

(Key and Solutions for AIMCAT1707)

Key

SECTION – I SUB-SECTION: RC

1. C	4. 1	7. B	10. C	13. B	16. B
2. B	5. D	8. D	11. D	14. C	17. B
3. B	6. C	9. A	12. A	15. D	18. C

SUB-SECTION: VA

1. D	4. 12	7. 3	10. 51362
2. B	5. 5	8. 4	11. 35264
3. C	6. 3	9. 2131	12. 42615

SECTION – II SUB-SECTION: DI

1. D	4. 8	7. D	10. C	13. 1500
2. B	5. 3	8. C	11. D	14. D
3. C	6. B	9. 17500	12. 712	15. A

SUB-SECTION: LR

1. D	4. B	7. 64	10. B	13. D
2. C	5. A	8. 96	11. A	14. B
3. D	6. 16	9. 24	12. C	15. C

SECTION – III: QA

1. 8	7. B	13. 13	19. 10	25. 1
2. 117	8. B	14. B	20. B	26. B
3. B	9. 1	15. 49	21. B	27. D
4. 12	10. 4	16. B	22. D	28. D
5. 15	11. C	17. 6720	23. A	29. A
6. 40	12. B	18. C	24. 47	30. 66

Solutions

SECTION – I SUB-SECTION: RC

Solutions for questions 1 to 6:

Number of words and Explanatory notes for RC:

Number of words: 855

1. The author begins Extract 1 by saying that we are lucky to exist. In the second paragraph, he mentions that: We're lucky life began on Earth at all, of course, and that something as complex as humans evolved. This points to choice C as the answer.

Option A: It was improbable that your parents met each other and conceived you at just the right instant, and their parents and their parents and so on back to time immemorial. But choice A runs tangent to the text and does not answer the question.

Option B: We are lucky that something as complex as

humans evolved. But we cannot say that we are born because of complex biological mechanisms.

Option D: Choice D is a misdirection. The last sentence of para 1 in Extract 1 appears twisted here. The last sentence says that we are impurities in an otherwise beautifully simple universe.

Choice (C)

2. The laws of physics themselves seem to be working against us. Ours isn't just a randomly hostile universe, it's an actively hostile universe. My physicist colleagues and I like to pretend that the laws of physics are orderly and elegant. Indeed, I just published an entire book, *The Universe in the Rearview Mirror*, about the beautiful symmetries of the universe. Programs like Nova or *Slate*'s own Bad Astronomy tend to focus on the knowable structure of how everything fits together. Towards the end of Extract 1, the author says that it would be a mistake to be comforted by the symmetries of the universe. In truth, they are our worst enemies. Everything we know about rational, predictable arrangements dictates that we shouldn't be here at all The symmetry of the

Option C: Choice C has not been suggested in the passage.

Option D: Choice D is not a summary of Rosen's advice. There is a stress on communication between parent and child. Rosen also suggests in the last paragraph that parents should help the child become aware of what is inappropriate and help them to move away from this.

Choice (A)

Solutions for questions 10 to 15:

Number of words and Explanatory notes for RC:

Number of words: 548

10. Refer to para 3. The author mentions that "Indian firms' water worries might just be beginning" and the main culprit for this is coal.

Option A: While the passage mentions that thermal power plants "guzzle 22 billion cubic meters of water a year", it also mentions that irrigation accounts for 85% of annual water use. Hence, we cannot conclude that thermal power plants consume the maximum amount of water in India.

Option B: The passage does not talk about the efficiency of thermal power plants. Hence, this cannot be a reason for the author to blame coal.

Option C: The author explains that "electricity generation has surged 37% over the past five years" and that thermal power generation will double the existing capacity. The water required for power generation will also increase with the capacity. Hence, this is the primary reason for the author to blame coal for India's water worries.

Option D: The quantity of water used for thermal power will definitely be lower than that used for irrigation as irrigation accounts for 85% of annual water use. Hence, this option is also incorrect.

Therefore, the correct answer is option C.

Choice (C)

11. Refer to para 5. The author cites the example of Farakka thermal power plant as it was forced to shut down.

Option A: While the author mentions that coal is not a scarce resource for thermal power plants, he does not mention the inventory levels of Farakka thermal plant nor of any other thermal power plants. Hence, this cannot be a reason for the shutting down of the plant.

Option B: The passage does not talk about the demand for electricity in any region. It has not been mentioned in the passage that solar power plants in that region generated ample electricity. Hence, this option is also incorrect.

Option C: The author does not talk about the environmental impact of power plant. Hence, this cannot be the reason.

Option D: The paragraph which mentions Farakka power plant talks about water being the "biggest resource crunch". This will result in power plants being turned off. The author says that "A foretaste of what may lie ahead came last month when state-run NTPC Ltd, India's largest power producer, was forced to shut down its Farakka thermal plant in eastern India". Hence, we can infer that the reason Farakka plant was shut down was because of water scarcity. Hence, this is the correct answer.

Choice (D)

12. The passage talks about the situation in industrialized western states in para 6. The passage mentions Maharashtra as having more thermal power capacity than any other state.

Option A: The passage mentions that "The state is under such pressure that it even decided to forego the revenue from holding some of this year's Indian Premier League cricket matches because the pitches take a lot of water to maintain". Hence, it did not allow the cricket matches to be hosted in the state. This option is correct.

Option B: The passage mentions that the state "is thinking of forcing electricity producers to use sewage water". But it does not say whether or not this has been implemented. Hence, this option is incorrect.

Option C: Farakka power plant is in Eastern India and not in Maharashtra. Therefore, this option is incorrect.

Option D: The passage does not talk about the maintenance of sports stadiums. Hence, this option is also incorrect.

Therefore, the correct answer is option A.

Choice (A)

13. According to the passage, the government wants to build 100 gigawatts of solar power by 2022 and "nearly 175 gigawatts of thermal power stations". Refer to para 4.

Option A: Power generation from solar plants will be around 100 gigawatts while from thermal power plants, power generation will be definitely more than 175 gigawatts. Hence, this option is incorrect.

Option B: The thermal power plants will definitely have a higher capacity than solar power plants. Hence, this option is correct.

Option C: The passage does not mention the current status of solar power plant capacity. Hence, we cannot compare the rate of growth of solar power and thermal power.

Option D: The passage mentions that "the government still wants to build nearly 175 gigawatts of thermal power stations in the same period, more than doubling existing capacity". This implies that the current capacity of thermal power plants will be less than 175 gigawatts. Hence, the power generation capacity of thermal power plants by 2022 need not be more than 350 gigawatts. Hence, this option is also incorrect.

Therefore, the correct answer is option B.

Choice (B)

14. The passage mentions in para 7 that "India's fickle monsoons has been all about divining the implications for farm income and food production". Farm income "weighs on GDP growth, and is an important consideration in determining sales of everything".

Option A: The farm income depends on monsoons and influences GDP growth. However, the passage does not mention that GDP growth determines the sales. It mentions that farm income determines the sales. Hence, this option is incorrect.

Option B: Monsoons do play a major role in food production. However, according to the passage, farm income, not food production, determines the sales of everything. Hence, this option is incorrect.

Option C: Monsoons impact farm income which determine the "sales of everything from tractors to gold jewellery and Unilever's skin-whitening cream". Hence, this option is correct.

Option D: Monsoons do not directly impact the GDP but impacts the GDP through farm income. Hence, this option is also incorrect.

Therefore, the correct answer is option C.

Choice (C)

15. Refer to the penultimate paragraph. The author mentions that "climate change raises the threat of once highly improbable events". One such improbable event is "three or more successive years of poor precipitation". Hence, one of the reasons for back to back deficient monsoons is climate change, according to the author. Therefore, the correct answer is option D.

Choice (D)

Solutions for questions 16 to 18:

Number of words and Explanatory notes for RC:

Number of words: 469

16. The passage mentions various probable reasons why the crime rate has decreased in the Netherlands.

Option A: According to Frank Weerman, decrease in the heroin addiction rates can be one of the reasons why crime rate has decreased. Hence, this is not the correct answer.

Option B: The passage mentions that "offering basic rights, like healthcare and personal space, kept the prison running safely and smoothly". However, it does not state that this also helps in reducing crime. Hence, this is not one of the reasons and is the correct answer.

Option C: The passage mentions Weerman "also credits the increased safety measures to secure stores and homes". Hence, this is also one of the probable reasons.

Option D: The passage talks about a 2008 study which mentions that "cutting short Dutch prisoners' sentences to let them reenter the workforce with ankle monitors reduced the recidivism rate". Hence, this is also one of the reason for reduction in crime rate.

Therefore, the correct answer is option B. Choice (B)

17. The passage mentions the difference between the Netherlands and the US in the last paragraph of the passage.

Option A: The passage mentions a 2010 study, according to which guards use ankle brackets for smooth operations in prisons. Also, the passage does not mention that ankle bracelets were used to 'inculcate' good behaviour and we can only infer that it could have been to 'enforce' good behaviour. Therefore, this choice extrapolates the information given in the passage without proper basis, and does not explain the low recidivism rate. Instead, the passage mentions that "better prisoner monitoring after the fact" (i.e., after they are released) can be one of the reasons. Since this option does not talk about prisoner monitoring 'after they are released,' it cannot be inferred from the passage.

Option B: Instead of long terms, Dutch prisoners serve shorter terms, so that they can re-enter the work force and lead productive lives. By providing them an opportunity to contribute to society, they have a chance to escape the "cycle of crime". Further, the passage mentions that "the programs offered to prisoners after they've been let go give them a real leg up on the American System." Hence, this can be inferred from the passage.

Option C: The passage does not mention that the prisoners in the US are not provided basic rights. Hence, this cannot be inferred from the passage.

Option D: The passage does not talk about heroin addiction in the US and this cannot be inferred from the passage.

Hence, the correct answer is option B. Choice (B)

18. According to Frank Weerman, "the decrease in heroin addiction rates through the 1990s might contribute to the low crime rates".

Option A: If heroin addiction has increased since 2004, the crime rate should have increased, according to Weerman. Hence, this statement does not support Weerman's hypothesis.

Option B: If crime rate increased during the 1990s, it will weaken Weerman's hypothesis and hence, this cannot be the correct answer.

Option C: If most of the crime in Netherlands are related to heroin, decrease in heroin addiction will reduce the use of heroin and the crimes associated with its peddling. Hence, this statement will support Weerman's hypothesis.

Option D: This statement neither weakens nor supports Weerman's hypothesis. Hence, this option is also incorrect.

Hence, the correct answer is option C. Choice (C)

Difficulty level wise summary - Section I	
Sub Section: RC	
Level of Difficulty	Questions
Very Easy	-
Easy	-
Medium	1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 14, 15, 16, 18
Difficult	5, 6, 13
Very Difficult	17

SUB-SECTION: VA

Solutions for questions 1 to 3:

1. Choice A is a consequence of the scenario. Choice B is not entirely true. "though it slipped to second place in 2009" in the first paragraph renders the choice incorrect. Choice C is

not an assumption. It has been stated in the first sentence of the second paragraph and it relates to only one aspect of the tourism promotion activity in New Zealand. Only choice D is a valid assumption behind the process of development of tourism activity in New Zealand. Choice (D)

2. Choice A does not weaken the argument. If choice B were true, then it would weaken the argument.

Choice C negates a premise i.e. the last sentence of the given paragraph. Hence it cannot be the answer. Choice D strengthens the argument as it highlights a benefit of caffeine.

3. We are asked to infer the valid course of action and not the primary course of action which means that we do not have to evaluate the courses of action in a hierarchical manner. Whichever course of action can counter the problem discussed in the paragraph would be a valid course of action. Note that "high levels of mercury" have not been defined.

Statement (a) can be inferred to be a valid course of action from the sentence: Consumers can be exposed to mercury and its compounds by exposure to air from production and processing facilities using mercury and its compounds

Statement (b) can be inferred to be a course of action from the sentence: People can also be exposed to mercury from dental work and medical treatments.

Statement (c) is also an appropriate course of action. Workers in the industries that use or produce mercury and its compounds (mercury mines and refineries, chemical manufacturing, dental/ health fields, metal smelters) are at risk of exposure. Workers in fossil fuel power plants and in cement manufacturing may be exposed to mercury compounds if they are exposed to gaseous process emissions. Statement (c) specifically relates to the plight of the industry workers and is a valid step to be taken to protect them from exposure to mercury.

Statement (d) is irrelevant. It is not a course of action.

Choice (C)

Solutions for questions 4 to 6:

4. Parts 1 and 2 are error-free.

Part 3 has an error of tense. The verb 'storm' needs to be mentioned in the past tense as the entire paragraph has been given in the past tense. So 'stormed' needs to be used in place of 'storm'.

In part 4, the adjective form of 'myth' needs to be used. The part should read: Inspired by this near-mythic event

Part 5 has an error of subject-verb agreement. The singular noun *A Brief History of Seven Killings* (novel or book) needs the singular verb 'takes'.

Ans: (12)

5. 'encompass with' in part 1 is incorrect. The part should read: to encompass

The conjunction 'and' needs to be replaced with the conjunction 'or'. The part should read: "..... time-scales cause was natural or anthropogenic".

Part 3 is incorrect as the indefinite article 'a' needs to be used before 'given'. The part should read: Change was considered a given

In part 4, the error is in the article. One needs to say 'the potential', not 'a potential'.

Part 5 is error-free and is the answer.

Ans: (5)

6. Part 1 has an error. 'from' needs to be replaced with 'since'. The part should read: since the year Sputnik was launched,

Part 2 again has an error. The part should read: and before anyone in Palo Alto had heard of Silicon Valley.

Part 3 is error-free.

In part 4, the comparative form of the adjective 'complex' needs to be used. The part should read: and the larger and more complex

Part 5 needs the possessive pronoun "its" in place of "it's". The part should read: it sends data to its earthbound clients.

Ans: (3)

Solutions for questions 7 and 8:

7. The word 'meet' will fit in sentence iv.
 The word 'reach' will fit in sentences i, ii and iii.
 The word 'sight' will fit in sentence i.
 The word 'stretch' fits in sentence v. It cannot be used with 'out' in sentence ii.
 Since the word 'reach' fits in a maximum of three sentences, the correct answer is 3. Ans: (3)

8. The word 'subvert' means to overthrow, destroy, overturn, undermine, render ineffective. It cannot fit in sentence 1 which has the conjunction 'or'. The word 'subvert' does not fit in any of the remaining sentences as well.
 The word 'grave' fits in sentence v.
 The word 'more' fits in sentence iii.
 The word 'further' fits in sentences i, ii, iii and iv.
 Since the word 'further' fits in a maximum of four sentences, the correct answer is 4. Ans: (4)

Solutions for question 9:

9. 'Disperse' means scatter while 'disburse' means to pay out or expend. 'Immerse' means to dip or absorb. 'dissipate' means 'vanish' or 'cause to vanish' or 'drive away'. Hence sentence (i) can be filled by 'disperse' and 'dissipate' (i.e. 2 words)
 For sentence (ii) only 'ascent' will work. 'Ascent' means an upward moment. 'Adjutant' means an assistant. 'Extant' means still in existence; not destroyed, lost, or extinct. 'Assent' means agreement or concurrence. ('Accent' relates to pronunciation). Hence sentence (ii) can be filled by 1 word.

'Imply' means to indicate (indirectly) or suggest usually through linguistic elements. 'Infer' means to derive by reasoning or conclude. In blank (iii), 'imply' would work. 'Mean' would also work because 'mean' refers to 'imply' or 'entail'. 'Indicate' is also correct. In this case, 'infer' would not work. A person infers and the active voice is necessary when using 'infer'. So 3 words can fill the blank in sentence (iii).

In sentence (iv), only 'bitter' will fit the blank. It means marked by resentment or cynicism. 'Pungent' means biting, sharp or caustic. 'Astringent' means sharp and penetrating; pungent or severe. 'Mordant' means sharply caustic or sarcastic; biting; incisive. One can say 'pungent satire', 'pungent talks', 'astringent remarks', 'mordant wit' etc. The abandonment had only turned him against society (bitter) but had not caused him to resort to pejorative talk. So 'mordant', 'pungent' and 'astringent' would not work. Hence 1 word can fill the blank in sentence (iv).

	Blank in sentence (i)		Blank in sentence (ii)		Blank in sentence (iii)		Blank in sentence (iv)
	disburse	✓	ascent	✓	imply		mordant
✓	disperse		adjutant		infer	✓	bitter
	immerse		assent	✓	indicate		astringent
✓	dissipate		extant	✓	mean		pungent

Since sentences (i), (ii), (iii) and (iv) can be filled by 2 words, 1 word, 3 words and 1 word respectively, the correct answer is 2131.

Ans: (2131)

Solutions for questions 10 to 12:

10. On a careful reading of the sentences, it can be understood that sentence 5 is a general sentence that begins the paragraph. It introduces the background of the story: Colombian scientists have discovered Sentence 5 is followed by sentence 1. "These so-called "Lazarus" comets" in sentence 1 link with "some of the interred are coming back to life" in sentence 5. Also "comets may represent a long-lost population of the icy space travelers and may alter scientists' understanding of their origins" in sentence 1 links with "Colombian scientists have discovered a graveyard of comets" in sentence 5. Sentences 1 and 3 form a mandatory pair. "long-lost population of the icy space travelers" in sentence 1 links with "These chunks of ice and rock" in sentence 3. Also "long held human imaginations" in sentence 3 points to "may represent" and "may alter scientists' understanding of their origins" in sentence 1. So, 513. Sentence 3 is followed by sentence 6. "falling stars" in sentence 3 is explained by "signature tail of glowing gas and dust to form behind it" in sentence 6. Sentence 2 is the conclusion of the scientists and it ends the para. So, 51362. Sentence 4 is the odd man out as it refers to "comets" in general and does not relate to the discovery of lazarus comets as discussed in the remaining sentences
 Ans: (51362)

11. On a careful reading of the sentences, it can be observed that sentence 3 is a general sentence that begins the paragraph. It introduces the Terracotta Army to us. Sentence 3 is followed by sentence 5. "Terracotta Army (literally: "Soldier-and-horse **funerary** statues") is a collection of terracotta sculptures" in sentence 3 links with "it is a form of **funerary** art" in sentence 5. The term "emperor" in sentence 5 refers to Qin Shi Huang, the first

Emperor of China, mentioned in sentence 3. Sentence 5 is followed by sentence 2 which tells us when and how the collection of terracotta sculptures was discovered. Sentences 2 and 6 form a mandatory pair. "The figures were discovered in 1974 by local farmers" in sentence 2 links with "Peasants digging a well uncovered an underground vault revealed thousands of terracotta figures" in sentence 6. Also "a whole army which would follow its emperor into immortality" in sentence 6 reiterates "assist the emperor to rule another empire in his afterlife" mentioned earlier in sentence 5. Sentence provides additional details (about two other vaults and the contents in the vaults) and closes the paragraph. So, 35264.

Sentence 1 is an odd man out and can be a part of another paragraph as it needs further substantiation.

Ans: (35264)

12. On a careful reading of the sentences, it can be observed that sentence 4 is a general sentence that begins the paragraph. It introduces the topic of discussion: "soul of wit" which may become "untruth". Sentence 4 is followed by sentence 2. "elegant and memorable" in sentence 2 point to "wit" in sentence 4. Also "brevity can never do justice to all the facts of a complex situation" in sentence 2 points to "the very body of untruth that the soul of wit may become" in sentence 4. Sentence 2 is followed by sentence 6. "On such a theme one can be brief" in sentence 6 refers to the point of view mentioned in sentence 2: brevity can never, in the nature of things, do justice to all the facts of a complex situation. So 426. Sentences 6 and 1 form a mandatory pair. "brief only by omission and simplification" in sentence 6 links with "Omission and simplification help us to understand the wrong thing" in sentence 1. Sentence 1 is followed by sentence 5. "our comprehension only of the abbreviator's neatly formulated notions not vast, ramifying reality" in sentence 5 throws some light on

"**Omission** and **simplification** help us to understand the wrong thing" mentioned in sentence 1. So, 42615. Sentence 3 is the odd sentence out. It runs tangent to the text which deals with brevity. It needs a precedent and more substantiation.

Ans: (42615)

Difficulty level wise summary - Section I	
Sub Section: VA	
Level of Difficulty	Questions
Very Easy	-
Easy	2
Medium	1, 3, 7, 8
Difficult	6
Very Difficult	4, 5, 9, 10, 11, 12

SECTION – II

SUB-SECTION: DI

Solutions for questions 1 to 5:

1. The total time to finish the race must be the lowest for the team that won the race.
 Time taken by Team 1 = $12.5 + 21.5 + 35.4 + 15.6 = 85$ seconds
 Time taken by Team 2 = $15.6 + 25.5 + 30.2 + 16.8 = 88.1$ seconds
 Time taken by Team 3 = $18.5 + 21 + 28.4 + 17.2 = 85.1$ seconds
 Time taken by Team 4 = $16.7 + 23.4 + 29.6 + 15.2 = 84.9$ seconds
 Hence, Team 4 won the race.

Choice (D)

2. Speed of First Sprinter in Team 3 = $\frac{50}{18.5}$
 Speed of Second Sprinter in Team 3 = $\frac{150}{21}$
 Speed of Third Sprinter in Team 3 = $\frac{200}{28.4}$
 Speed of Fourth Sprinter in Team 3 = $\frac{100}{17.2}$

By observation, we can see that the fastest has to be either Second Sprinter or Third Sprinter.

Solutions for questions 6 to 10:

Let $10x$ be the Expense on Rent for each month. In January, the expenses on Utility will be $20x$, since it is twice the expense on Rent. Similarly, we can find the expense for each category for each month in terms of x .

The following table presents this data:

Category	January	February	March	April	May	June
Utility	$20x$	$7.5x$	$23.33x$	$12x$	$15x$	$6.67x$
Rent	$10x$	$10x$	$10x$	$10x$	$10x$	$10x$
Entertainment	$30x$	$7.5x$	$10x$	$6x$	$25x$	$5x$
Groceries	$20x$	$15x$	$16.67x$	$6x$	$35x$	$10x$
Others	$20x$	$10x$	$6.67x$	$6x$	$15x$	$1.67x$

6. The expense on Entertainment was greater as compared to the previous month for March and May. Choice (B)
 7. The total monthly expense of Mr. Sharma will be the lowest for the month in which the percentage of Rent is the highest. Hence, the total monthly expense will be the lowest for June. Choice (D)
 8. The highest percentage increase in Groceries is highest for the month of May.

Average speed of Second Sprinter = 7.14 m/s and average speed of Third Sprinter = 7.04 m/s
 Hence, Second Sprinter has the highest average speed.
 Choice (B)

3. Average speed of Third Sprinter of Team 1 = $\frac{200}{35.4} = 5.65$
 Average speed of Second Sprinter of Team 2 = $\frac{150}{25.5} = 5.88$
 Average speed of Fourth Sprinter of Team 2 = $\frac{100}{16.8} = 5.95$
 Average speed of First Sprinter of Team 4 = $\frac{50}{16.7} = 2.99$
 Hence, the average speed of the Fourth Sprinter of Team 2 is the highest.
 Choice (C)
4. In Leg I, the time taken should be less than $\frac{50}{6} = 8.33$ seconds. No sprinter satisfies this criterion in this leg. Similarly, in leg II, the time taken should be less than 25 seconds. Three sprinter satisfy this condition. In leg III, the time taken should be less than 33.33 seconds. Three sprinters satisfy this condition. In Leg IV, the time taken should be less than 16.67 seconds. Two Sprinters satisfy this condition. Total number of sprinters = $3 + 3 + 2 = 8$

Ans: (8)

5. For Team 1, the fourth sprinter had the baton after $12.5 + 21.5 + 35.4 = 69.4$ seconds.
 For Team 2, it was after $15.6 + 25.5 + 30.2 = 71.3$ seconds.
 For Team 3, it was after $18.5 + 21 + 28.4 = 67.9$ seconds.
 For Team 4, it was after $16.7 + 23.4 + 29.6 = 69.7$ seconds.
 Hence, for three teams, the Fourth Sprinter had the baton before 70 seconds.

Ans: (3)

- Required percentage = $\frac{29x}{6x} = 483.33\%$
 Choice (C)
9. Given $12x = 6000 \Rightarrow x = 500$
 Expense on Groceries in May = $35x = 35 \times 500 = 17500$.
 Ans: (17500)
10. The expense on Utility was the lowest in June.
 Choice (C)

Solutions for questions 11 to 15:

Let $x\%$ be the percentage of units transferred at the end of Day 1.

For Stage V, $1800 \times x\%$ units would have been transferred from Shift IV. $1400 \times x\%$ of units would have been finished.

Therefore, $1400 + 1800 \times x\% - 1400 \times x\% = 1480 \Rightarrow x = 20$
Similarly for Day 2, $1480 + 1760 \times x\% - 1480 \times x\% = 1592 \Rightarrow x = 40$

For Day 3, $1592 + 1728 \times x\% - 1592 \times x\% = 1660 \Rightarrow x = 50$
For Day 4, $1660 + 1752 \times x\% - 1660 \times x\% = 1729 \Rightarrow x = 75$

11. The highest percentage of units transferred were at the end of Day 4. Choice (D)

12. Number of units transferred from Shift I to Shift II at the end of:
Day 1 = $1600 \times 20\% = 320$

$$\text{Day 2} = 1780 \times 40\% = 712$$

$$\text{Day 3} = 1368 \times 50\% = 684$$

$$\text{Day 4} = 884 \times 75\% = 663$$

Hence, the maximum number of units transferred from Stage I to Stage II on any day is 712.
Ans: (712)

13. Number of new units added on Day 2 = $1780 - 1600 \times 80\% = 500$

$$\text{Number of new units added on Day 3} = 1368 - 1780 \times 60\% = 300$$

$$\text{Number of new units added on Day 4} = 884 - 1368 \times 50\% = 200$$

$$\text{Number of new units added on Day 5} = 721 - 884 \times 25\% = 500$$

$$\text{Total number of new units added} = 1500$$

Ans: (1500)

14. The number of units transferred from Shift I to Shift II at the end of Day 4 = $884 \times 0.75 = 663$

The number of units transferred from Shift III to Shift IV at the end of Day 2 = $1680 \times 0.4 = 672$

The number of units transferred from Shift I to Shift II at the end of Day 3 = $1368 \times 0.5 = 684$

The number of units transferred from Shift IV to Shift V at the end of Day 2 = $1760 \times 0.4 = 704$

Hence, option D is the highest. Choice (D)

15. Number of units finished at the end of Day 1 = $1400 \times 0.2 = 280$

Number of units finished at the end of Day 2 = $1480 \times 0.4 = 592$

Number of units finished at the end of Day 3 = $1592 \times 0.5 = 796$

Number of units finished at the end of Day 4 = $1660 \times 0.75 = 1245$

Highest number of units finished on any day = 1245.

Choice (A)

SUB-SECTION: LR

Solutions for questions 1 to 5:

Let the seats around the table be numbered according to the adjacent diagram.

From (i), let Raman be at 1 and Raghav be at 4. Since Raman does not have a red card, he must have a black card. From (iii), Ramesh is sitting to the left of Ram. They can be sitting at 3, 2 or at 5, 6 respectively. If they are sitting at 3, 2, then the person adjacent to Ram will have a black card violating condition (iv). Hence, Ram must be sitting at 5 and Ramesh must be sitting at 6. Both of them have a low card.

From (iv), Raghav (who is adjacent to Ram) must have a high red card.

From (v), Rafi must be at 2 (he cannot be adjacent to Raghav since he has a red card). Rohan must be at 3. Rohan will have a black card. The person sitting opposite Rafi, Ram will have a red card.

Rafi must have a high card which is red (since there are two red high cards) and Ramesh must have a black low card. From (ii), Rohan must have a Black Low card and Raman must have the Black high card. The following table provides the seating arrangement and the cards that they hold:

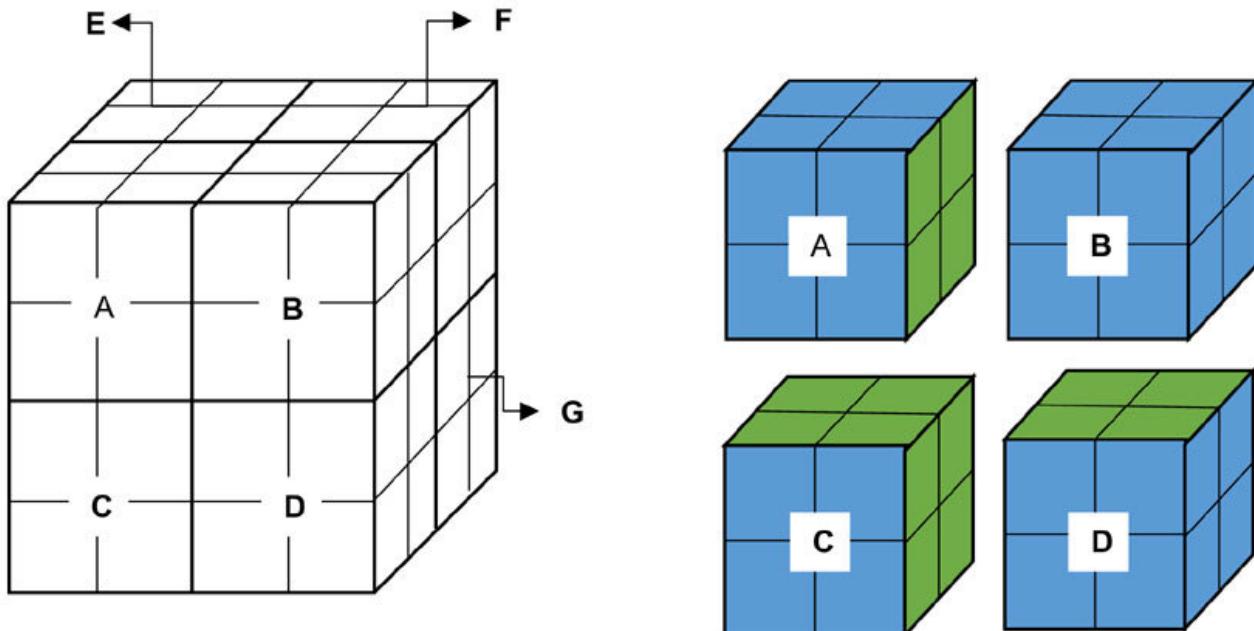
Position	Person	Card
1	Raman	Black High
2	Rafi	Red High
3	Rohan	Black Low
4	Raghav	Red High
5	Ram	Red Low
6	Ramesh	Black Low

1. Rafi has a Red High card. Choice (D)
2. Rohan and Ramesh are sitting opposite each other and have the same type of card. Choice (C)
3. The persons sitting adjacent Rohan (Rafi and Raghav) have the same coloured cards. Choice (D)
4. Raman has a Black High card which no one else has. Choice (B)
5. Ram has a Red Low card. Choice (A)

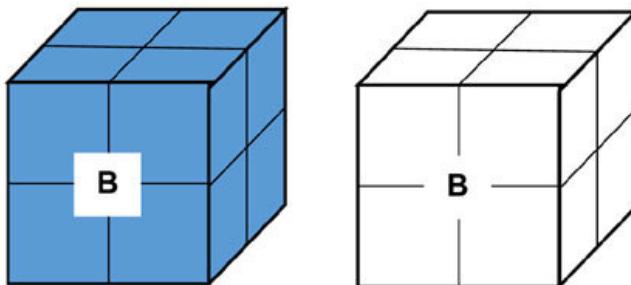
Difficulty level wise summary - Section II	
Sub Section: DI	
Level of Difficulty	Questions
Very Easy	-
Easy	1, 4, 5
Medium	2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
Difficult	-
Very Difficult	-

Solutions for questions 6 to 10:

The cube of side 4 cm is painted blue and cut into 8 cubes of side 2 cm. After this, the unpainted faces will be painted green. The following diagram shows the colours of the faces of the cube of side 4 cm and the faces of 4 cubes of side 2 cm:

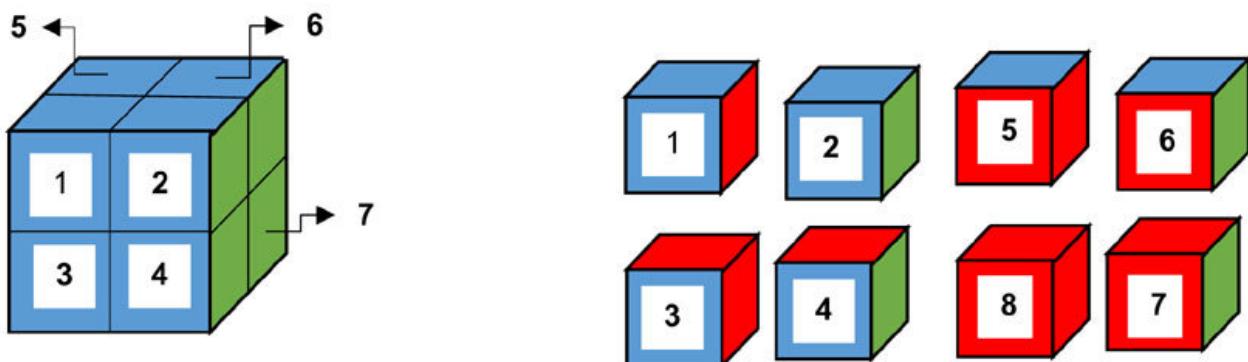


Consider cube B. Before cutting, this cube would have been painted blue on three faces. Three faces would be unpainted. All the three faces would be painted green, after cutting. This is shown in the following diagram:



Further, by observation, we can see that each cube of side 2 cm is similar. This is because, for each cube, there are three faces painted blue (these three faces share a corner) and the other three faces are painted green (these three faces share the diagonally opposite corner). Hence, the unit cubes that is obtained from each cube of side 2 cm will be same for all the cubes of side 2 cm.

Each cube of side 2 cm is further cut into 8 unit cubes and each unpainted face is painted red. The following diagram shows the unit cubes from cube A (from the above diagram):



Consider the unit cube numbered 1. This cube would have been painted blue on three faces, the front face, the top face and the left face. Before cutting this cube, the other three faces would have been unpainted. After cutting, the three unpainted faces would be painted red.

Consider the unit cube numbered 2. This cube would have been painted blue on the front and top faces. It would have been painted green on the right face. The other three faces would be unpainted before it was cut. After cutting, the three faces would be painted red. Similarly, we can deduce the colours of the faces of each cube.

6. By observing the unit cubes from the above diagram, we can observe that cube numbered 1 will have 3 faces painted blue and 3 faces painted red. Cube numbered 7 will have three faces painted green and other three faces painted red. Hence, from each cube of side 2 cm, we obtain two unit cubes which are painted with exactly two different colours. Hence, the total number of cubes that will be painted with exactly two colours will be $2 \times 8 = 16$.
Ans: (16)
7. In the diagram above, we can see that for each unit cube, three faces will be painted red. All the three faces will share a corner. Hence, all the unit cubes will have three faces painted red which will also share a corner. Therefore, the answer will be the total number of unit cubes which is = 64.
Ans: (64)
8. For cube A, we can see that three faces are painted green. Each of these three faces will become four faces when cut into unit cubes. Hence, from cube A, we will get $3 \times 4 = 12$ faces painted green, when cut into unit cubes. Similarly, from each of the other eight cubes of side 2 cm, we will get 12 faces. Hence, the required total is $12 \times 8 = 96$.
Ans: (96)

9. Cube 1 will have no face painted green.
Cube 2 will have 1 face painted green.
Cube 3 will have 1 face painted green (bottom face).
Cube 4 will have 2 faces painted green.
Cube 5 will have 1 face painted green.
Cube 6 will have 2 faces painted green.
Cube 7 will have 3 faces painted green.
Cube 8 will have 2 faces painted green.
Hence, a total of 3 cubes will have exactly two faces painted green from one cube of side 2 cm. From eight such cubes, we get $3 \times 8 = 24$ cubes with two faces painted green.
Ans: (24)

10. For forming a cube of side 2 cm which has all the faces painted green, we need eight unit cubes which have three faces painted green and share a corner. These eight cubes can be rearranged to form one cube of side 2 cm which has all the faces painted green. The total number of cubes which have three faces painted green and share a corner are 8 (one from each cube of side 2 cm). Hence, we can form exactly one cube of side 2 cm which has all the faces painted green.

Choice (B)

Solutions for questions 11 to 15:

Given that Steven had Dates, Figs and Mangoes with him at the end of the second day. Hence, he must have found one of these orchards. He could not have found Mango orchard since Roger found it (from (vi)). If he found Figs orchard, he must have traded with the person who found the Apple orchard (from (ii)). However, this is not possible as he does not have Apples at the end of the second day. Hence, Steve must have found the Dates orchard. From (vi), he must have traded with Roger on the first day. On the second day, he must have traded with the person who found the Figs orchard. The person who found the Figs orchard cannot be John or Kim (from (v)). It also cannot be Graham because Graham traded with the person who found the Grape orchard on the second day. Hence, it can only be either Trevor or Adam. Similarly, the person who found the Apple orchard cannot be John or Kim (they do not have Mangoes \Rightarrow they did not trade with Roger). Also, it cannot be Graham. Hence, it has to be either Adam or Trevor. Therefore, between Adam and Trevor, they must have found the Apple and Fig orchard.

From (i), Graham and Kim did not find the Grape orchard. Hence, they must have found Banana and Kiwi orchard in any order. John must have found the Grape orchard. On the second day, Graham traded with John (from (i)). Hence, on the second day, David must have traded with Kim. On the first day, Kim could not have traded with David or Graham (from (i)). Hence, Kim must have traded with John on the first day and Graham must have traded with David. From (ii), Graham could not have found the Banana orchard. Hence, Graham must have found the Kiwi orchard and Kim must have found the Banana orchard. The following table gives the persons who found each orchard, the persons with whom they traded on each day:

Orchard	Found By	Day 1		Day 2	
		Traded with	Fruits	Traded With	Fruits
Apple	Trevor/Adam	Adam/Trevor	Fig, Apple	Roger	Fig, Apple, Mango
Cherry	David	Graham	Cherry, Kiwi	Kim	Cherry, Kiwi, Banana
Kiwi	Graham	David	Kiwi, Cherry	John	Grape, Kiwi, Cherry
Grape	John	Kim	Grape, Banana	Graham	Kiwi, Grape, Banana
Banana	Kim	John	Banana, Grape	David	Cherry, Banana, Grape
Mango	Roger	Steven	Mango, Date	Adam/Trevor	Mango, Date, Apple
Date	Steven	Roger	Date, Mango	Trevor/Adam	Date, Fig, Mango
Fig	Adam/Trevor	Trevor/Adam	Apple, Fig	Steven	Apple, Fig, Date

11. David traded with Graham on the first day.
Choice (A)
12. John had Bananas with him at the end of the second day.
Choice (C)
13. If Adam traded with Steven, he must have found the Fig orchard. In this case, Trevor will have Figs, Apples and Mangoes with him.
Choice (D)
14. John found the Grape orchard.
Choice (B)
15. David and Adam will not have any fruits in common at the end of the second day (irrespective of whether Adam found the Fig orchard or the Apple orchard).
Choice (C)

Difficulty level wise summary - Section II	
Sub Section: LR	
Level of Difficulty	Questions
Very Easy	-
Easy	1, 2, 3, 4, 5
Medium	6, 8, 9
Difficult	7, 10, 11, 12, 13, 14, 15
Very Difficult	-

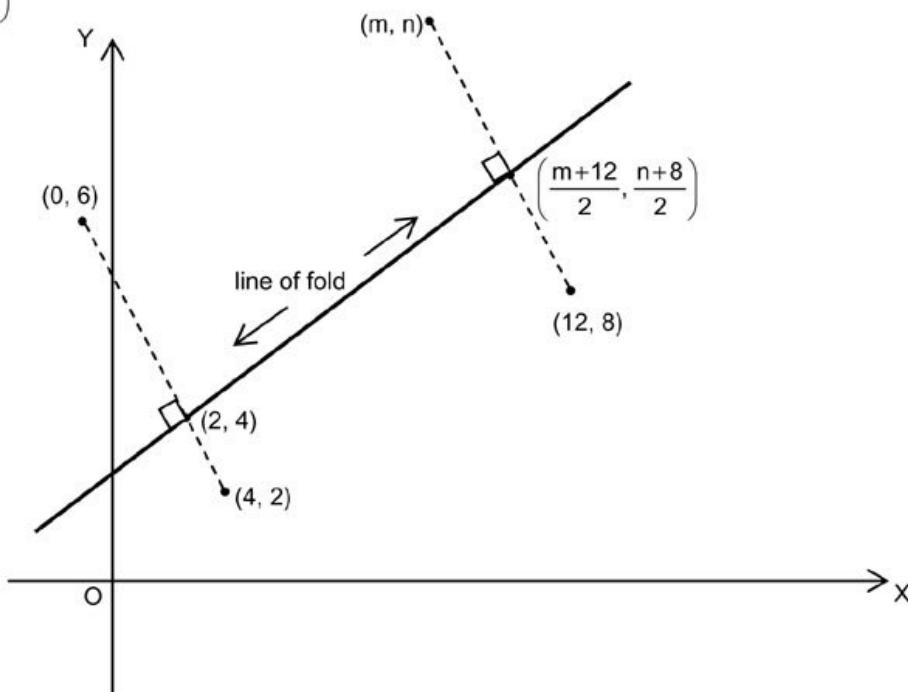
SECTION – III: QA

Solutions for questions 1 to 30:

1. After the graph paper is folded, each point on the paper will coincide with its reflection over the line along which the paper is folded. As the point $(0, 6)$ coincides with $(4, 2)$ and the point $(12, 8)$ coincides with (m, n) , we can conclude that the midpoint of $(0, 6)$ and $(4, 2)$ and that of $(12, 8)$ and (m, n) both lie on the line of the fold, which is perpendicular to the line joining $(0, 6)$ and $(4, 2)$ and also to and the line joining $(12, 8)$ and (m, n) .

The midpoint of the line joining $(0, 6)$ and $(4, 2)$ is $(2, 4)$ and the midpoint of the line joining (m, n) and $(12, 8)$ is

$$\left(\frac{m+12}{2}, \frac{n+8}{2} \right)$$



Now the slope of the line joining $(0, 6)$ and $(4, 2)$ is -1

$$\therefore \text{Slope of the line joining } \left(\frac{m+12}{2}, \frac{n+8}{2} \right) \text{ and } (2, 4) \text{ will be } \frac{\left(\frac{n+8}{2} - 4 \right)}{\left(\frac{m+12}{2} - 2 \right)} = 1 \Rightarrow n - m = 8$$

Ans: (8)

2. Let the amounts with them be denoted by A, B, C, D and E respectively.

It is given that

$$\frac{A}{4} = \frac{3B}{8} = \frac{C}{2} = \frac{3}{4} D = \frac{7}{8} E$$

$$2A = 3B = 4C = 6D = 7E$$

The LCM of 2, 3, 4, 6 and 7 is 84.

$$\therefore 2A = 3B = 4C = 6D = 7E = 84.$$

$$\therefore A = 42, B = 28, C = 21, D = 14 \text{ and } E = 12.$$

$$\therefore A + B + C + D + E = 117. \quad \text{Ans: (117)}$$

3. Let the initial quantities of milk and water be $3x$ and x .

The volume of water added to increase the total volume by

$$50\% \text{ will be } \frac{(3x+x)}{2} = 2x.$$

Now, quantities of milk and water will be $3x$ and $(x + 2x)$, i.e., the ratio $= 3x : 3x$, i.e., $1 : 1$. Hence, any volume of mixture removed will have equal quantities of milk and water. That is, 25 litres of mixture that was removed must have had 12.5 litres each of milk and water.

$$\therefore \text{Ratio of Final quantities after replacing 25 litres with water} = \frac{3x - 12.5}{(3x - 12.5) + 25} = \frac{3x - 12.5}{3x + 12.5} = \frac{1}{3} \text{ (given)}$$

$$\Rightarrow 3x = 25$$

Now initial quantity of mixture was $3x + x = 4x$

$$= \frac{25 \times 4}{3} = 33 \frac{1}{3} \text{ litres.}$$

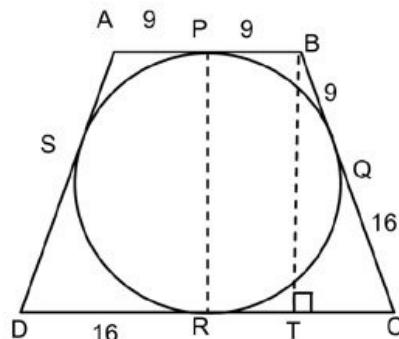
Choice (B)

4. Let ABCD be the trapezium.

Where $AB \parallel CD$ and P and R are the midpoints of AB and CD respectively.

Now, $BP = BQ = 9, CQ = CR = 16$ (tangents from the same point.)

$$\Rightarrow BC = BQ + QC = 25$$



We drop a perpendicular from B to side CD which meets CD at T.

$$\text{Now, } PB = RT = 9$$

$$\Rightarrow TC = CR - RT = 16 - 9 = 7$$

$$\text{In } \triangle BTC, BT = \sqrt{BC^2 - TC^2} = \sqrt{25^2 - 7^2} = 24$$

Since $BT = PR$ = Diameter of the circle.

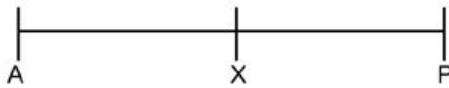
$$\text{The radius of the circle} = \frac{BT}{2} = 12 \text{ cm}$$

Ans: (12)

Therefore the minimum value of the given expression is 4 (and it occurs at $x = 3$ and $y = 2$).

Ans: (4)

11. Let the speeds of the trains starting from Asansol and Patna be v_A and v_P respectively. Let us denote Asansol, Patna and their meeting points by A, P and X respectively. Considering the train starting from Patna take t hours more to reach its destination after crossing the other train



Before meeting

$$AX = v_A \times 4$$

$$PX = v_P \times 4$$

$$(AX)(PX) = v_A v_P \times 16$$

$$\therefore v_A v_P \times 16 = v_A v_P t(t + \frac{88}{60})$$

$$t(t + \frac{88}{60}) = 16$$

$$t^2 + \frac{22}{15}t = 16$$

$$15t^2 + 22t - 240 = 0$$

$$15t^2 + 72t - 50t - 240 = 0$$

$$3t(5t + 24) - 19(5t + 24) = 0$$

$$(3t - 10)(5t + 24) = 0$$

$$\therefore t = 10/3$$

$$\therefore t + \frac{88}{60} = \frac{10}{3} + \frac{22}{15} = \frac{72}{15} = \frac{24}{5} \text{ hrs.}$$

Thus the train reaches Patna $\frac{24}{5}$ hrs after 3 pm.

i.e., at 7:48 pm

Alternative Solution 1:

After the two trains met, the time taken by the train from Asansol to reach Patna = $4 \frac{v_p}{v_a}$ and the time taken by the

train from Patna to reach Asansol = $4 \frac{v_a}{v_p}$

The difference of the above times is given as 88 minutes

$$\text{i.e., } 4 \times 60 \left(\frac{v_p}{v_a} - \frac{v_a}{v_p} \right) = 88.$$

$$\text{Let } \frac{v_p}{v_a} = x.$$

$$\therefore 240 \left(x - \frac{1}{x} \right) = 88,$$

$$\text{i.e., } x - \frac{1}{x} = \frac{11}{30}$$

Now, the above equation will have roots that are reciprocals of each other. Further, neither x nor $\frac{1}{x}$ can be greater than 2 (since the difference of reciprocals would then exceed 1 and we need the difference to be $\frac{11}{30}$).

Also, the LCM of the denominators is 30 (or a multiple of 30)

By trial and error we could look at $\frac{2}{15}, \frac{3}{10}, \frac{5}{6}$, out of which only $\frac{5}{6}$ satisfies the condition that both $\frac{5}{6}$ and $\frac{6}{5}$ are less than 2.

$$\text{Hence, } \frac{6}{5} - \frac{5}{6} = \frac{11}{30} \text{ which satisfies } \Rightarrow \frac{v_p}{v_a} = \frac{6}{5}$$

\therefore The train from Asansol reached Patna at
 $3:00 \text{ pm} + 4 \text{ hrs} \times \frac{6}{5} = 3:00 \text{ pm} + 240 \times \frac{6}{5} \text{ min}$
 $= 3:00 \text{ pm} + 288 \text{ min i.e., } 7:48 \text{ pm.}$

Note: The equation $x - \frac{1}{x} = \frac{11}{30}$ could also be solved in the traditional way as a quadratic, which will yield the equation $30x^2 - 11x - 30 = 0$, i.e., $(5x - 6)(6x + 5) = 0$
 $\Rightarrow x = \frac{6}{5}$.

Alternative Solution 2:

We have the formula $t^2 = t_1 \times t_2$, where t is the time for the two trains to meet, while t_1 and t_2 are the times taken by the two trains to reach their respective destinations after they meet.

This formula can be used along with the options, where $t = 4$ hours (240 minutes) and $t_1 - t_2 = 88$ min (here $t_1 \rightarrow$ train reaching Patna and $t_2 \rightarrow$ train reaching Asansol)

For example, using option (A): $t_1 = 7:20 \text{ pm} - 3:00 \text{ pm} = 260 \text{ min}$
 $\Rightarrow t_2 = t_1 - 88 = 172$.
 $\text{Now } (240)^2 \neq (260) \times (172)$

In this manner, we can check for each option and see that only option (C) satisfies.
Choice (C)

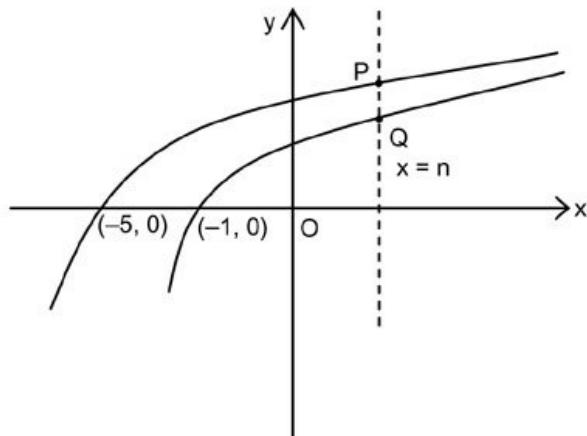
12. If A takes thrice the time as (B + C), then the efficiencies of A and (B + C) will be k and $3k$ (i.e., in the ratio 1 : 3). Hence, combined efficiency of (A + B + C) = $4k$ (i.e., 4 times that of A alone).

If A alone takes 20 days, then (A + B + C) will take $20 \times \frac{1}{4} = 5$ days.
Choice (B)

$$\begin{aligned} 8^{672} \times 25^{1010} &= (2^3)^{672} (5^2)^{1010} \\ &= (2^{2016}) (5^{2020}) \\ &= 5^4 (10^{2016}) \\ &= 625 (10^{2016}) \end{aligned}$$

This gives us 625 followed by 2016 zeroes.
 Therefore, the sum of the digits will be $6 + 2 + 5 = 13$.
Ans: (13)

14. The graph of the curves will look as given below:
 The given distance between points P and Q is simply the difference between the y-coordinates at $x = n$.



It is given that $\log_9(n+6) - \log_9(n+2) = \frac{1}{4}$

$$\Rightarrow \log_9 \frac{(n+6)}{(n+2)} = \frac{1}{4}$$

$$\Rightarrow \frac{n+6}{n+2} = (9)^{\left(\frac{1}{4}\right)}$$

$$\Rightarrow x+6 = \sqrt[4]{(n+2)}$$

$$\Rightarrow (\sqrt[4]{n+2})^4 = 6^4$$

$$\Rightarrow n = 2\sqrt[4]{3}$$

Choice (B)

15. Since the form of the equation given in the question does not lend itself to any standard approach for simplification, we will need to check if it corresponds to any standard result/expression. The first possibility is to check if it can be reduced to the form $(x+y)^3 = k^3$. Since $\sqrt[3]{110592} = 48$ (using calculator), we proceed further.

Hence $x^3 + y^3 + 3xy(x+y) = 48^3$, i.e., $3(x+y) = 144$ (by comparing the coefficient of xy).

\therefore Given equation is simply $(x+y)^3 = 48^3$, i.e., $x+y = 48$.

Hence (x, y) can be $(0, 48), (1, 47), (2, 46), \dots, (48, 0)$.

\therefore 49 ordered pairs (x, y) are possible.

Alternative Solution:

$$x^3 + y^3 + 144xy = 48^3 [\because 11052 = 48^3]$$

$$\Rightarrow x^3 + y^3 - 48^3 + 144xy = 0$$

$$\Rightarrow x^3 + y^3 + (48)^3 - 3(x)(y)(-48) = 0$$

$$\text{now, } a^3 + b^3 + c^3 - 3abc = (a+b+c)(a^2 + b^2 + c^2 - ab - bc - ac)$$

$$\therefore x^3 + y^3 + (-48)^3 - 3(x)(y)(-48) = (x+y - 48)$$

$$\left[\frac{1}{2}((x-y)^2 + (x+48)^2 + (y+48)^2) \right]$$

$$\therefore (x+y-48) \left[\frac{1}{2}((x-y)^2 + (x+48)^2 + (y+48)^2) \right] = 0$$

$$\Rightarrow (x+y-48) = 0 \text{ or } x = y = -48$$

As x, y are non negative integers $x = y = -48$ is not possible
 $x+y-48 = 0$ will give us 49 solutions

$$\begin{array}{ccccccc} x & 0 & 1 & 2 & \dots & 47 & 48 \\ y & 48 & 47 & 46 & \dots & 0 & 0 \end{array}$$

Therefore, the number of ordered pairs (x, y) is 49.

Ans: (49)

16. Here, the transaction between A and B does not effect the required answer.

The required discount percentage will simply be

$$100 \times \left(1 - \frac{120}{140}\right)\% = 14\frac{2}{7}\%$$

Choice (B)

17. Let us denote the number of persons standing in front of the four counters by a, b, c and d respectively.

Now $a + b + c + d = 5$ where $a, b, c, d \geq 0$.

[Since there are a total of five persons standing in front of the four counters].

The total number of non-negative integral solutions to the above equation is $5 + 4 - 1_{C_4-1} = 8_{C_3} = 56$

Again, the five persons can be arranged among themselves in $5!$ ways.

Therefore the total number of ways = $56 \times 5! = 6720$ ways.

Alternative solution:

The first person can stand in front of any of the four counters i.e in 4 ways

Now, wherever the first person stands, the second person has five places (options) available and so he can stand in 5 ways.

Counter 1	Counter 2	Counter 3	Counter 4
✓	✓	✓	✓
1 st person			
✓			

[We are denoting the number of positions available to the second person by the tick marks]

So, the first two persons can stand in (4) (5) ways.

Similarly, the third person can (always, i.e., irrespective of where the 2nd person stood) stand in 6 ways.

Counter 1	Counter 2	Counter 3	Counter 4
✓	✓	✓	✓
1 st	2 nd		
✓	✓		

OR

Counter 1	Counter 2	Counter 3	Counter 4
✓	✓	✓	✓
1 st			
✓			
2 nd			
✓			

Proceeding similarly, the fourth person can stand in 7 ways and the fifth in 5 ways.

Therefore the total number of ways = (4) (5) (6) (7) (8) = 6720 ways.

Ans: (6720)

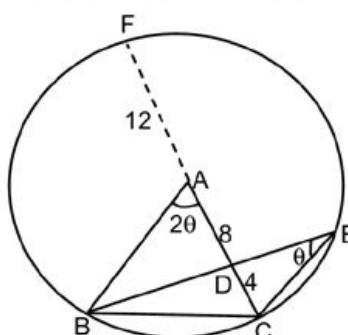
18. Choice (A): The graph of e^{-x} (with or without the modulus sign) will lie only above the x-axis. Hence, this is eliminated.

Choice (B): $\log(-x)$ should become zero at $x = -1$. By observation, both Choices (B) and (D) are also eliminated.

Choice (C): This graph is possible, which is simply the graph of e^{-x} reflected in the y-axis.

Choice (C)

19. As $\angle CEB = \frac{1}{2} \angle CAB$, we can consider AB and AC as radii of a circle as shown in the figure below:



We produce CA such that it meets the circle at F.

Now $(FD)(DC) = (BD)(DE)$

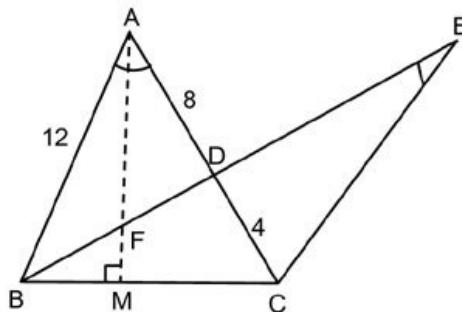
Where, $FD = FA + AD = AC + AD = 20$

$[\because FA = AC = \text{Radius of the circle}]$

$\therefore (20)(4) = (8)(DE)$

$\Rightarrow DE = 10$

Alternative Solution:



Dropping a perpendicular (AM) from A to BC, let it intersect BD at F. In $\triangle ABD$, $AB = (8 + 4) = 12$ and $AD = 8$. Hence the angular bisector of $\angle A$ will divide BD in the ratio of the sides AB and AD.

Hence, $BF : FD = AB : AD = 3 : 2$

$$\Rightarrow FD = \frac{BD \times 2}{3+2} = 8 \times \frac{2}{5} = 3.2$$

Now, $\triangle ADF \cong \triangle EDC$

Hence, taking ratio of corresponding sides, $\frac{DE}{DC} = \frac{AD}{FD}$

$$\Rightarrow DE = DC \times \frac{AD}{FD} = 4 \times \frac{8}{3.2} = 10\text{cm}$$

Ans: (10)

20. Let the initial amount be A.

$$\text{The amount after 8 years} = Ae^{\frac{8r}{100}} = Ae^{\frac{8 \times 12.5}{100}} = Ae^{2.71828P}$$

Increase in amount = $1.71828A$

Percentage increase in amount = 171.82%

Choice (B)

21. Let the number and divisor be N and d respectively

$$N = dq_1 + 8 \text{ and } N^2 = dq_2 + 6$$

$$N^2 = d^2q_1^2 + 16dq_1 + 64$$

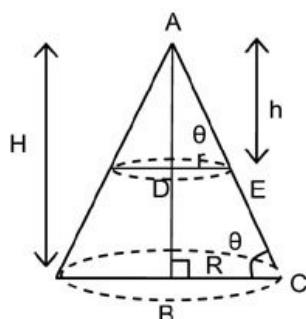
Clearly, the first two terms ($d^2q_1^2$, and $16dq_1$) are both divisible by d. Hence, 64 when divisible by d should leave a remainder of 6, i.e., $dq_3 + 6 = 64$

$$\Rightarrow dq_3 = 64 - 6 = 58.$$

$\therefore d$ must be a factor of 58 and must also be greater than 8. Thus d can assume only two distinct values 29 and 58.

Choice (B)

- 22.



Let the radius and height of the original cone be R and H respectively and that of the smaller cone be r and h respectively.

Now $\triangle ADE \approx \triangle ABC$

$$\frac{r}{R} = \frac{h}{H}$$

$$\Rightarrow h = \frac{r}{R}H$$

$$\text{Volume of the original cone } V = \frac{1}{3}\pi R^2 H$$

$$\text{Volume of the smaller cone} = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi r^2 \frac{r}{R} H$$

$$= \frac{1}{3}\pi \frac{r^3 H}{R}$$

$$= \frac{1}{3}\pi \frac{R^2 H}{R^3}$$

$$= \frac{r^3}{R^3} V$$

$$= \left(\frac{r}{R}\right)^3 V$$

$$\text{It is given that, } r = \frac{4}{5}R \Rightarrow \frac{r}{R} = \frac{4}{5}$$

Volume of the smaller cone

$$= \left(\frac{4}{5}\right)^3 \text{ volume of the original cone}$$

$$= \frac{64}{125} \text{ volume of the original cone}$$

$$\therefore \text{Percentage reduction in volume} = \frac{61}{125} \times 100\%$$

$$= 48.8\%$$

Alternative Solution:

The radius of the smaller cone will be $(100 - 20)\%$ of that of the larger cone.

Since the smaller cone is similar in shape to the larger cone, the volume of smaller cone will simply be

$$\left(\frac{80}{100}\right)^3 \left(i.e., \left(\frac{8}{10}\right)^3\right) \text{ times that of the larger cone i.e.,}$$

$$\left(\frac{512}{1000}\right) \text{ times that of the larger cone.}$$

Therefore the fraction (percentage) of reduction

$$= \left(\frac{488}{1000}\right) \times 100 = 48.8\%. \quad \text{Choice (D)}$$

23. Total volume of metal used in the copper wire

$$= \pi(r)^2 \ell \text{ where } r = \left(\frac{1.5}{2}\right) = 0.75 \text{ and } \ell = 8000 \text{ cm}$$

$$\text{Volume of the spherical ball} = \frac{4}{3}\pi R^3 \text{ cu.cm.}$$

As, the ball is obtained by melting the wire, their volumes will be equal

$$\therefore \frac{4}{3}\pi R^3 = \pi \left(\frac{3}{4}\right)^2 8000$$

$$\Rightarrow R^3 = \frac{3^3}{4^3} \times 8000 = \left(\frac{3}{4} \times 20\right)^3$$

$$\therefore R = \left(\frac{3}{4} \times 20\right) = 15 \text{ cm}$$

Choice (A)

24. $1 + 2 + 3 + \dots + N = \frac{N(N+1)}{2}$

We see that, $\frac{N(N+1)}{2}$ is close to 2000.

$$\frac{N(N+1)}{2} \approx 2000$$

$$N(N+1) \approx 4000$$

$$N^2 + N \approx 4000$$

A perfect square less than or equal to 4000 is $62^2 = 3844$.

$$\text{If } N = 62, \frac{N(N+1)}{2} = 1953$$

Say Bulu added the number denoted by K twice.

$$\therefore \text{His sum} = \frac{N(N+1)}{2} + K = 2000.$$

For N = 62, we get K = 47.

Ans: (47)

25. By Wilson's theorem

$$R\left[\frac{30!}{31}\right] = -1 \quad \dots (1)$$

$$\Rightarrow R\left[\frac{29! \times 30}{31}\right] = -1$$

$$\Rightarrow R\left[\frac{29!}{31}\right] \times R\left[\frac{30}{31}\right] = -1$$

$$\Rightarrow R\left[\frac{29!}{31}\right] \times -1 = -1 \quad (\text{from (1)})$$

$$\Rightarrow R\left[\frac{29!}{31}\right] = 1$$

$\therefore 29!$ When divisible by 31 will leave a remainder of 1

Ans: (1)

26. We observe that, $f(-1) = 1 - 3 + 3 - 3 + 2 = 0$

And $f(-2) = 16 - 24 + 12 - 6 + 2 = 0$

$\therefore (x+1)$ and $(x+2)$ are factors of $f(x)$

$$\therefore x^4 + 3x^3 + 3x^2 + 3x + 2 = (x+1)(x+2)(x^2 + 1)$$

$(x^2 + 1) = 0$ gives imaginary values for n. Thus $f(x)$ has exactly 2 real roots.

Choice (B)

27. Since $0 < x < \frac{1}{2}$, let $x = \frac{1}{4}$.

From the options, we get

$$(A) x^{-2} = \frac{1}{x^2} = \frac{1}{\left(\frac{1}{4}\right)^2} = 16$$

$$(B) x^{-\frac{3}{2}} = \frac{1}{x^{\frac{3}{2}}} = \frac{1}{\left(\frac{1}{4}\right)^{\frac{3}{2}}} = 4^{\frac{3}{2}} = 8$$

$$(C) \frac{1}{\sqrt{x}} = \frac{1}{\sqrt{\frac{1}{4}}} = \pm 2 \quad (\text{assuming positive root as per convention})$$

$$(D) \left(\frac{1}{x^{-2}}\right)^{-3} (x^2)^{-3} = x^{-6} = \frac{1}{x^6} = \frac{1}{\left(\frac{1}{4}\right)^6} = 4096$$

Therefore, choice (D) gives the greatest value.

Alternative Solution:

$$\text{Let } y = \frac{1}{x}, \text{ where } y > 2$$

Considering the options, we are required to compare

$y^3, y^2, y^{\frac{1}{2}}$ and y^6 . Since $y > 2$, clearly y^6 will be the greatest.

Choice (D)

$$28. 5^{(\log_{25} 961)} = 5^{\left(\frac{1}{2} \log_5 961\right)} = 5^{\left(\log_5 961^{\frac{1}{2}}\right)}$$

$$= 5^{(\log_5 31)} = 31$$

$$7^{(\log_7 \sqrt{29})} = 7^{(\log_7 29)} = 7^{(\log_7 29^2)}$$

$$= 29^2 = 841$$

$$\therefore 13^{(\log_x 872)} = 31 + 841 = 872$$

$$\therefore x = 13$$

Choice (D)

29. Let the radius of the semicircle be x .

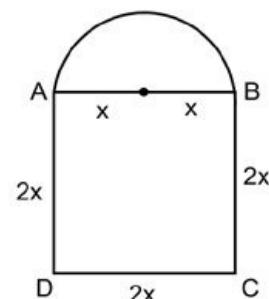
\therefore Side of the square = $2x$

$$\text{Perimeter of the window} = 6x + \frac{22}{7}x$$

$$= \frac{64}{7}x$$

$$\text{Now } \frac{64}{7}x = 16$$

$$\therefore x = \frac{7}{4}$$



$$\therefore \text{Area of the window} = 2x^2 + \frac{22}{7} \left(\frac{x^2}{2}\right)$$

$$= 4 \times \left(\frac{7}{4}\right)^2 + \frac{22}{7} \times \frac{1}{2} \left(\frac{7}{4}\right)^2$$

$$= \frac{49}{4} + \frac{77}{16}$$

$$= 17 \text{ sq.ft}$$

Choice (A)

30. The cube of the surd $a + \sqrt{b}$ is $a^3 + 3ab + \sqrt{b}(3a^2 + b)$

$$\text{It is given that } a^3 + 3ab + \sqrt{b}(3a^2 + b) = 45 + 29\sqrt{2}$$

Equating the rational and irrational parts, we get

$$a^3 + 3ab = 45 \text{ and } \sqrt{b}(3a^2 + b) = 29\sqrt{2}$$

Taking $b = 2$, we get

$$\sqrt{2}(3a^2 + 2) = 29\sqrt{2}$$

$$\Rightarrow a = \pm 3$$

But, only for $a = 3$ and $b = 2$, we get $a^3 + 3ab = 45$.

Therefore the cube root of $45 + 29\sqrt{2}$ is $3 + \sqrt{2}$

$$\Rightarrow 2a^3 + 3b^2 = (2 \times 27) + (3 \times 4)$$

$$= 54 + 12 = 66$$

Ans: (66)

Difficulty level wise summary - Section III: QA

Level of Difficulty	Questions
Very Easy	16, 27
Easy	7, 12, 13, 18, 23, 28, 29
Medium	1, 2, 3, 4, 5, 8, 9, 10, 14, 20, 21, 22, 24, 30
Difficult	6, 11, 26
Very Difficult	15, 17, 19, 25