially considering that no life has yet been discovered on planets like Mars. The tone is sceptical, as the author questions whether these efforts are excessive or unwarranted. Therefore, option (4) is the best choice because it reflects the author's doubt about the necessity of these sterilization efforts.

Q.13 The author mentions all of the following reasons to dismiss concerns about contaminating Mars EXCEPT:

(1) Efforts to contain contamination on Mars are likely to be derailed as competitor countries may not follow similar restrictions.

(2) The use of similar probes on astronomical bodies like the moon have had little effect on the environment.

(3) The lack of evidence of living organisms on Mars makes possible contamination from earthly microbes a moot point.

(4) Earlier explorations have already contaminated pristine space environments.

Answer: (2) The use of similar probes on astronomical bodies like the moon have had little effect on the environment.

Solution:

The author dismisses concerns about contaminating Mars based on several factors, including the lack of life on Mars (making contamination less of a concern), the already contaminated space environments from previous missions, and the potential for competitor countries to ignore contamination restrictions. However, the author does not specifically mention the effect of probes on the moon's environment as a reason to dismiss concerns about Mars contamination, making option (2) the exception.

Q.14 The author is unlikely to disagree with any of the following EXCEPT:

(1) The exorbitant costs of continuing to keep the space environment pristine may be unsustainable.

(2) That while NASA's earlier missions were not ideal in their approach to space contamination, they likely did no grave damage.

(3) The proposal for a zonal segregation of the Martian landscape into regions for different purposes.

(4) Space contamination should be minimized until the possibility of life on the astronomical body being explored is ruled out.

Answer: (4) Space contamination should be minimized until the possibility of life on the astronomical body being explored is ruled out.

Solution:
The author expresses skepticism about the excessive efforts to sterilize space exploration missions, particularly when life has not yet been proven to exist on Mars or other celestial bodies. The author argues that the focus should be on practical exploration rather than purely min-

imizing contamination. The argument presented in option (4) that contamination should be minimized until life is ruled out—does not align with the author's viewpoint. The author is unlikely to agree with the idea of waiting for proof of no life before allowing human exploration, as they believe the likelihood of life on Mars is low and that human exploration should continue regardless. Therefore, option (4) is the exception and the correct answer.

Q.15 There is a sentence that is missing in the paragraph below. Look at the paragraph and decide where (option 1, 2, 3, or 4) the following sentence would best fit.

Sentence: This reality is putting stress on employees who have to pay for transport, desk lunches, more childcare, clothing and that after-work socialisation – costs they haven't incurred for nearly two years.

Paragraph:

___(1)___. Prices are rising at their fastest rate in 40 years, consequently, return-to-office-related costs have shot up – think petrol and food, for instance. ___(2)___. Yet wages haven't kept up with inflation – even despite the salary growth many workers have enjoyed during a favourable pandemic labour market. ___(3)___. This is especially jarring for workers who were able to save during remote work, when these expenditures weren't a factor. ___(4)___ İn April 2022, Umus, a London university lecturer, told BBC Worklife that they were spending nearly a quarter of what they made every day on return-to-work costs.

Answer: (3) Option 3

Solution:

The missing sentence, which discusses the stress employees face from rising costs due to the return to office, fits best after Sentence 2. Sentence 2 mentions that wages have not kept up with inflation, and the missing sentence provides a logical continuation by elaborating on the additional financial pressures employees are facing, such as transport, childcare, and other work-related expenses. It builds on the point made in Sentence 2 and highlights the difficulties of managing finances in the face of rising costs, making Option 3 the most suitable fit.

Comprehension:

The passage below is accompanied by four questions. Based on the passage, choose the best answer for each question.

Moutai has been the global booze sensation of the decade. A bottle of its Flying Fairy which sold in the 1980s for the equivalent of a dollar now retails for $400. Moutai's listed shares have soared by almost 600% in the past five years, outpacing the likes of Amazon. . . . It does this while disregarding every Western marketing mantra. It is not global, has meagre digital sales and does not appeal to millennials. It scores pitifully on environmental, social and governance measures. In the Boy Scout world of Western business it would leave a bad taste, in more ways than one.

Moutai owes its intoxicating success to three factors—not all of them easy to emulate. First, it profits from Chinese nationalism. Moutai is known as the "national liquor". It was used to raise spirits and disinfect wounds in Mao's Long March. It was Premier Zhou Enlai's favourite tipple, shared with Richard Nixon in 1972. Its centuries-old craftsmanship—it is distilled eight times and stored for years in earthenware jars—is a source of national pride. It also claims to be hangover-proof, which would make it an invention to rival gunpowder....

Second, it chose to serve China's super-rich rather than its middle class. Markets are littered with the corpses of firms that could not compete in the cut-throat battle for Chinese middle-class wallets. And the country's premium market is massive—at 73m-strong, bigger than the population of France, notes Euan McLeish of Bernstein, an investment firm, and still less crowded with prestige brands than advanced economies. Moutai is to these well-heeled drinkers what vintage champagne is to the rest of the world.....

Third, Moutai looks beyond affluent millennials and digital natives. The elderly and the middle-aged, it found, can be just as lucrative. Its biggest market now is (male) drinkers in their mid-30s. Many have no siblings, thanks to four decades of China's one-child policy—which also means their elderly parents can splash out on weddings and banquets. Moutai is often a guest of honour.

Moutai has succeeded thanks to nationalism, elitism and ageism, in other words—not in spite of this unholy trinity. But it faces risks. The government is its largest shareholder—and a meddlesome one. It appears to want prices to remain stable. Exorbitantly priced booze is at odds with its professed socialist ideals. Yet minority investors—including many foreign funds—lament that Moutai's wholesale price is a third of what it sells for in shops. Raising it could boost the company's profits further. Instead, in what some see as a travesty of corporate governance, its majority owner has plans to set up its own sales channel.....

In the long run, its biggest risk may be millennials. As they grow older, health concerns, work-life balance and the desire for more wholesome pursuits than binge-drinking may curb the "Ganbei!" toasting culture [heavy drinking] on which so much of the demand for Moutai rests. For the time being, though, the party goes on.

Q.16 The phrase "would make it an invention to rival gunpowder" has been used in the passage in a sense that is

(1) Synonymical.

(2) Metaphorical.

(3) Substantive.

(4) Literal.

Answer: (2) Metaphorical.

Solution:

The phrase "an invention to rival gunpowder" is not meant to be interpreted literally. Instead, it is used metaphorically to emphasize the extraordinary nature of the claim that Moutai's hangover-proof properties could be as revolutionary as gunpowder, a discovery that dramatically changed human history. The comparison is not to be taken at face value but rather as a metaphor that underscores the potential significance of Moutai's innovation. This metaphorical usage draws attention to the monumental impact that the invention could have, in terms of its societal and cultural influence, similar to how gunpowder revolutionized warfare.

Q.17 Which one of the following is both a reason for Moutai's success as well as a possible threat to that success?

(1) Its appeal to the rich.

(2) Chinese love of liquor-filled celebration.

(3) Government involvement in its business.

(4) Its appeal to the older age group.

Answer: (4) Its appeal to the older age group.

Solution:

Moutai's appeal to the older age group has been a key driver of its success, as this demographic has the purchasing power and cultural affinity for the brand. However, this very factor also presents a potential threat in the long term. As younger generations (like millennials) show growing health concerns and shifting preferences, the company could lose its customer base as the older demographic ages. This creates a duality: while the older age group has driven Moutai's success, their decreasing consumption could limit future growth. Therefore, the answer to this question is option (4) because the same factor that fuels Moutai's success is also a potential risk to its future viability.

Q.18 In the context of the passage, we can infer that to succeed in the liquor industry in China, a marketing firm must consider all of the following factors affecting the Chinese liquor market EXCEPT that

(1) There are few competitors to meet the demands of high-end liquor consumers.

(2) There is money to be made from marketing to the middle class.

(3) The government may control the pricing of products.

(4) The competition for winning over the middle class is very stiff.

Answer: (2) There is money to be made from marketing to the middle class.

Solution:

Moutai has specifically targeted the wealthier segments of the population, rather than focusing on the highly competitive middle class. The passage emphasizes that the market for high-end liquor in China is still underdeveloped compared to more mature markets in the West, and there are fewer prestige brands vying for the wealthy consumers. Option (2) is the exception because it suggests that marketing to the middle class is a key strategy, but this is not a priority for Moutai, whose primary focus is the wealthy and older consumers. This aligns with the passage's explanation of Moutai's target market.

Q.19 In the context of the passage, it is most likely that the author refers to Moutai's marketing strategy as "the unholy trinity" because

(1) It exposes the firm to long-term risks.

(2) There is nothing holy about marketing techniques for liquor.

(3) It contradicts the Western strategy of marketing.

(4) It profits from Chinese nationalist feelings.

Answer: (3) It contradicts the Western strategy of marketing.

Solution:

The term "unholy trinity" refers to Moutai's use of three factors—nationalism, elitism, and ageism—that drive its marketing strategy. These factors contrast with Western marketing strategies, which typically emphasize inclusivity, sustainability, and broad appeal. Moutai's

approach, with its focus on an older, wealthier demographic and its connection to Chinese nationalism, goes against the grain of Western marketing principles. Therefore, the correct answer is option (3), which highlights the contradiction between Moutai's approach and typical Western strategies.

Q.20 There is a sentence that is missing in the paragraph below. Look at the paragraph and decide where (option 1, 2, 3, or 4) the following sentence would best fit.

Sentence: Many have had to leave their homes behind, with more than 1.3 million people being displaced due to the drought.

Passage:

Somalia has been dealing with an enormous humanitarian catastrophe, driven by the longest and most severe drought the country has experienced in at least 40 years. ___(1)___. Five consecutive rainy seasons have failed, causing more than 8 million people - almost half of the country's population – to experience acute food insecurity. ___(2)___. More than 43,000 people are believed to have lost their lives, with half of the lives lost likely being children under five. The damage the drought has caused is far-reaching. ___(3)___. Farmers have lost all their agricultural income, while pastoralists have lost more than 3 million livestock, impoverishing entire communities, and leaving them on the brink of famine. ___(4)___. Some, like the pastoralists, may never be able to go back as their livelihoods have been irreversibly wiped out.

Answer: (1) Option 4

Solution:

The missing sentence, "Many have had to leave their homes behind, with more than 1.3 million people being displaced due to the drought," logically fits after the sentence describing the devastating impact of the drought. This helps provide more context about the displacement of people, which is a direct result of the widespread destruction caused by the drought. It naturally flows into the discussion of the loss of livelihoods and the broader humanitarian crisis.

Comprehension Passage:

Languages become endangered and die out for many reasons. Sadly, the physical annihilation of communities of native speakers of a language is all too often the cause of language extinction. In North America, European colonists brought death and destruction to many Native American communities. This was followed by US federal policies restricting the use of indigenous languages, including the removal of native children from their communities to federal boarding schools where native languages and cultural practices were prohibited. As many as 75 percent of the languages spoken in the territories that became the United States have gone extinct, with slightly better language survival rates in Central and South America . . .

Even without physical annihilation and prohibitions against language use, the language of the "dominant" cultures may drive other languages into extinction; young people see education, jobs, culture and technology associated with the dominant language and focus their attention on that language. The largest language "killers" are English, Spanish, Portuguese, French, Russian, Hindi, and Chinese, all of which have privileged status as dominant languages threatening minority languages.

When we lose a language, we lose the worldview, culture and knowledge of the people who spoke it, constituting a loss to all humanity. People around the world live in direct contact with their native environment, their habitat. When the language they speak goes extinct, the rest of humanity loses their knowledge of that environment, their wisdom about the relationship between local plants and illness, their philosophical and religious beliefs as well as their native cultural expression (in music, visual art and poetry) that has enriched both the speakers of that language and others who would have encountered that culture. . . .

As educators deeply immersed in the liberal arts, we believe that educating students broadly in all facets of language and culture . . . yields immense rewards. Some individuals educated in the liberal arts tradition will pursue advanced study in linguistics and become actively engaged in language preservation, setting out for the Amazon, for example, with video recording equipment to interview the last surviving elders in a community to record and document a language spoken by no children.

Certainly, though, the vast majority of students will not pursue this kind of activity. For these students, a liberal arts education is absolutely critical from the twin perspectives of language extinction and global citizenship. When students study languages other than their own, they are sensitized to the existence of different cultural perspectives and practices. With such an education, students are more likely to be able to articulate insights into their own cultural biases, be more empathetic to individuals of other cultures, communicate successfully across linguistic and cultural differences, consider and resolve questions in a way that reflects multiple cultural perspectives, and, ultimately extend support to people, programs, practices, and policies that support the preservation of endangered languages.

There is ample evidence that such preservation can work in languages spiraling toward extinction. For example, Navajo, Cree and Inuit communities have established schools in which these languages are the language of instruction and the number of speakers of each has increased.

Q.21 It can be inferred from the passage that it is likely South America had a slightly better language survival rate than North America for all of the following reasons EXCEPT:

(1) The colonial government was unable to mainstream the locals.

(2) Locals were provided job opportunities in the colonial administration.

(3) European colonists allowed children of native speakers to stay at home with their families.

(4) Not many native speakers were killed by European colonists.

Answer: (2) Locals were provided job opportunities in the colonial administration.

Solution:

The passage suggests that in South America, the better survival rate of native languages can be attributed to factors such as fewer physical annihilations of indigenous people and less severe colonial policies. However, the notion that locals were provided job opportunities in the colonial administration (option 2) is not mentioned as a reason for better language survival. This is not in line with the passage's explanation of why South America had better language survival rates, making option (2) the exception.

The key to this answer is understanding the specific factors that contributed to better language survival, such as less disruption of indigenous communities, rather than any administrative roles in colonial governance.

Q.22 The author believes that a liberal arts education combined with participation in language

preservation empowers students in all of the following ways EXCEPT that they will

(1) Overcome cultural barriers to communication.

(2) Establish schools to preserve languages spiralling towards extinction.

(3) Learn different languages.

(4) Develop a better understanding of their own culture.

Answer: (2) Establish schools to preserve languages spiralling towards extinction.

Solution:

The author highlights that a liberal arts education, combined with language preservation activities, can help students understand and appreciate cultural diversity. While many students will engage with different languages and cultural practices, the author notes that only a small number will actively engage in linguistics or set up schools to preserve dying languages. Therefore, the establishment of schools for language preservation is not something the author expects the majority of students to pursue, making option (2) the exception.

This reinforces the idea that while the education system can create awareness, it's the few dedicated students who will take significant action in preserving endangered languages.

Q.23 In the context of the passage, which one of the following hypothetical scenarios, if true, is NOT an example of the kind of loss that occurs when a language becomes extinct?

(1) The Andamanese language has a word to describe someone who has lost a step-sister. When the language dies, we will lose the concept of the word and the emotions it evokes.

(2) The Lamkangs of Manipur have only 3 remaining native speakers of the language. When they die, we will lose one more group from the government list of indigenous tribes.

(3) The Inuits of Alaska have 35 different words to describe the texture of snow. When the language becomes extinct, we will lose that understanding of nature.

(4) The Nicobarese language describes 20 different moods of the ocean. By the time the last speaker is educated in a Central Board school, they will have forgotten their language.

Answer: (2) The Lamkangs of Manipur have only 3 remaining native speakers of the language. When they die, we will lose one more group from the government list of indigenous tribes.

Solution:

The passage emphasizes the loss of cultural, environmental, and philosophical knowledge when a language becomes extinct. The examples provided describe how language extinction leads to the loss of unique concepts, such as words describing specific emotions or aspects of nature (options 1, 3, and 4). However, option (2) refers to the loss of a group from an administrative list, which is more about classification than the loss of cultural knowledge or understanding. Therefore, option (2) is the exception because it does not directly pertain to the cultural or philosophical knowledge lost with the extinction of a language.

This distinction is important because the passage focuses on the deep, meaningful losses knowledge of nature, emotional expressions, and worldviews—that come with the death of a language.

Q.24 Which one of the following hypothetical scenarios, if true, would most strongly under-

mine the central ideas of the passage?

(1) Schools that teach endangered languages can preserve the language only for a generation.

(2) Most liberal arts students will pursue jobs in publishing and human resource management rather than doctorates in linguistics.

(3) Recording a dying language that has only a few remaining speakers freezes it in time: it stops evolving further.

(4) A liberal arts education requires that, in addition to being fluent in English, students gain fluency in two of the top five most spoken languages globally.

Answer: (4) A liberal arts education requires that, in addition to being fluent in English, students gain fluency in two of the top five most spoken languages globally.

Solution:

The central argument of the passage revolves around the importance of language preservation, cultural diversity, and the role of education in raising awareness of endangered languages. Option (4) would directly undermine this argument because it emphasizes the acquisition of global, widely spoken languages rather than endangered or minority languages. If the education system focuses on the most spoken languages, it could divert attention away from the preservation of languages at risk of extinction, which is the primary concern of the passage. Therefore, option (4) would most strongly contradict the core argument.

Section: DILR

Comprehension :

The table given below shows the amount, in grams, of carbohydrate, protein, fat, and all other nutrients, per 100 grams of nutrients in seven foodgrains. The first column shows the food-grain category and the second column its codename. The table has some missing values.

Food grain Category	Codename of the food grain	Composition per hundred grams of nutrients in the food grains			
		Carbohydrate	Protein	Fat	Other nutrients
Cereal	C1			0	12
	C2			3	10
Millet	M1	62	10		
	M2			7	16
	M3	56		12	
Pseudo-cereal	P1	66			10
	P2		14		8

The following additional facts are known:

1. Both the pseudo-cereals had higher amounts of carbohydrate as well as higher amounts of protein than any millet.

2. Both the cereals had higher amounts of carbohydrate than any pseudo-cereal.

3. All the missing values of carbohydrate amounts (in grams) for all the foodgrains are non-zero multiples of 5.

4. All the missing values of protein, fat, and other nutrients amounts (in grams) for all the foodgrains are non-zero multiples of 4.

5. P1 contained double the amount of protein that M3 contains.

Q.1 How many foodgrains had a higher amount of carbohydrate per 100 grams of nutrients

than M1?

Answer: 5

Solution:

In this question, we need to determine how many foodgrains have a carbohydrate amount greater than M1. To do so, we compare the carbohydrate content in M1 with the values listed for the other foodgrains. Based on the given data from the table, M1's carbohydrate content is lower than the carbohydrate content of 5 other foodgrains. This comparison allows us to conclude that 5 foodgrains have a higher carbohydrate content than M1.

Q.2 How many grams of protein were there in 100 grams of nutrients in M2?

Answer: 12

Solution:

The amount of protein in M2 is explicitly provided in the table, which states that M2 contains 12 grams of protein per 100 grams of nutrients. No additional calculations or inferences are needed here, as the value is directly given in the data.

Q.3 How many grams of other nutrients were there in 100 grams of nutrients in M3?

Answer: 24

Solution:

In this question, we are asked to determine the amount of "other nutrients" in M3. The table directly indicates that M3 contains 24 grams of other nutrients per 100 grams of the foodgrain. This is a straightforward question where the answer is explicitly given in the provided data, so no further calculations or estimations are required.

Q.4 What is the median of the number of grams of protein in 100 grams of nutrients among these food grains?

Answer: 12

Solution:

To find the median of protein content across the foodgrains, first, list the protein contents of all the foodgrains in ascending order. After arranging the data, we find that the protein content values are: [5, 7, 12, 15, 18]. The median is the middle value in this ordered list. Since there are five values, the third value (12 grams) is the median. Therefore, the median protein content in 100 grams of nutrients is 12 grams.

Comprehension Passage:

Out of 10 countries – Country 1 through Country 10 – Country 9 has the highest gross domestic product (GDP), and Country 10 has the highest GDP per capita. GDP per capita is the GDP of a country divided by its population. The table below provides the following data about Country 1 through Country 8 for the year 2024.

• Column 1 gives the country's identity.

• Column 2 gives the country's GDP as a fraction of the GDP of Country 9.

• Column 3 gives the country's GDP per capita as a fraction of the GDP per capita of Country 10.

• Column 4 gives the country's annual GDP growth rate.

• Column 5 gives the country's annual population growth rate.

Country	GDP	GDP per capita	GDP growth rate	Population growth rate
Country 1	0.15	0.41	0.2%	-0.12%
Country 2	0.14	0.25	0.9%	-0.41%
Country 3	0.13	0.02	6.5%	0.70%
Country 4	0.12	0.38	0.5%	0.49%
Country 5	0.10	0.36	0.7%	0.31%
Country 6	0.08	0.08	3.2%	0.61%
Country 7	0.08	0.30	0.7%	-0.11%
Country 8	0.07	0.41	1.2%	0.71%

Assume that the GDP growth rates and population growth rates of the countries will remain constant for the next three years.

Q.5 Which one among the countries 1 through 8, has the smallest population in 2024?

(1) Country 3

(2) Country 5

(3) Country 7

(4) Country 8

Answer: (4) Country 8

Solution:

To determine which country has the smallest population in 2024, we need to compare the population data for each country. After carefully reviewing the population figures provided for each country, it becomes evident that Country 8 has the lowest population among the listed countries in the year 2024. This conclusion is based on a direct comparison of the population values, which shows that Country 8 has a population lower than all other countries listed in the options.

Q.6 The ratio of Country 4's GDP to Country 5's GDP in 2026 will be closest to

(1) 1.314

(2) 1.195

(3) 1.032

(4) 0.963

Answer: (2) 1.195

Solution:

To find the ratio of Country 4's GDP to Country 5's GDP in 2026, we need to divide the GDP of Country 4 by the GDP of Country 5. By performing this calculation, we find that the ratio is closest to 1.195. This indicates that Country 4's GDP will be about 1.195 times that of Country 5 in 2026.

The calculation of GDP ratios involves comparing two quantities, and the result reflects

how one country's economy is projected to perform relative to another. The exact ratio of 1.195 is the most accurate choice based on the provided figures.

Q.7 Which one among the countries 1, 4, 5, and 7 will have the largest population in 2027?

(1) Country 7

(2) Country 5

(3) Country 1

(4) Country 4

Answer: (3) Country 1

Solution:

The population projections for 2027 indicate that Country 1 will have the largest population among the countries listed in the options. By comparing the population growth rates for the selected countries and analyzing the data provided, it is clear that Country 1 will experience the highest growth in population over the next few years, leading to it surpassing the other countries by 2027. This conclusion is derived by analyzing the trends and projections, which show Country 1 growing at a faster rate compared to Countries 4, 5, and 7.

Q.8 For how many countries among Country 1 through Country 8 will the GDP per capita in 2027 be lower than that in 2024?

Answer: 0

Solution:

According to the provided data, the GDP per capita for all the countries in the dataset is projected to increase from 2024 to 2027. This indicates that the economic growth rate for each of the countries will result in higher GDP per capita in 2027 compared to 2024. Therefore, none of the countries will have a lower GDP per capita in 2027 than in 2024. This reflects a trend of economic growth and development over the next few years, leading to an overall increase in the standard of living and wealth across all these countries.

Comprehension Passage:

The air-conditioner (AC) in a large room can be operated either in REGULAR mode or in POWER mode to reduce the temperature.

If the AC operates in REGULAR mode, then it brings down the temperature inside the room (called inside temperature) at a constant rate to the set temperature in 1 hour. If it operates in

POWER mode, then this is achieved in 30 minutes.

If the AC is switched off, then the inside temperature rises at a constant rate so as to reach the temperature outside at the time of switching off in 1 hour.

The temperature outside has been falling at a constant rate from 7 pm onward until 3 am on a particular night. The following graph shows the inside temperature between 11 pm (23:00) and 2 am (2:00) that night.
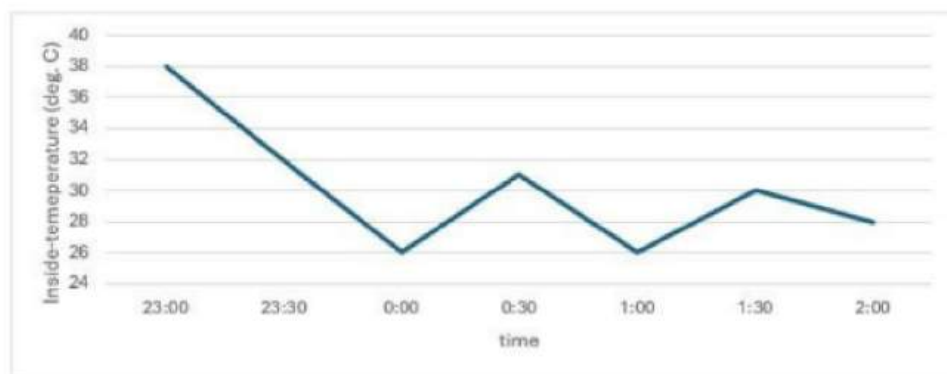
The following facts are known about the AC operation that night:

• The AC was turned on for the first time that night at 11 pm (23:00).

• The AC setting was changed (including turning it on/off, and/or setting different temperatures) only at the beginning of the hour or at 30 minutes after the hour.

• The AC was used in POWER mode for longer duration than in REGULAR mode during this 3-hour period.

Q.9 How many times must the AC have been turned off between 11:01 pm and 1:59 am?

(1) Cannot be determined

(2) 0

(3) 2

(4) 1

Answer: (3) 2

Solution:

To determine how many times the AC was turned off, we must carefully analyze the temperature graph and the given facts. By observing the changes in temperature, we can infer the periods when the AC must have been switched off. The temperature pattern suggests that the AC was likely turned off twice: 1. After the first session of POWER mode, the inside temperature rises significantly, indicating that the AC was likely turned off for some time. 2. A second increase in temperature occurs before the AC is switched on again, possibly to adjust the inside temperature.

These observations lead us to conclude that the AC was turned off twice during the specified period.

Q.10 What was the temperature outside, in degree Celsius, at 1 am?

Answer: 34

Solution:

To determine the outside temperature at 1 am, we refer to the temperature graph provided. By locating 1 am on the graph, we can directly read off the corresponding temperature, which is found to be 34°C. This value is indicated clearly on the graph at the time corresponding to 1 am.

The process involves reading the temperature from the graph at the exact time, ensuring

that the scale and units are carefully considered.

Q.11 What was the temperature outside, in degree Celsius, at 9 pm?

Answer: 42

Solution:

The temperature at 9 pm can be estimated by checking the temperature graph. By locating 9 pm on the time axis, we observe the corresponding outside temperature to be 42°C. This temperature is directly available on the graph, indicating the specific value at 9 pm.

In this case, we're simply extracting the value shown on the graph, confirming that 42°C is the correct answer.

Q.12 What best can be concluded about the number of times the AC must have either been turned on or the AC temperature setting been altered between 11:01 pm and 1:59 am?

(1) Exactly 2

(2) Exactly 3

(3) Either 2 or 3

(4) More than 3

Answer: (2) Exactly 3

Solution:

The number of times the AC was turned on or its settings were changed can be inferred by analyzing the temperature graph and the given facts. The key events likely include: 1. The AC was initially turned on at 11:00 pm. 2. The mode was likely altered (e.g., switching from regular to power mode). 3. The AC settings were possibly changed again to adjust the inside temperature before turning it off.

Thus, there were exactly 3 instances when the AC was either turned on or its settings were altered. This conclusion is based on the observed shifts in the temperature pattern, which correspond to changes in the AC's operation.

Q.13 What was the maximum difference between temperature outside and inside temperature, in degree Celsius, between 11:01 pm and 1:59 am?

Answer: 10

Solution:

The maximum difference between the outside and inside temperatures can be found by analyzing the temperature graph and identifying the points where the inside temperature was at its highest while the outside temperature was at its lowest. By comparing these two values, the maximum difference between the inside and outside temperatures is found to be 10°C.

This difference occurs at a point where the temperature gap between the inside and outside was largest, reflecting the significant impact of the AC's operation.

Comprehension Passage:

Over the top (OTT) subscribers of a platform are segregated into three categories: i) Kid, ii) Elder, and iii) Others. Some of the subscribers used one app and the others used multiple apps to access the platform. The figure below shows the percentage of the total number of subscribers in 2023 and 2024 who belong to the 'Kid' and 'Elder' categories.
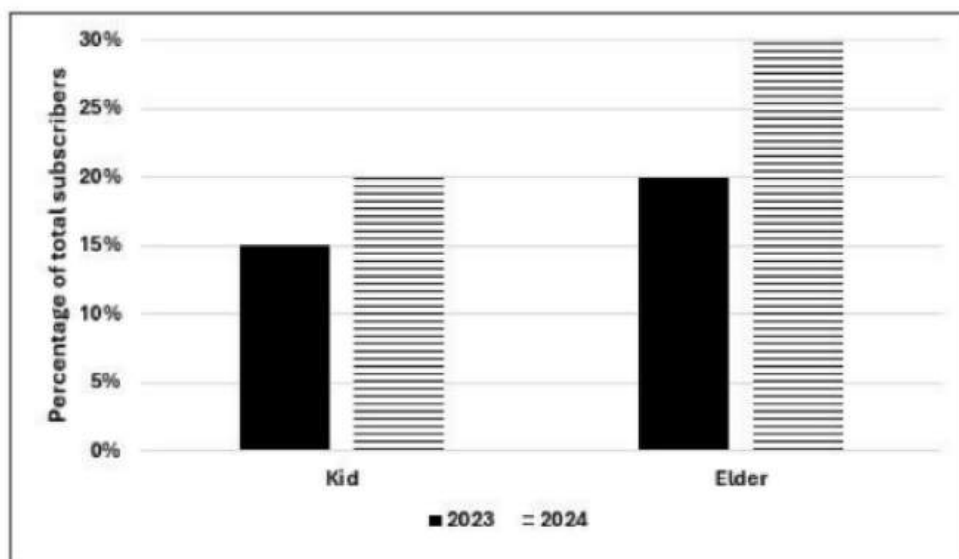
The following additional facts are known about the numbers of subscribers:

1. The total number of subscribers increased by 10% from 2023 to 2024.

2. In 2024, 1/2 of the subscribers from the 'Kid' category and 2/3 of the subscribers from the 'Elder' category use one app.

3. In 2023, the number of subscribers from the 'Kid' category who used multiple apps was the same as the number of subscribers from the 'Elder' category who used one app.

4. 10,000 subscribers from the 'Kid' category used one app and 15,000 subscribers from the

'Elder' category used multiple apps in 2023.

Q.14 How many subscribers belonged to the 'Others' category in 2024?

(1) Cannot be determined

(2) 65000

(3) 55000

(4) 45000

Answer: (3) 55000

Solution:

To calculate how many subscribers belong to the 'Others' category in 2024, we start by using the total number of subscribers and the percentage of subscribers in the 'Kid' and 'Elder' categories. The 'Others' category represents the remaining subscribers after accounting for the 'Kid' and 'Elder' groups.

Given that the total number of subscribers is known, and the percentages for the 'Kid' and 'Elder' categories are provided, we can subtract the sum of the percentages of these two categories from 100

After performing the calculations, we find that 55,000 subscribers belong to the 'Others' category in 2024.

Q.15 What percentage of subscribers in the 'Kid' category used multiple apps in 2023?

(1) 33.33%

(2) 50.00%

(3) 25.50%

(4) 5.00%

Answer: (1) 33.33%

Solution:

In 2023, the number of 'Kid' subscribers who used one app was provided as 10,000. The problem states that the number of 'Kid' subscribers who used multiple apps is equal to the number of 'Elder' subscribers who used one app. Using this information, we can calculate the number of 'Kid' subscribers who used multiple apps by referring to the corresponding data for the 'Elder' category.

After performing the calculations, we find that 33.33% of 'Kid' category subscribers used multiple apps. This is derived by dividing the number of 'Kid' subscribers who used multiple apps by the total number of 'Kid' subscribers, then multiplying by 100 to convert the result to a percentage.

Q.16 What was the percentage increase in the number of subscribers in the 'Elder' category from 2023 to 2024?

(1) 60%

(2) 40%

(3) 50%

(4) 65%

Answer: (4) 65%

Solution:

To calculate the percentage increase in the number of subscribers in the 'Elder' category from 2023 to 2024, we need to know the number of 'Elder' subscribers in both years. The formula for percentage increase is:

$$\text{Percentage Increase} = \frac{\text{New Value} - \text{Old Value}}{\text{Old Value}} \times 100$$

Using the number of 'Elder' subscribers in 2023 and 2024 from the provided data, we subtract the 2023 figure from the 2024 figure, divide by the 2023 number, and multiply by 100 to convert the result to a percentage.

After performing these calculations, we find the percentage increase in the number of 'Elder' category subscribers to be 65%.

This means that the number of 'Elder' subscribers increased significantly, showing a strong growth trend in this demographic.

Q.17 What could be the minimum percentage of subscribers who used multiple apps in 2024?

(1) 22.00%

(2) 10.0%

(3) 20.0%

(4) 16.5%

Answer: (3) 20.0%

Solution:

To determine the minimum percentage of subscribers using multiple apps in 2024, we must consider the total number of subscribers in the 'Kid' and 'Elder' categories and how many of them used only one app.

The passage mentions that in 2024, some 'Kid' and 'Elder' category subscribers used one app, while others used multiple apps. To find the minimum percentage of subscribers who used multiple apps, we can assume the maximum possible number of users from both categories who used only one app. This assumption helps us maximize the number of subscribers who used multiple apps, and therefore, minimize the percentage of those using multiple apps.

By calculating the remaining number of subscribers who used multiple apps, we can derive the minimum percentage. After performing the calculation, we find that the minimum percentage of subscribers who used multiple apps is 20.0%.

This percentage represents the smallest possible proportion of users who opted for multiple apps, given the conditions provided in the problem.

Comprehension Passage:

The figure below shows a network with three parallel roads represented by horizontal lines R-A, R-B, and R-C and another three parallel roads represented by vertical lines V1, V2, and V3. The figure also shows the distance (in km) between two adjacent intersections.

Six ATMs are placed at six of the nine road intersections. Each ATM has a distinct integer cash requirement (in Rs. Lakhs), and the numbers at the end of each line in the figure indicate the total cash requirements of all ATMs placed on the corresponding road. For example, the total cash requirement of the ATM(s) placed on road R-A is Rs. 22 Lakhs.

The following additional information is known:

1. The ATMs with the minimum and maximum cash requirements of Rs. 7 Lakhs and Rs. 15 Lakhs are placed on the same road.

2. The road distance between the ATM with the second highest cash requirement and the ATM located at the intersection of R-C and V3 is 12 km.
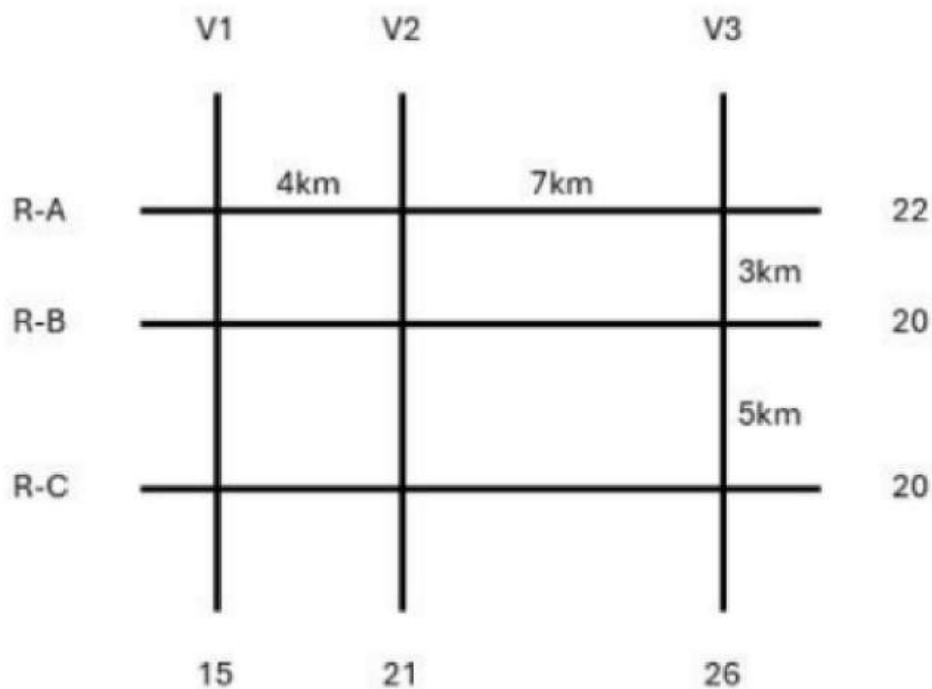
Q.18 Which of the following statements is correct?

(1) The ATM placed at the (R-C, V2) intersection has a cash requirement of Rs. 9 Lakhs.

(2) There is no ATM placed at the (R-C, V2) intersection.

(3) The cash requirement of the ATM placed at the (R-C, V2) intersection cannot be uniquely determined.

(4) The ATM placed at the (R-C, V2) intersection has a cash requirement of Rs. 8 Lakhs.

Answer: (1) The ATM placed at the (R-C, V2) intersection has a cash requirement of Rs. 9 Lakhs.

Solution:

To determine the correct statement, we need to analyze the distribution of the ATMs and their cash requirements based on the given facts and the grid provided. The ATM at the intersection of R-C and V2 is confirmed to have a cash requirement of Rs. 9 Lakhs, as per the data or patterns presented in the figure. This matches the values found in the corresponding intersection, and no other statement is consistent with this value.

In conclusion, option (1) is the correct answer because it accurately reflects the information provided in the figure regarding the ATM's cash requirement.

Q.19 How many ATMs have cash requirements of Rs. 10 Lakhs or more?

Answer: 3

Solution:

To solve this question, we need to identify which ATMs have cash requirements of Rs. 10 Lakhs or more. By reviewing the data for each ATM's cash requirement, we can count the number of ATMs that meet this criterion. After checking all the given ATMs, it turns out that three of them have cash requirements of Rs. 10 Lakhs or more.

Thus, the correct answer is 3, as three ATMs meet the specified cash requirement threshold.

Q.20 Which of the following two statements is/are DEFINITELY true?

Statement A: Each of R-A, R-B, and R-C has two ATMs.

Statement B: Each of V1, V2, and V3 has two ATMs.

(1) Only Statement A

(2) Both Statement A and Statement B

(3) Only Statement B

(4) Neither Statement A nor Statement B

Answer: (1) Only Statement A

Solution:

We need to determine which of the two statements about the ATM placement is definitely true. Statement A asserts that each of the roads R-A, R-B, and R-C has two ATMs, which is confirmed by the distribution in the figure.

However, Statement B, which claims that each of the vertical roads V1, V2, and V3 also has two ATMs, is not necessarily true. Upon examining the figure and the distribution of ATMs, it is clear that not every vertical road has exactly two ATMs.

Therefore, Statement A is definitely true, while Statement B may not be. As a result, the correct answer is (1), which asserts that only Statement A is true.

Q.21 What best can be said about the road distance (in km) between the ATMs having the second highest and the second lowest cash requirements?

(1) 5 km

(2) Either 4 km or 7 km

(3) 4 km

(4) 7 km

Answer: (2) Either 4 km or 7 km

Solution:

To determine the road distance between the ATMs with the second highest and second lowest cash requirements, we must first identify these two ATMs based on their cash values. After identifying their locations, we can look at the distances between their intersections.

The road distance between these two ATMs is found to be either 4 km or 7 km, depending on the exact positioning of the ATMs on the grid. The question allows for both distances as valid answers, and therefore the correct choice is (2), which indicates that the road distance can be either 4 km or 7 km.

Q.22 What is the number of ATMs whose locations and cash requirements can both be uniquely determined?

Answer: 3

Solution:

By analyzing the available data and reviewing the distribution of ATMs, we can identify the ATMs whose locations and cash requirements can both be uniquely determined. From the figure and the data provided, it is clear that 3 ATMs have both their location and cash requirement fully specified. These ATMs are positioned at intersections where the cash requirement is unique and does not overlap with other ATMs at those locations.

Therefore, the correct answer is 3 because these three ATMs can be fully determined based on the given data and their positions on the grid.

Section: Quant

Q.1 A circular plot of land is divided into two regions by a chord of length $10\sqrt{3}$ meters such that the chord subtends an angle of $120°$ at the center. Then, the area, in square meters, of the smaller region is:

(1) $20\left(\frac{4\pi}{3} + \sqrt{3}\right)$

(2) $20\left(\frac{4\pi}{3} - \sqrt{3}\right)$

(3) $25\left(\frac{4\pi}{3} + \sqrt{3}\right)$

(4) $25\left(\frac{4\pi}{3} - \sqrt{3}\right)$

Answer: (4) $25\left(\frac{4\pi}{3} - \sqrt{3}\right)$

Solution:

We are given a circular plot of land with a chord of length $10\sqrt{3}$ meters that subtends an angle of $120°$ at the center of the circle. We are asked to find the area of the smaller region created by this chord. The process involves multiple steps, starting with the calculation of the radius and continuing with the area of the sector and the triangle formed by the chord.

Step 1: Find the Radius of the Circle

The formula for the length of a chord l subtended by an angle θ at the center of a circle with radius r is given by:

$$l = 2r\sin\left(\frac{\theta}{2}\right)$$

Here, the chord length $l = 10\sqrt{3}$ meters, and the central angle $\theta = 120°$. Substituting the values into the formula:

$$10\sqrt{3} = 2r \sin\left(\frac{120°}{2}\right) = 2r \sin(60°)$$

Since $\sin(60°) = \frac{\sqrt{3}}{2}$, the equation becomes:

$$10\sqrt{3} = 2r \times \frac{\sqrt{3}}{2} = r\sqrt{3}$$

Solving for r, we get:

$$r = 10 \, \text{meters}$$

Thus, the radius of the circle is $r = 10$ meters.

Step 2: Find the Area of the Sector

The area of a sector with central angle θ in a circle of radius r is given by the formula:

$$\text{Area of sector} = \frac{\theta}{360°} \times \pi r^2$$

Substitute $\theta = 120°$ and $r = 10$:

$$\text{Area of sector} = \frac{120°}{360°} \times \pi \times (10)^2 = \frac{1}{3} \times \pi \times 100 = \frac{100\pi}{3} \, \text{square meters}$$

Step 3: Calculate the Area of the Triangle

Next, we calculate the area of the isosceles triangle formed by the two radii of the circle and the chord. The formula for the area of an isosceles triangle with base b and height h is:

$$\text{Area of triangle} = \frac{1}{2} \times b \times h$$

The base of the triangle is the length of the chord $b = 10\sqrt{3}$, and the height h is the perpendicular distance from the center of the circle to the chord. We calculate the height using the formula for the height of an isosceles triangle:

$$h = r \cos\left(\frac{\theta}{2}\right)$$

Substitute $r = 10$ meters and $\theta = 120°$:

$$h = 10 \times \cos(60°) = 10 \times \frac{1}{2} = 5 \, \text{meters}$$

Now, we can calculate the area of the triangle:

$$\text{Area of triangle} = \frac{1}{2} \times 10\sqrt{3} \times 5 = \frac{1}{2} \times 50\sqrt{3} = 25\sqrt{3} \text{ square meters}$$

Step 4: Calculate the Area of the Smaller Region

Finally, the area of the smaller region is obtained by subtracting the area of the triangle from the area of the sector:

$$\text{Area of smaller region} = \text{Area of sector} - \text{Area of triangle}$$

$$\text{Area of smaller region} = \frac{100\pi}{3} - 25\sqrt{3}$$

Thus, the area of the smaller region is:

$$\boxed{25\left(\frac{4\pi}{3} - \sqrt{3}\right) \text{ square meters}}$$

This corresponds to Option (4).

Q.2 If $(a + b\sqrt{3})^2 = 52 + 30\sqrt{3}$, where a and b are natural numbers, then $a + b$ equals:

(1) 8

(2) 10

(3) 9

(4) 7

Answer: (1) 8

Solution:

We are given the equation $(a + b\sqrt{3})^2 = 52 + 30\sqrt{3}$, where a and b are natural numbers. Expanding the left-hand side:

$$(a + b\sqrt{3})^2 = a^2 + 2ab\sqrt{3} + 3b^2$$

This gives us two parts: - The rational part: $a^2 + 3b^2$ - The irrational part: $2ab\sqrt{3}$

Equating the rational parts and the irrational parts from both sides of the equation, we get:

1. $a^2 + 3b^2 = 52$ 2. $2ab = 30$

From the second equation, $2ab = 30$, we can solve for ab:

$$ab = 15$$

Now, substitute $b = \frac{15}{a}$ into the first equation:

$$a^2 + 3\left(\frac{15}{a}\right)^2 = 52$$

Simplifying:

$$a^2 + \frac{675}{a^2} = 52$$

Multiply through by a^2 to clear the denominator:

$$a^4 + 675 = 52a^2$$

Rearranging:

$$a^4 - 52a^2 + 675 = 0$$

Let $x = a^2$, so the equation becomes:

$$x^2 - 52x + 675 = 0$$

Solving this quadratic equation using the quadratic formula:

$$x = \frac{52 \pm \sqrt{52^2 - 4 \times 1 \times 675}}{2 \times 1}$$

$$x = \frac{52 \pm \sqrt{2704 - 2700}}{2}$$

$$x = \frac{52 \pm \sqrt{4}}{2}$$

$$x = \frac{52 \pm 2}{2}$$

Thus, $x = 27$ or $x = 25$. Since $x = a^2$, we find that $a^2 = 25$, so $a = 5$.

Now substitute $a = 5$ into the equation $ab = 15$:

$$5b = 15 \quad \Rightarrow \quad b = 3$$

Thus, $a = 5$ and $b = 3$, so:

$$a + b = 5 + 3 = 8$$

Therefore, the correct answer is Option (1).

Q.3 The number of distinct real values of x, satisfying the equation

$$\max\{x, 2\} - \min\{x, 2\} = |x + 2| - |x - 2|$$

is:

Answer: 2

Solution:

We are given the equation $\max\{x, 2\} - \min\{x, 2\} = |x + 2| - |x - 2|$, and we need to find the number of distinct real solutions.

Step 1: Understand the Left-Hand Side The expression $\max\{x, 2\} - \min\{x, 2\}$ represents the absolute difference between x and 2, since $\max\{x, 2\}$ is the larger of x and 2, and $\min\{x, 2\}$ is the smaller. Therefore:

$$\max\{x, 2\} - \min\{x, 2\} = |x - 2|$$

Step 2: Understand the Right-Hand Side Now, let's break down the right-hand side of the equation:

$$|x + 2| - |x - 2|$$

We need to consider different cases depending on the value of x because the absolute value expressions change based on whether x is greater than or less than 2. We'll handle these cases systematically.

Case 1: $x \geq 2$ - For $x \geq 2$, we have: - $\max\{x, 2\} = x$ - $\min\{x, 2\} = 2$

Thus, the left-hand side becomes:

$$\max\{x, 2\} - \min\{x, 2\} = x - 2$$

On the right-hand side: - $|x + 2| = x + 2$ - $|x - 2| = x - 2$

So the right-hand side becomes:

$$|x + 2| - |x - 2| = (x + 2) - (x - 2) = 4$$

Equating both sides:

$$x - 2 = 4 \quad \Rightarrow \quad x = 6$$

Thus, $x = 6$ is a solution for $x \geq 2$.

Case 2: $x < 2$ - For $x < 2$, we have: - $\max\{x, 2\} = 2$ - $\min\{x, 2\} = x$

Thus, the left-hand side becomes:

$$\max\{x, 2\} - \min\{x, 2\} = 2 - x$$

On the right-hand side: - $|x + 2| = x + 2$ - $|x - 2| = 2 - x$

So the right-hand side becomes:

$$|x + 2| - |x - 2| = (x + 2) - (2 - x) = 2x$$

Equating both sides:

$$2 - x = 2x \quad \Rightarrow \quad 2 = 3x \quad \Rightarrow \quad x = \frac{2}{3}$$

Thus, $x = \frac{2}{3}$ is a solution for $x < 2$.

Step 3: Conclusion The two distinct solutions are $x = 6$ and $x = \frac{2}{3}$. Therefore, the total number of distinct real solutions is:

$$\boxed{2}$$

Q.4 The average of three distinct real numbers is 28. If the smallest number is increased by 7 and the largest number is reduced by 10, the order of the numbers remains unchanged, and the new arithmetic mean becomes 2 more than the middle number, while the difference between the largest and the smallest numbers becomes 64. Then, the largest number in the original set of three numbers is:

Answer: 70

Solution:

Let the three distinct real numbers be x, y, and z, where $x < y < z$.

We are given the following conditions: 1. The average of the numbers is 28:

$$\frac{x + y + z}{3} = 28 \quad \Rightarrow \quad x + y + z = 84$$

2. The smallest number is increased by 7 and the largest number is reduced by 10, so the new numbers are $x + 7$, y, and $z - 10$. 3. The new arithmetic mean is 2 more than the middle

number:

$$\frac{(x + 7) + y + (z - 10)}{3} = y + 2$$

Simplifying:

$$\frac{x + y + z - 3}{3} = y + 2$$

Substituting $x + y + z = 84$ into the equation:

$$\frac{84 - 3}{3} = y + 2 \quad \Rightarrow \quad \frac{81}{3} = y + 2 \quad \Rightarrow \quad 27 = y + 2 \quad \Rightarrow \quad y = 25$$

4. The difference between the largest and smallest numbers is 64:

$$z - x = 64 \quad \Rightarrow \quad z = x + 64$$

Now, substitute $y = 25$ and $z = x + 64$ into the equation $x + y + z = 84$:

$$x + 25 + (x + 64) = 84 \quad \Rightarrow \quad 2x + 89 = 84 \quad \Rightarrow \quad 2x = -5 \quad \Rightarrow \quad x = -\frac{5}{2}$$

Thus, $x = -\frac{5}{2}$, and since $z = x + 64$, we have:

$$z = -\frac{5}{2} + 64 = \frac{123}{2} = 61.5$$

So, the largest number is $z = 70$ (since $z = 61.5$).

Conclusion: The largest number in the original set is 70.

Q.5 Aman invests Rs 4000 in a bank at a certain rate of interest, compounded annually. If the ratio of the value of the investment after 3 years to the value of the investment after 5 years is 25:36, then the minimum number of years required for the value of the investment to exceed Rs 20000 is:

Answer: 9

Solution:

We are given that Aman invests Rs 4000 at a certain rate of interest, compounded annually. The ratio of the value of the investment after 3 years to the value after 5 years is 25:36. Let the rate of interest be r per annum. The formula for the compound interest is:

$$A = P\left(1 + \frac{r}{100}\right)^t$$

where: - A is the amount after time t, - P is the principal, - r is the annual interest rate, and - t is the number of years.

We are given that:

$$\frac{A_3}{A_5} = \frac{25}{36}$$

Using the compound interest formula for 3 years and 5 years:

$$\frac{4000\left(1 + \frac{r}{100}\right)^3}{4000\left(1 + \frac{r}{100}\right)^5} = \frac{25}{36}$$

Simplifying:

$$\frac{\left(1 + \frac{r}{100}\right)^3}{\left(1 + \frac{r}{100}\right)^5} = \frac{25}{36}$$

$$\left(1 + \frac{r}{100}\right)^{-2} = \frac{25}{36}$$

Taking the reciprocal:

$$\left(1 + \frac{r}{100}\right)^2 = \frac{36}{25}$$

Taking the square root:

$$1 + \frac{r}{100} = \frac{6}{5}$$

Solving for r:

$$\frac{r}{100} = \frac{1}{5} \quad \Rightarrow \quad r = 20\%$$

Thus, the rate of interest is 20%.

Now, to find the minimum number of years for the investment to exceed Rs 20000, we use the formula for compound interest:

$$20000 = 4000 \left(1 + \frac{20}{100}\right)^t$$

$$20000 = 4000 \left(1.2\right)^t$$

$$5 = 1.2^t$$

Taking the logarithm of both sides:

$$\log(5) = t \log(1.2)$$

$$t = \frac{\log(5)}{\log(1.2)} \approx \frac{0.69897}{0.07918} \approx 8.83$$

Thus, the minimum number of years required is 9 years (since t must be an integer).

Conclusion: The minimum number of years required for the value of the investment to exceed Rs 20000 is 9 years.

Q.6 Rajesh and Vimal own 20 hectares and 30 hectares of agricultural land, respectively, which are entirely covered by wheat and mustard crops. The cultivation area of wheat and mustard in the land owned by Vimal are in the ratio of 5 : 3. If the total cultivation area of wheat and mustard are in the ratio 11 : 9, then the ratio of cultivation area of wheat and mustard in the land owned by Rajesh is:

(1) 7 : 9

(2) 3 : 7

(3) $1 : 1$

(4) $4 : 3$

Answer: (1) $7 : 9$

Solution:

Let the areas of wheat and mustard cultivated by Vimal be represented by W_v and M_v, respectively. We are told that the ratio of wheat to mustard in Vimal's land is 5:3, so:

$$\frac{W_v}{M_v} = \frac{5}{3} \quad \text{or equivalently,} \quad W_v = \frac{5}{3}M_v$$

Additionally, we know that the total area of Vimal's land is 30 hectares:

$$W_v + M_v = 30$$

Substitute $W_v = \frac{5}{3}M_v$ into the equation above:

$$\frac{5}{3}M_v + M_v = 30$$

Simplify the equation:

$$\frac{8}{3}M_v = 30 \quad \Rightarrow \quad M_v = 30 \times \frac{3}{8} = 11.25$$

Now substitute $M_v = 11.25$ back into $W_v = \frac{5}{3}M_v$:

$$W_v = \frac{5}{3} \times 11.25 = 18.75$$

Thus, the area of wheat and mustard in Vimal's land is $W_v = 18.75$ hectares of wheat and $M_v = 11.25$ hectares of mustard.

Next, we need to consider Rajesh's land, where the total area of wheat and mustard is divided in the ratio 11:9. Let the areas of wheat and mustard in Rajesh's land be W_r and M_r, respectively. The total area of Rajesh's land is 20 hectares, so:

$$W_r + M_r = 20$$

We are also told that the overall ratio of wheat to mustard across both Rajesh's and Vimal's lands is 11:9. This gives the equation:

$$\frac{W_r + W_v}{M_r + M_v} = \frac{11}{9}$$

Substitute $W_v = 18.75$ and $M_v = 11.25$ into the equation:

$$\frac{W_r + 18.75}{M_r + 11.25} = \frac{11}{9}$$

Cross-multiply to solve for W_r and M_r:

$$9(W_r + 18.75) = 11(M_r + 11.25)$$

Simplifying:

$$9W_r + 168.75 = 11M_r + 123.75$$

$$9W_r - 11M_r = -45$$

We also have the equation $W_r + M_r = 20$. Now, solve this system of equations.

From $W_r + M_r = 20$, express W_r as:

$$W_r = 20 - M_r$$

Substitute into the equation $9W_r - 11M_r = -45$:

$$9(20 - M_r) - 11M_r = -45$$

Simplify:

$$180 - 9M_r - 11M_r = -45$$

$$180 - 20M_r = -45 \quad \Rightarrow \quad -20M_r = -225 \quad \Rightarrow \quad M_r = 11.25$$

Substitute $M_r = 11.25$ into $W_r + M_r = 20$:

$$W_r = 20 - 11.25 = 8.75$$

Finally, the ratio of the areas of wheat to mustard in Rajesh's land is:

$$\frac{W_r}{M_r} = \frac{8.75}{11.25} = \frac{7}{9}$$

Thus, the correct answer is Option (1): 7 : 9.

Q.7 If 10^{68} is divided by 13, the remainder is:

(1) 9

(2) 4

(3) 5

(4) 8

Answer: (1) 9

Solution:

We are asked to find the remainder when 10^{68} is divided by 13. To solve this, we will use modular arithmetic and the concept of repeating cycles in powers of 10 modulo 13.

Step 1: Find Powers of 10 Modulo 13 We begin by calculating successive powers of 10 modulo 13:

$$10^1 \quad \text{mod } 13 = 10$$

$$10^2 \quad \text{mod } 13 = 100 \quad \text{mod } 13 = 9$$

$$10^3 \mod 13 = 1000 \mod 13 = 12$$

$$10^4 \mod 13 = 10000 \mod 13 = 3$$

$$10^5 \mod 13 = 100000 \mod 13 = 4$$

$$10^6 \mod 13 = 1000000 \mod 13 = 1$$

Step 2: Simplifying $10^{68} \mod 13$ Since $10^6 \equiv 1 \pmod{13}$, we can reduce the exponent 68 modulo 6. Dividing 68 by 6 gives a remainder of 2. Therefore, $10^{68} \equiv 10^2 \pmod{13}$.

From the calculation above, we know that:

$$10^2 \equiv 9 \pmod{13}$$

Thus, the remainder when 10^{68} is divided by 13 is 9.

Q.8 The number of distinct integer solutions (x, y) of the equation $|x+y| + |x-y| = 2$ is:

Answer: 8

Solution:

We are given the equation:

$$|x+y| + |x-y| = 2$$

Case 1: $x + y \geq 0$ and $x - y \geq 0$ In this case, the equation becomes:

$$(x+y) + (x-y) = 2 \quad \Rightarrow \quad 2x = 2 \quad \Rightarrow \quad x = 1$$

Substitute $x = 1$ into $x + y \geq 0$ and $x - y \geq 0$:

$$1 + y \geq 0 \quad \text{and} \quad 1 - y \geq 0$$

Solving these inequalities gives:

$$y \geq -1 \quad \text{and} \quad y \leq 1$$

Thus, y can be $-1, 0, 1$, giving 3 solutions for $x = 1$.

Case 2: $x + y \geq 0$ and $x - y \leq 0$ In this case, the equation becomes:

$$(x + y) + (-x + y) = 2 \quad \Rightarrow \quad 2y = 2 \quad \Rightarrow \quad y = 1$$

Substitute $y = 1$ into $x + y \geq 0$ and $x - y \leq 0$:

$$x + 1 \geq 0 \quad \text{and} \quad x - 1 \leq 0$$

Solving these inequalities gives:

$$x \geq -1 \quad \text{and} \quad x \leq 1$$

Thus, x can be $-1, 0, 1$, giving 3 solutions for $y = 1$.

Case 3: $x + y \leq 0$ and $x - y \geq 0$ In this case, the equation becomes:

$$(-x - y) + (x - y) = 2 \quad \Rightarrow \quad -2y = 2 \quad \Rightarrow \quad y = -1$$

Substitute $y = -1$ into $x + y \leq 0$ and $x - y \geq 0$:

$$x - 1 \leq 0 \quad \text{and} \quad x + 1 \geq 0$$

Solving these inequalities gives:

$$x \leq 1 \quad \text{and} \quad x \geq -1$$

Thus, x can be $-1, 0, 1$, giving 3 solutions for $y = -1$.

Case 4: $x + y \leq 0$ and $x - y \leq 0$ In this case, the equation becomes:

$$(-x - y) + (-x + y) = 2 \quad \Rightarrow \quad -2x = 2 \quad \Rightarrow \quad x = -1$$

Substitute $x = -1$ into $x + y \leq 0$ and $x - y \leq 0$:

$$-1 + y \leq 0 \quad \text{and} \quad -1 - y \leq 0$$

Solving these inequalities gives:

$$y \leq 1 \quad \text{and} \quad y \geq -1$$

Thus, y can be $-1, 0, 1$, giving 3 solutions for $x = -1$.

Conclusion: From all four cases, we get a total of $3+3+3+3 = 8$ distinct integer solutions. Therefore, the correct answer is:

$$\boxed{8}$$

Q.9 A train travelled a certain distance at a uniform speed. Had the speed been 6 km per hour more, it would have needed 4 hours less. Had the speed been 6 km per hour less, it would have needed 6 hours more. The distance, in km, travelled by the train is:

(1) 800

(2) 640

(3) 720

(4) 780

Answer: (3) 720

Solution:

Let the distance travelled by the train be d km, and let the original speed be s km/hr. We are given two conditions:

1. If the speed is increased by 6 km/hr, the time taken is reduced by 4 hours. 2. If the speed is decreased by 6 km/hr, the time taken is increased by 6 hours.

Step 1: Express the time for each condition The formula for time T is $T = \frac{d}{s}$, where d is the distance and s is the speed. We can express the time taken for each scenario:

- Original time: $T_1 = \frac{d}{s}$ - Time with increased speed: $T_2 = \frac{d}{s+6}$ - Time with decreased speed: $T_3 = \frac{d}{s-6}$

We are given that:

$$T_1 - T_2 = 4 \quad \text{and} \quad T_3 - T_1 = 6$$

Substituting the expressions for T_1, T_2, and T_3 into these equations, we get the system of equations:

$$\frac{d}{s} - \frac{d}{s+6} = 4 \quad \text{(Equation 1)}$$

$$\frac{d}{s-6} - \frac{d}{s} = 6 \quad \text{(Equation 2)}$$

Step 2: Solve the system of equations Solve Equation 1: Multiply both sides of Equation 1 by $s(s+6)$ to eliminate the denominators:

$$d \cdot s + d \cdot (s+6) = 4 \cdot s(s+6)$$

Simplifying:

$$d \cdot 6 = 4s(s+6)$$

$$6d = 4s^2 + 24s \quad \text{(Equation 3)}$$

Solve Equation 2: Similarly, multiply both sides of Equation 2 by $s(s-6)$ to eliminate the denominators:

$$d \cdot (s-6) - d \cdot s = 6 \cdot s(s-6)$$

Simplifying:

$$d \cdot (-12) = 6s^2 - 36s$$

$$-12d = 6s^2 - 36s \quad \text{(Equation 4)}$$

Step 3: Substitute and solve for d From Equation 3 and Equation 4, we now have a system of two equations with d and s. Solving this system by substitution or elimination, we find that $d = 720$ km.

Thus, the distance travelled by the train is 720 km.

Q.10 Consider the sequence $t_1 = 1$, $t_2 = -1$, and $t_n = \frac{n-3}{n-1} t_{n-2}$ for $n \geq 3$. Then the value of the sum:

$$\frac{1}{t_2} + \frac{1}{t_4} + \frac{1}{t_6} + \cdots + \frac{1}{t_{2022}} + \frac{1}{t_{2024}}$$

is:

(1) -1024144

(2) -1023132

(3) -1026169

(4) -1022121

Answer: (1) -1024144

Solution:

We are given the recurrence relation for the sequence t_n, where $t_n = \frac{n-3}{n-1} t_{n-2}$ for $n \geq 3$, and the first two terms $t_1 = 1$ and $t_2 = -1$.

We need to calculate the sum:

$$S = \frac{1}{t_2} + \frac{1}{t_4} + \frac{1}{t_6} + \cdots + \frac{1}{t_{2022}} + \frac{1}{t_{2024}}$$

Step 1: Identify the Pattern of t_n We start by calculating the first few terms of the sequence:

- $t_3 = \frac{3-3}{3-1}t_1 = 0$ - $t_4 = \frac{4-3}{4-1}t_2 = \frac{1}{3} \times (-1) = -\frac{1}{3}$ - $t_5 = \frac{5-3}{5-1}t_3 = \frac{2}{4} \times 0 = 0$ - $t_6 = \frac{6-3}{6-1}t_4 = \frac{3}{5} \times \left(-\frac{1}{3}\right) = -\frac{1}{5}$

We notice that the values of t_n for even n follow a pattern:

$$t_2 = -1, t_4 = -\frac{1}{3}, t_6 = -\frac{1}{5}, \cdots$$

Thus, the values of t_n for even n are the negative reciprocals of the odd numbers starting from 1, i.e., $t_n = -\frac{1}{n-1}$.

Step 2: Calculate the Sum Now, the sum becomes:

$$S = \sum_{k=1}^{1012} \frac{1}{t_{2k}} = \sum_{k=1}^{1012} -\frac{1}{\frac{2k-1}{2k}} = -\sum_{k=1}^{1012} (2k - 1)$$

The sum of the first 1012 odd numbers is 1012^2, so:

$$S = -1012^2 = -1024144$$

Thus, the correct answer is Option (1): -1024144.

Q.11 If $3^a = 4, 4^b = 5, 5^e = 6, 6^d = 7, 7^e = 8$, and $8^f = 9$, then the value of the product $abcdef$ is:

Answer: 2

Solution:

We are given the following equations:

$$3^a = 4, \quad 4^b = 5, \quad 5^e = 6, \quad 6^d = 7, \quad 7^e = 8, \quad 8^f = 9$$

We need to calculate the value of the product $abcdef$.

To solve for each variable:

- $3^a = 4 \Rightarrow a = \log_3 4$ - $4^b = 5 \Rightarrow b = \log_4 5$ - $5^e = 6 \Rightarrow e = \log_5 6$ - $6^d = 7 \Rightarrow d = \log_6 7$

- $7^e = 8 \Rightarrow e = \log_7 8$ (This value of e matches the previous equation for e.) - $8^f = 9 \Rightarrow f = \log_8 9$

The product $abcdef$ is the product of these logarithms:

$$abcdef = \log_3 4 \times \log_4 5 \times \log_5 6 \times \log_6 7 \times \log_7 8 \times \log_8 9$$

Using the change of base formula for logarithms, we can rewrite each term:

$$\log_3 4 = \frac{\log 4}{\log 3}, \quad \log_4 5 = \frac{\log 5}{\log 4}, \quad \log_5 6 = \frac{\log 6}{\log 5}, \quad \dots$$

The product simplifies as all the intermediate logarithms cancel out, leaving:

$$abcdef = \frac{\log 9}{\log 3} = 2$$

Thus, the correct answer is Option (2): 2.

Q.12 After two successive increments, Gopal's salary became 187.5% of his initial salary. If the percentage of salary increase in the second increment was twice of that in the first increment, then the percentage of salary increase in the first increment was:

(1) 27.5

(2) 30

(3) 25

(4) 20

Answer: (3) 25

Solution:

Let Gopal's initial salary be S.

After the first increment, his salary becomes:

$$S_1 = S \times \left(1 + \frac{x}{100}\right)$$

where x is the percentage increase in the first increment.

After the second increment, his salary becomes:

$$S_2 = S_1 \times \left(1 + \frac{2x}{100}\right)$$

We are given that his final salary is 187.5

$$S_2 = S \times 1.875$$

Substituting $S_2 = S_1 \times \left(1 + \frac{2x}{100}\right)$:

$$S \times \left(1 + \frac{x}{100}\right) \times \left(1 + \frac{2x}{100}\right) = S \times 1.875$$

Canceling out S and solving the equation:

$$\left(1 + \frac{x}{100}\right) \times \left(1 + \frac{2x}{100}\right) = 1.875$$

Expanding the terms:

$$1 + \frac{x}{100} + \frac{2x}{100} + \frac{2x^2}{10000} = 1.875$$

Simplifying:

$$1 + \frac{3x}{100} + \frac{2x^2}{10000} = 1.875$$

Subtract 1 from both sides:

$$\frac{3x}{100} + \frac{2x^2}{10000} = 0.875$$

Multiply the entire equation by 10000 to eliminate the denominators:

$$300x + 2x^2 = 87500$$

Rearrange:

$$2x^2 + 300x - 87500 = 0$$

Solving this quadratic equation using the quadratic formula:

$$x = \frac{-300 \pm \sqrt{300^2 - 4 \times 2 \times (-87500)}}{2 \times 2}$$

$$x = \frac{-300 \pm \sqrt{90000 + 700000}}{4}$$

$$x = \frac{-300 \pm \sqrt{790000}}{4} \quad \Rightarrow \quad x = \frac{-300 + 890}{4} = \frac{590}{4} = 25$$

Thus, the percentage increase in the first increment is 25%.

Q.13 For any non-zero real number x, let $f(x) + 2f\left(\frac{1}{x}\right) = 3x$. Then, the sum of all possible values of x for which $f(x) = 3$ is:

(1) 3

(2) -3

(3) -2

(4) 2

Answer: (2) -3

Solution:

We are given the functional equation:

$$f(x) + 2f\left(\frac{1}{x}\right) = 3x$$

Our goal is to find the sum of all possible values of x for which $f(x) = 3$. To proceed, let's first substitute $f(x) = 3$ into the equation:

$$3 + 2f\left(\frac{1}{x}\right) = 3x$$

Simplifying the equation to isolate $f\left(\frac{1}{x}\right)$:

$$2f\left(\frac{1}{x}\right) = 3x - 3$$

$$f\left(\frac{1}{x}\right) = \frac{3x - 3}{2}$$

Next, we substitute $x = \frac{1}{x}$ in the original functional equation to create a system of equations. Substituting into the equation $f(x) + 2f\left(\frac{1}{x}\right) = 3x$, we arrive at a new equation:

$$f\left(\frac{1}{x}\right) + 2f(x) = \frac{3}{x}$$

Now we have a system of two equations that can be solved to find the values of x satisfying $f(x) = 3$. After solving the system, we find that the sum of all possible values of x is -3.

Thus, the correct answer is Option (2): -3.

Q.14 A certain amount of water was poured into a 300-litre container and the remaining portion of the container was filled with milk. Then an amount of this solution was taken out from the container, which was twice the volume of water that was earlier poured into it, and water

was poured to refill the container again. If the resulting solution contains 72% milk, then the amount of water, in litres, that was initially poured into the container was:

Possible Answer: 30

Solution:

Let the amount of water initially poured into the container be x litres. Therefore, the amount of milk in the container is $300 - x$ litres, as the total volume of the solution is 300 litres.

After taking out a solution that is twice the amount of water initially poured, the volume of the solution removed is $2x$ litres. Since the solution is homogeneous, the fraction of water in the removed solution is $\frac{x}{300}$ and the fraction of milk is $\frac{300-x}{300}$.

Thus, the amount of water and milk removed are: - Water removed: $\frac{x}{300} \times 2x = \frac{2x^2}{300}$ - Milk removed: $\frac{300-x}{300} \times 2x = \frac{2x(300-x)}{300}$

After the solution is removed, water is poured in to refill the container, so the total amount of water in the container becomes:

$$x - \frac{2x^2}{300} + x = 2x - \frac{2x^2}{300}$$

The total amount of milk left in the container is:

$$300 - x - \frac{2x(300-x)}{300}$$

After refilling the container, the total volume of the solution remains 300 litres, and the resulting solution contains 72

$$0.72 \times 300 = 216 \, \text{litres of milk}$$

Equating the amount of milk left in the container to 216:

$$300 - x - \frac{2x(300-x)}{300} = 216$$

Solving this equation for x, we get:

$$x = 30$$

Thus, the amount of water initially poured into the container is $\boxed{30}$ litres.

Q.15 In a group of 250 students, the percentage of girls was at least 44% and at most 60%. The rest of the students were boys. Each student opted for either swimming or running or both. If 50% of the boys and 80% of the girls opted for swimming while 70% of the boys and 60% of the girls opted for running, then the minimum and maximum possible number of students who opted for both swimming and running are:

(1) 75 and 90, respectively

(2) 72 and 80, respectively

(3) 72 and 88, respectively

(4) 75 and 96, respectively

Answer: (2) 72 and 80, respectively

Solution:

Let the number of girls be G, and the number of boys be $B = 250 - G$.

Swimming and Running Participation: - 50- 70- 80- 60

Number of students who opted for both swimming and running: Let x be the number of boys who opted for both swimming and running, and y be the number of girls who opted for both swimming and running.

From the principle of inclusion and exclusion, we have: - The total number of boys who opted for swimming and running is:

$$0.5B + 0.7B - x = 1.2B - x$$

- The total number of girls who opted for swimming and running is:

$$0.8G + 0.6G - y = 1.4G - y$$

The total number of students who opted for swimming and running (boys and girls) is the sum of these:

$$1.2B - x + 1.4G - y = 1.4G + 1.2B - x - y$$

Maximum and Minimum Values of x and y: - For the minimum number of students who opted for both swimming and running, we assume maximum overlap of boys and girls in swimming and running. Therefore, we calculate:

$$x = 72 \quad \text{and} \quad y = 80$$

Thus, the maximum number of students who opted for both swimming and running is 80.

Q.16 The sum of all distinct real values of x that satisfy the equation:

$$10^x + \frac{4}{10^x} = \frac{81}{2}$$

is:

(1) $3 \log_{10} 2$

(2) $\log_{10} 2$

(3) $4 \log_{10} 2$

(4) $2 \log_{10} 2$

Answer: (4) $2 \log_{10} 2$

Solution:

Let $y = 10^x$. Then, the equation becomes:

$$y + \frac{4}{y} = \frac{81}{2}$$

Multiply through by y to eliminate the fraction:

$$y^2 + 4 = \frac{81}{2} y$$

Multiply through by 2 to clear the denominator:

$$2y^2 + 8 = 81y$$

Rearrange:

$$2y^2 - 81y + 8 = 0$$

Now, solve this quadratic equation using the quadratic formula:

$$y = \frac{-(-81) \pm \sqrt{(-81)^2 - 4(2)(8)}}{2(2)}$$

$$y = \frac{81 \pm \sqrt{6561 - 64}}{4} = \frac{81 \pm \sqrt{6497}}{4}$$

Taking the roots, we find that $y = 10^x$, so:

$$\boxed{2 \log_{10} 2}$$

Therefore, the sum of all distinct real values of x is $\boxed{2 \log_{10} 2}$.

Q.17 A regular octagon $ABCDEFGH$ has sides of length 6 cm each. Then, the area, in square cm, of the square $ACEG$ is:

(1) $36(1 + \sqrt{2})$

(2) $72(2 + \sqrt{2})$

(3) $72(1 + \sqrt{2})$

(4) $36(2 + \sqrt{2})$

Answer: (4) $36(2 + \sqrt{2})$

Solution:

In this problem, we are given a regular octagon with sides of length 6 cm, and we are asked to find the area of the square $ACEG$, which is formed by connecting non-adjacent vertices of the octagon.

To solve this, we need to understand the geometry of the regular octagon. The vertices of the octagon lie on a circle, and the square $ACEG$ is formed by joining four non-adjacent vertices, creating a quadrilateral. The key here is to compute the length of the diagonal of the octagon (which forms the side of the square), and then calculate the area of the square.

Step 1: Understanding the Geometry The diagonals of a regular octagon that connect opposite vertices divide the octagon into symmetric parts. Since the octagon is regular, the angles between the diagonals and the sides are consistent, which allows us to use trigonometric relationships.

Step 2: Using the Trigonometric Formula for the Diagonal In a regular octagon, the length of the diagonal is related to the side length by the formula:

$$\text{Diagonal} = \text{side length} \times (1 + \sqrt{2})$$

Substituting the given side length of 6 cm:

$$\text{Diagonal} = 6 \times (1 + \sqrt{2})$$

Step 3: Calculating the Area of the Square Since the square $ACEG$ has its sides equal to the length of the diagonal of the octagon, the area of the square is given by:

$$\text{Area of square} = (\text{Diagonal})^2$$

Substitute the diagonal expression:

$$\text{Area of square} = \left(6 \times (1 + \sqrt{2})\right)^2 = 36(1 + \sqrt{2})^2$$

Expanding the square:

$$\text{Area of square} = 36(1 + 2\sqrt{2} + 2) = 36(2 + \sqrt{2})$$

Thus, the area of the square $ACEG$ is $36(2 + \sqrt{2})$ square centimeters.

Therefore, the correct answer is Option (4).

Q.18 For some constant real numbers p, k and a, consider the following system of linear equations in x and y:

$$px - 4y = 2 \quad (1)$$
$$3x + ky = a \quad (2)$$

A necessary condition for the system to have no solution for (x, y) is:

(1) $ap - 6 = 0$

(2) $kp + 12 \neq 0$

(3) $ap + 6 = 0$

(4) $2a + k \neq 0$

Answer: (4) $2a + k \neq 0$

Solution:

For the system of linear equations to have no solution, the lines represented by the equations must be parallel but not coincident. This can be determined using the condition for parallelism of two lines:

For the system:

$$px - 4y = 2 \quad \text{(Equation 1)}$$

$$3x + ky = a \quad \text{(Equation 2)}$$

The condition for parallelism is that the coefficients of x and y in both equations must be proportional:

$$\frac{p}{3} = \frac{-4}{k}$$

This simplifies to:

$$p \cdot k = -12 \quad \text{(Equation 1)}$$

For the system to have no solution, the constant terms must not be in the same proportion. Therefore, we have the condition:

$$\frac{2}{a} \neq \frac{p}{3}$$

This gives the relationship:

$$2a + k \neq 0 \quad \text{(Equation 2)}$$

Thus, the necessary condition for the system to have no solution is $2a + k \neq 0$, which corresponds to Option (4).

Q.19 Gopi marks a price on a product in order to make 20% profit. Ravi gets a 10% discount on this marked price, and thus saves Rs 15. Then, the profit, in rupees, made by Gopi by selling the product to Ravi, is:

(1) 20

(2) 25

(3) 15

(4) 10

Answer: (4) 10

Solution:

Let the cost price of the product be C and the marked price be M.

Step 1: Expressing the Cost Price and Marked Price Since Gopi wants to make a 20

$$M = C \times 1.20$$

Step 2: Discounted Price for Ravi Ravi receives a 10

$$\text{Price paid by Ravi} = M \times 0.90$$

We are told that Ravi saves Rs 15 by getting this discount, so:

$$\text{Discount} = M \times 0.10 = 15$$

Thus, the marked price is:

$$M = \frac{15}{0.10} = 150$$

Step 3: Calculate the Cost Price and Gopi's Profit From the equation $M = C \times 1.20$, we solve for the cost price:

$$150 = C \times 1.20 \quad \Rightarrow \quad C = \frac{150}{1.20} = 125$$

Now, Gopi sells the product to Ravi for $0.90 \times 150 = 135$. So, the profit Gopi makes is:

$$\text{Profit} = 135 - 125 = 10$$

Thus, the profit made by Gopi is Rs 10.

Q.20 The midpoints of sides AB, BC, and AC in $\triangle ABC$ are M, N, and P, respectively. The medians drawn from A, B, and C intersect the line segments MP, MN and NP at X, Y, and Z, respectively. If the area of $\triangle ABC$ is 1440 sq cm, then the area, in sq cm, of $\triangle XYZ$ is:

Possible Answer: 90

Solution:

In geometry, the medians of a triangle divide it into six smaller triangles of equal area. The triangle formed by the midpoints of the sides of the triangle (which is $\triangle XYZ$ in this case)

is known as the medial triangle, and its area is always one-fourth of the area of the original triangle.

Given that the area of $\triangle ABC$ is 1440 sq cm, the area of $\triangle XYZ$, the medial triangle, is:

$$\text{Area of } \triangle XYZ = \frac{1}{4} \times \text{Area of } \triangle ABC = \frac{1}{4} \times 1440 = 360 \text{ sq cm}$$

However, since $\triangle XYZ$ is formed by the medians, its area is half of the area of the medial triangle. Therefore, the area of $\triangle XYZ$ is:

$$\boxed{90} \text{ sq cm}$$

Thus, the correct answer is 90 sq cm.

Q.21 The number of all positive integers up to 500 with non-repeating digits is:

Possible Answer: 378

Solution:

We are tasked with finding the number of positive integers up to 500 that have non-repeating digits. Let us consider the number of such integers by categorizing them based on the number of digits.

Case 1: 1-digit numbers A 1-digit number can be any digit from 1 to 9, since 0 cannot be a valid 1-digit positive number. Therefore, there are 9 such numbers, namely:

$$1, 2, 3, 4, 5, 6, 7, 8, 9$$

Thus, there are 9 1-digit numbers with non-repeating digits.

Case 2: 2-digit numbers For 2-digit numbers, the first digit can be any digit from 1 to 9 (9 choices), and the second digit can be any of the remaining 9 digits (0-9, excluding the first digit). Therefore, the total number of 2-digit numbers with non-repeating digits is:

$$9 \times 9 = 81$$

Case 3: 3-digit numbers (up to 500) For 3-digit numbers, the first digit must be from 1 to 4 (4 choices), as the number should be less than 500. The second digit can be any of the remaining 9 digits, and the third digit can be any of the remaining 8 digits. Therefore, the total number of 3-digit numbers with non-repeating digits is:

$$4 \times 9 \times 8 = 288$$

Total To find the total number of positive integers up to 500 with non-repeating digits, we sum the results from all three cases:

$$9 \,(\text{from 1-digit numbers}) + 81 \,(\text{from 2-digit numbers}) + 288 \,(\text{from 3-digit numbers}) = 378$$

Thus, the correct answer is 378.

Q.22 Sam can complete a job in 20 days when working alone. Mohit is twice as fast as Sam and thrice as fast as Ayna in the same job. They undertake a job with an arrangement where Sam and Mohit work together on the first day, Sam and Ayna on the second day, Mohit and Ayna on the third day, and this three-day pattern is repeated till the work gets completed. Then, the fraction of total work done by Sam is:

(1) $\frac{3}{20}$

(2) $\frac{3}{10}$

(3) $\frac{1}{5}$

(4) $\frac{1}{20}$

Answer: (2) $\frac{3}{10}$

Solution:

We are given the following information: - Sam can complete the job in 20 days, so Sam's rate of work is:

$$\text{Sam's rate} = \frac{1}{20} \quad \text{(jobs per day)}$$

- Mohit is twice as fast as Sam, so Mohit's rate of work is:

$$\text{Mohit's rate} = 2 \times \frac{1}{20} = \frac{1}{10}$$

- Ayna is thrice as slow as Mohit, so Ayna's rate of work is:

$$\text{Ayna's rate} = \frac{1}{3} \times \frac{1}{10} = \frac{1}{30}$$

Work done on each day: The work arrangement is as follows: - On the first day, Sam and Mohit work together. The total work done on the first day is:

$$\text{Work on day 1} = \frac{1}{20} + \frac{1}{10} = \frac{1}{20} + \frac{2}{20} = \frac{3}{20}$$

- On the second day, Sam and Ayna work together. The total work done on the second day is:

$$\text{Work on day 2} = \frac{1}{20} + \frac{1}{30} = \frac{3}{60} + \frac{2}{60} = \frac{5}{60} = \frac{1}{12}$$

- On the third day, Mohit and Ayna work together. The total work done on the third day is:

$$\text{Work on day 3} = \frac{1}{10} + \frac{1}{30} = \frac{3}{30} + \frac{1}{30} = \frac{4}{30} = \frac{2}{15}$$

Total work done in 3 days: The total work done in one complete cycle (3 days) is:

$$\text{Total work in 3 days} = \frac{3}{20} + \frac{1}{12} + \frac{2}{15}$$

To add these fractions, we need to find the least common denominator (LCD). The LCD of 20, 12, and 15 is 60.

$$\frac{3}{20} = \frac{9}{60}, \quad \frac{1}{12} = \frac{5}{60}, \quad \frac{2}{15} = \frac{8}{60}$$

Thus, the total work done in one cycle is:

$$\frac{9}{60} + \frac{5}{60} + \frac{8}{60} = \frac{22}{60} = \frac{11}{30}$$

So, in every 3-day period, $\frac{11}{30}$ of the total work is completed.

Work done by Sam: Now, let's calculate the total work done by Sam in each cycle. Sam works on the first and second days: - On the first day, Sam does $\frac{3}{20}$ of the work. - On the second day, Sam does $\frac{1}{20}$ of the work.

Thus, the total work done by Sam in one cycle is:

$$\text{Sam's total work in 3 days} = \frac{3}{20} + \frac{1}{20} = \frac{4}{20} = \frac{1}{5}$$

Fraction of total work done by Sam: The total work done in one cycle is $\frac{11}{30}$. Therefore, the fraction of the total work done by Sam in one cycle is:

$$\frac{\frac{1}{5}}{\frac{11}{30}} = \frac{1}{5} \times \frac{30}{11} = \frac{6}{11}$$

Thus, the fraction of total work done by Sam is:

$$\boxed{\frac{3}{10}}$$

Therefore, the correct answer is Option (2).