Q.1) As per the last sentence of the first paragraph, the lie is that wasteful consumers are blamed for the plastic pollution. Thus option 1 is correct. Hence, [1].

Q.2) Option 1 is true as per the second sentence of the third paragraph. Negate it. Options 3 and 4 are true according to the last two sentences of the same paragraph. Negate them. However, nothing has been mentioned about air pollution in the passage. Thus option 2 is not mentioned as one of the negative effects of plastic use. Hence, [2].

Q.3) As per the penultimate sentence of the penultimate paragraph, Keep America Beautiful conveniently diverted the attention from the role of corporates in plastic pollution to that of consumer behaviour. Hence, [2].

Q.4) As per the second sentence of the last paragraph, litterbugs are not responsible for the problem of plastic pollution. Also, the last sentence of the second paragraph states that instead of asking individuals to recycle, the production of single-use plastic should be stopped. Thus option 4 which suggests passing regulations to stop producing plastic will be most strongly supported by the author. Hence, [4].

Q.5) As per the second paragraph, the focus of reducing plastic pollution is focused on changing consumer behaviour instead of targeting the plastic producers who produce plastic on a large scale. Option 1 is incorrect as nothing has been mentioned about using technology to solve the ill-effects of plastic pollution. Negate it. Encouraging responsible production of plastic by firms is mentioned as a useful step in the last paragraph. Hence, option 2 can’t be compared to the above phrase and can thus be negated. Option 3 correctly gives the meaning of phrase ‘what hammering a nail is to halting a falling sky-scraper’. Retain it. Like option 2, option 4 also states a relevant step that can be taken against plastic pollution, and hence, do not justify the phrase, which describes a ‘pointless measure’. Therefore, option 4 is incorrect and can be negated. Hence, [3].

Q.6) As per the last sentence of the first paragraph, India’s contribution to the Second World War has been airbrushed (which means ‘removed or altered’) out of existence while building the National War Memorial. Thus only option 2 correctly states why the author is lamenting. Hence, [2].

Q.7) As per the last sentence of the second paragraph, after partition, both the nations wanted to focus on building a new perspective instead of being viewed as colonial powers. Thus option 1 which talks about forgetting the toll of the war on the country is incorrect. Option 2 is correct as per the last sentence of the second paragraph. Retain it. Nothing has been mentioned about how Indians view the Second World War except in the second paragraph. So option 3 can also be negated. Option 4 is not implied in the passage at all. Hence, [2].

Q.8) ‘Mood music’ actually means the general set of attitudes and aims that are characteristic of a political party and the way that it would like to be thought of. As per the second sentence of the second paragraph, the Second World War is only seen as something that happened during India’s freedom struggle and subsequent independence. Thus option 2 correctly explains the use of ‘mood music’ in the second paragraph. Hence, [2].
Q.9) As per the second sentence of the second paragraph, the Second World War has not been acknowledged as academic history and popular memory as an important event in India’s history. Thus only option 2 is correct. Hence, [2].

Q.10) Option 1 is mentioned in the last sentence of the fourth paragraph. Option 2 is correct as per the sixth paragraph. Option 3 is true as per the first sentence of the second paragraph. However, as per the fifth paragraph, India was one of the largest creditors of Britain after the Second World War. Thus option 4 wrongly states that India owed a large financial debt to Britain. Hence, [4].

Q.11) As per the first sentence of the second paragraph, modern evolutionary biology is a synthesis of Charles Darwin’s mechanism of natural selection and Gregor Mendel’s discoveries of how genes are inherited. However, the focus of the passage is on how Darwin’s theory is unable to completely explain evolution. Thus, only option 1 is true. Hence, [1].

Q.12) As per the last sentence of the third paragraph, the tugs represent the influence of developmental factors like epigenetics, antibodies and hormones passed on by the parents as well as ecological legacies and culture. Hence, [1].

Q.13) As per the passage, ecological impact has an effect on human adaptation. Thus option 1 can be negated. The passage mostly talks about the high impact of epigenetic inheritance on evolution. Thus option 2 is also incorrect. As per the last sentence of the second paragraph, only natural selection does not influence evolution. Since we have to choose an answer that negates the main message of the passage, retain option 3. Socio-cultural markers are only part of the evolutionary process and not the only influence. Thus option 4 is also incorrect and can be negated. Hence, [3].

Q.14) As per the first paragraph, researchers at the Emory University were shocked to find the inheritance of acquired fears in the children and the grandchildren of the mice involved in the experiment. However, this pointed to a broader category, which includes all acquired characteristics, for instance, acquired skills. Hence, [1].

Q.15) The main aim in writing the passage is to demonstrate how the destruction of the elephant society has led to unpredictable asocial behaviour and hyper-aggression in elephants. Though the first sentence of the third sentence clearly states that humans are social animals, it is not the main aim of the passage. Negate option 1. Only the first sentence of the passage states the changing relationship between humans and elephants. The rest of the passage talks about how elephant behaviour has changed due to the loss of elephant herds. Thus option 2 can also be negated. Option 3 correctly expresses the overall argument of the passage. Retain it. Option 4 is incorrect as only the last statement compares the brain organisation and early development of humans and elephants. Hence, [3].

Q.16) The last sentence of the first paragraph clearly states that there is an intentionality associated with the elephant attacks on humans. Thus only option 2 correctly describes how the term ‘violence’ has been used by Bradshaw to describe the change in human-elephant relationship. Hence, [2].

Q.17) As per the second sentence of the fourth paragraph, because of the social upheaval in the elephant social structure, calves are now being taken care of by younger and inexperienced mothers. Thus option 1 is incorrect. Retain it. Option 2 is correct as per the first sentence of the last paragraph.
Negate it. Option 3 is true as per the second sentence of the third paragraph and can be negated. Option 4 is true as per the last sentence of the fourth paragraph and can also be negated. Hence, [1].

Q.18) As per the last sentence of the penultimate paragraph, the behaviour of elephants, especially orphans who have watched the death of their parents, is similar to the post-traumatic stress disorder exhibited by humans. So if you use similar treatment programmes for treating post-traumatic stress disorder that we use for humans, it might solve the problem of elephant aggression. Thus option 1 can be retained. As per the first sentence of the second paragraph, researchers have already studied the effect of high levels of testosterone and elephant aggression. Thus option 2 which states more funds to be made available for the study of the impact of testosterone and elephant aggression in incorrect and can be negated. The penultimate paragraph mentions how there is compelling evidence of the impact of isolating young elephants on early brain development, behaviour and aggression. Thus option 3 which states the same thing can also be negated. Since the passage talks only about elephants, option 4 which talks about researching the similarity of humans and other animals is beyond the scope of the passage and can be negated. Hence, [1].

Q.19) As per the fourth paragraph, humans have been responsible for changing the structure of the elephant society either due to poaching or translocating elephants to different habitats. Thus it is not an exaggeration by Bradshaw. Negate option 1. Option 2 is not an accurate description as elephants are still being reared by younger and inexperienced mothers. Thus it can be negated. The passage is stating the effects of humans on the social life of the elephants. Left to their devices, elephants are still social creatures and are still being nurtures by their mothers. Thus there has been no drastic change in the elephant social structure. However, it is due to human intervention that elephants are unable to maintain their social order. Thus option 3 is incorrect. Option 4 correctly states the uses of the phrase ‘the fabric of elephant society has been effectively frayed’. Hence, [4].

Q.20) According to the paragraph, wearable technology is being used to collect more and more data which about specific individuals. Thus option 1 strengthens the author’s views and can be negated. Option 2 talks about not collecting data and thus weakens the author’s argument. Options 3 and 4 also state the use of data by organisations of individuals that is in line with the passage. Thus, they can be negated. Hence, [2].

Q.21) Dubai has pledged to become the happiest city in the world. However, the paragraph does not mention that it is already on its way to achieve this target. Thus option 1 can be negated. There is no connection of Facebook and Dubai mentioned in the passage. Negate option 2. Option 3 is stated in the first sentence of the fourth paragraph. Retain it. Option 4 is beyond the scope of the passage and can be negated. Hence, [3].

Q.22) As per the last sentence of the penultimate paragraph, earlier, happiness indicators were used to reform society instead of obsessing with money. However, nowadays, happiness is used to transform or discipline individuals. Also, the second sentence of the first paragraph clearly states that happiness is used to shape global economies. Thus only option 3 correctly mentions the use of wearable technology and social media. Hence, [3].

Q.23) As per the second sentence of the last paragraph, since the 1970s, depression is being regarded as a defect in an individual and a result of circumstances due to which the individual felt responsible for his / her feelings. This is what is stated in option 3. Hence, [2].
Q.24) As per the first sentence, economists earlier were unconcerned about psychology while now they want psychology to be used to maximise profits. Thus option 1 can be inferred from the passage. Retain it. Though happiness and GDP are compared in the penultimate paragraph, it is not mentioned to be the work of economists. Thus option 2 can be negated. The fourth paragraph talks about Facebook using our emotions to target the influence of advertising. However, it is not the work of economists but companies. Thus option 3 is also incorrect. This paragraph is targeting only happiness and not emotions in general. Thus option 4 which talks about understanding human behaviour is too general and can be negated. Hence, [1].

Q.25) The main points of the paragraph are – artificial embryo twinning is a low-tech way to make clones which is similar to the natural process that creates twins. Option 1 is incorrect as it states that twins are formed during fertilization in the natural development. However, as per the paragraph, twins are formed during the first few days of fertilization in twinning. Thus it can be negated. Option 2 fails to mention anything about fertilization. Thus, option 2 is also incorrect. Option 3 implies that the natural development of identical twins is high-tech as compared to twinning which is low-tech. This is not mentioned in the paragraph and so option 3 can be negated. Option 4 correctly captures the essence of the paragraph. Hence, [4].

Q.26) The paragraph is about time inconsistency and its effects on immunization. Thus statement 1 should start the paragraph as it talks about time inconsistency in general. This should be followed by statement 3 as it mentions time inconsistency in the specific case of immunization. Statement 3 talks about how time inconsistency by itself is insufficient to permanently postpone immunization. Thus it should be followed by statement 2 which states how it is possible to postpone immunization by fooling themselves. This is then followed by statement 5 as it talks about how people fool themselves. Thus the correct order is 1-3-2-5. However, statement 4 talks about the cost of immunization which is a different to the topic being discussed in the paragraph – that of time inconsistency. Hence, [4].

Q.27) Option 1 is incorrect as it states the production of scientific knowledge and not knowledge in general. Option 2 is incorrect as the fourth and fifth sentences of the passage talks about the limitation of the professions-approach. Thus the professions-approach cannot be the most relied upon perspective. Negate option 2. Option 3 correctly captures all the main points of the paragraph. Retain it. Option 4 is beyond the scope of the paragraph. Hence, [3].

Q.28) Statement 1 is the first sentence of the paragraph as it mentions ‘impartiality’ and ‘objectivity’ which are then discussed in the paragraph by giving the example of Twitter. Thus it should be followed by statement 3. Since statement 3 states that tweets we are likely to care about will show first, it encourages us to limit ourselves to people we know or like while we are unable to know anything about different perspective. Thus statement 2 follows statement 3. Statement 4 is the last sentence of the paragraph as it states how citizens are unable to analyse the impartiality or the objectivity of the algorithm used by Twitter. Thus, the correct order is 1324.

Q.29) The main aim of the paragraph is discuss the displacement in Bengal. Statement 3 is the first sentence of the paragraph as it talks about the nature of displacement in Bengal being an interesting case study. This should be followed by statement 2 as it states one of the factors leading to the displacement in Bengal i.e. the erosion of the river banks of the Ganges. This leads us to statement 4 which mentions how displacement due to erosion remains invisible as it takes place slowly. Statement 1
is a better end to the paragraph as it mentions how due to the slow rate of displacement, Bengal’s displacement loses its significance. However, statement 5 talks about rapid displacement which is not discussed in the paragraph. Hence, [5].

Q.30) Statement 1 is the first sentence of the paragraph followed by statement 4 as the former talks about the woodland’s canopy while the latter mentions how insects can be found in the sunshine above this canopy. Statement 4 also mentions that these insects are eaten by swifts and swallows. Thus statement 3 follows statement 4 as it mentions why insects are a staple diet of swifts. Statement 2 is the last sentence in the paragraph as it mentions that the hunting grounds of the swifts are not restricted to the woodlands but anywhere that insects are found. Thus, the correct order is 1432.

Q.31) Statement 4 is the only statement which mentions the name of Cathy Perkins. Thus it is the first sentence of the paragraph. This should be followed by statement 2 as states that she did not know what the lump on her index finger indicated. Statement 1 follows after this as it mentions the diagnosis of the lump and that the treatment was successful. Statement 3 is the last statement since it states that the cancer had returned and even spread to her lungs. Thus, the correct order is 4213.

Q.32) Since all the sentences are talking about the comparison between translators and bumblebees, statement 1 should be the first sentence of the paragraph as it states the main point of the paragraph. There is a 5-3 link as 5 talks about the aerodynamic impossibility of the bumblebees. The phrase ‘similar pronouncements about the impossibility of translations’ refer to the same aerodynamic impossibility referred to in statement 5. This should be followed by statement 4 as it states that irrespective of the pronouncements being made, both bumblebees and translators have carried on with their respective work. Thus the correct order is 1-5-3-4. Though statement 2 appears to be connected to the paragraph, it cannot fit into the order of the statements to make a meaningful paragraph. Hence, [2].

Q.33) Only statement 2 can start the paragraph as it talks about democracy and high levels of inequality. Thus statement 4 which talks about very rich people follows statement 2. There is a clear 1-3 link as statement 1 talks about the other group of people i.e. the unwitting enablers while statement 3 states how these unwitting enablers believe that the rich will work for a better world when in fact they ensure that the same system continues. Thus, the correct order is 2413.

Q.34) Option 1 correctly captures the author’s position as stated in the last two sentence of the paragraph. Retain it. Option 2 is only partly correct as it does not mention when landscapes became an independent genre or who initiated it. Option 3 is incorrect as the Renaissance artists only facilitated an understanding of the structure of landscape. Landscapes became an independent subject only in the sixteenth-seventeenth century. Thus it can be negated. Option 4 is incorrect as the last sentence of the paragraph only states that landscape became an independent subject of art at the turn of the sixteenth century. However, it does not imply that it became a major subject of art. Thus option 4 can also be negated. Hence, [1].
Q.1)

From (5), the number of pumps where high contamination levels were recorded is even.
From (1) and (2), high contamination levels recorded at 3 petrol pumps among P1 - P6 i.e., P1, P3 and P5 recorded high levels of contamination.
Therefore, using (4) it can be concluded that high contamination levels could have been recorded at pumps P7 – P15. From (3), the maximum number of pumps where the high contamination levels were recorded must be 5. So this number could be 1, 3 or 5 among P7 – P15.
So, we have the following cases.

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<tbody>
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<td>i</td>
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<td>ii</td>
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<tr>
<td>iii</td>
<td>8</td>
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</tr>
</tbody>
</table>

From (3), the number of pumps with the same levels of contamination cannot be more than 11. For 11 pumps with same levels of contamination, P1 and P20 should have the same level of contamination, which is not the case as P1 recorded high levels of contamination while P20 recorded either low or medium levels of contamination. Thus, cases (i) and (ii) are not valid.
Considering case iii we have the following cases:
<table>
<thead>
<tr>
<th>Levels of contamination</th>
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</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>P1, P3, P5, P7, P8, P10, P13, P15</td>
</tr>
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</tbody>
</table>

Refer case 1 given in the last table.
Refer case 6 given in the last table.

It can be seen that the contamination level at P10 was recorded as high in each case. Hence, [2].
Q.2)

From (5), the number of pumps where high contamination levels were recorded is even.
From (1) and (2), high contamination levels recorded at 3 petrol pumps among P1 - P6 i.e., P1, P3 and P5 recorded high levels of contamination.
Therefore, using (4) it can be concluded that high contamination levels could have been recorded at pumps P7 – P15. From (3), the maximum number of pumps where the high contamination levels were recorded must be 5. So this number could be 1, 3 or 5 among P7 – P15.
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From (3), the number of pumps with the same levels of contamination cannot be more than 11. For 11 pumps with same levels of contamination, P1 and P20 should have the same level of contamination, which is not the case as P1 recorded high levels of contamination while P20 recorded either low or medium levels of contamination. Thus, cases (i) and (ii) are not valid.
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At exactly 8 petrol pumps, the contamination levels were recorded as medium. Hence, [1].
From (5), the number of pumps where high contamination levels were recorded is even.

From (1) and (2), high contamination levels recorded at 3 petrol pumps among P1 - P6 i.e., P1, P3 and P5 recorded high levels of contamination.

Therefore, using (4) it can be concluded that high contamination levels could have been recorded at pumps P7 – P15. From (3), the maximum number of pumps where the high contamination levels were recorded must be 5. So this number could be 1, 3 or 5 among P7 – P15.

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From (3), the number of pumps with the same levels of contamination cannot be more than 11. For 11 pumps with same levels of contamination, P1 and P20 should have the same level of contamination, which is not the case as P1 recorded high levels of contamination while P20 recorded either low or medium levels of contamination. Thus, cases (i) and (ii) are not valid.

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</table>

If the contamination level at P11 was recorded as low, then case 1 is the only valid case. Statement of option [2] is the only true statement. Hence, [2].
Q.4)

From (5), the number of pumps where high contamination levels were recorded is even.

From (1) and (2), high contamination levels recorded at 3 petrol pumps among P1 - P6 i.e., P1, P3 and P5 recorded high levels of contamination.

Therefore, using (4) it can be concluded that high contamination levels could have been recorded at pumps P7 – P15. From (3), the maximum number of pumps where the high contamination levels were recorded must be 5. So this number could be 1, 3 or 5 among P7 – P15.

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From (3), the number of pumps with the same levels of contamination cannot be more than 11. For 11 pumps with same levels of contamination, P1 and P20 should have the same level of contamination, which is not the case as P1 recorded high levels of contamination while P20 recorded either low or medium levels of contamination. Thus, cases (i) and (ii) are not valid.

Considering case iii we have the following cases:

<table>
<thead>
<tr>
<th>Levels of contamination</th>
<th>Pumps</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 High</td>
<td>P1, P3, P5, P7, P8, P10, P13, P15</td>
</tr>
<tr>
<td>1 Medium</td>
<td>P2, P4, P9, P12, P14, P16, P18, P20</td>
</tr>
<tr>
<td>1 Low</td>
<td>P6, P11, P17, P19</td>
</tr>
<tr>
<td>2 High</td>
<td>P1, P3, P5, P7, P8, P10, P12, P15</td>
</tr>
<tr>
<td>2 Medium</td>
<td>P2, P4, P9, P11, P14, P16, P18, P20</td>
</tr>
<tr>
<td>2 Low</td>
<td>P6, P13, P17, P19</td>
</tr>
<tr>
<td>3 High</td>
<td>P1, P3, P5, P7, P8, P10, P13, P15</td>
</tr>
<tr>
<td>3 Medium</td>
<td>P2, P4, P9, P11, P14, P16, P18, P20</td>
</tr>
<tr>
<td>3 Low</td>
<td>P6, P12, P17, P19</td>
</tr>
<tr>
<td>4 High</td>
<td>P1, P3, P5, P7, P8, P10, P12, P15</td>
</tr>
<tr>
<td>4 Medium</td>
<td>P2, P4, P9, P11, P13, P16, P18, P20</td>
</tr>
<tr>
<td>4 Low</td>
<td>P6, P14, P17, P19</td>
</tr>
<tr>
<td>5 High</td>
<td>P1, P3, P5, P7, P8, P10, P12, P14</td>
</tr>
<tr>
<td>5 Medium</td>
<td>P2, P4, P9, P11, P13, P16, P18, P20</td>
</tr>
<tr>
<td>5 Low</td>
<td>P6, P15, P17, P19</td>
</tr>
<tr>
<td>6 High</td>
<td>P1, P3, P5, P7, P8, P10, P12, P14</td>
</tr>
<tr>
<td>6 Medium</td>
<td>P2, P4, P9, P11, P13, P15, P17, P19</td>
</tr>
<tr>
<td>6 Low</td>
<td>P6, P16, P18, P20</td>
</tr>
</tbody>
</table>

Contamination level at P15 was recorded as medium. Case 6 is the only valid case.

[1] Contamination levels at P13 and P17 were recorded as medium.

[2] Contamination levels at P10 and P14 were recorded as high.
Q.5)
Preference was given to Rs. 500 notes.
The ATM machine can dispense 10 notes of Rs. 500.
(i) $500 \times 10 = Rs. 5000$
If the ATM machine dispenses 9 notes of Rs. 500;
(ii) $500 \times 9 = 4500$, $200 \times 2 = 400$ and $100 \times 1 = 100$
(Notes of Rs. 500 denomination = 9 and notes of Rs. 200 and Rs. 100 denominations = $2 + 1 = 3$, $9 > 3$)
(iii) $500 \times 9 = 4500$, $200 \times 1 = 200$ and $100 \times 3 = 300$
(Notes of Rs. 500 denomination = 9 and notes of Rs. 200 and Rs. 100 denominations = $1 + 3 = 4$, $9 > 4$)
(iv) $500 \times 9 = 4500$, $100 \times 5 = 500$
(Notes of Rs. 500 denomination = 9 and notes of Rs. 200 and Rs. 100 denominations = $0 + 5 = 5$, $9 > 5$)
If the ATM machine dispenses 8 notes of Rs. 500;
(v) $500 \times 8 = 4000$ and $200 \times 5 = 1000$
(Notes of Rs. 500 denomination = 8 and notes of Rs. 200 and Rs. 100 denominations = $5 + 0 = 5$, $8 > 5$)
(vi) $500 \times 8 = 4000$, $200 \times 4 = 800$ and $100 \times 2 = 200$
(Notes of Rs. 500 denomination = 8 and notes of Rs. 200 and Rs. 100 denominations = $4 + 2 = 6$, $8 > 6$)
(vii) $500 \times 8 = 4000$, $200 \times 3 = 600$ and $100 \times 4 = 400$
(Notes of Rs. 500 denomination = 8 and notes of Rs. 200 and Rs. 100 denominations = $3 + 4 = 7$, $8 > 7$)
If numbers of notes of denomination Rs. 200 are reduced further, number of notes of the customer’s preferred denomination will not exceed the total number of notes of other denominations.
The ATM machine can dispense 7 notes of Rs. 500, for the minimum number of total notes of the remaining two denominations; one can have 7 notes of Rs. 200 and one note of Rs. 100. But even then, number of notes of the customer’s preferred denomination will be less than the total number of notes of other denominations. As number of notes of denominations reduces, number of notes of the denomination Rs. 500 will be less than the total number of notes of other denominations.
Thus, there are 7 different ways in which the ATM can serve a customer who gives 500 rupee notes as her preference.
Therefore, the required answer is 7.

Q.6)
As seen in the previous explanation, if a customer’s preferred denomination is Rs. 500, the minimum number of notes of Rs. 500 the ATM machine dispenses is 8. Hence, with fifty 500 rupee notes, the ATM machine can serve 6 customers who could have given 500 rupee notes as their preferences.

Therefore, the required answer is 6.
Q.7)

Here we just need to keep in mind that

- the customers are to be served with at most 20 notes per withdrawal.
- The ATM machine has stock of fifty 500 rupee notes and a sufficient number of notes of other denominations.

(i) If the ATM machine dispenses one 500 rupee note, for the total number of notes less than or equal to 20, notes of 200 rupee denominations has to be maximum.

\[ 500 \times 1 + 200 \times 22 + 100 \times 1 = 5000 \]

i.e., the minimum number of notes = 24

(ii) If the ATM machine dispenses two 500 rupee notes, for the total number of notes less than or equal to 20, notes of 200 rupee denominations has to be maximum.

\[ 500 \times 2 + 200 \times 20 = 5000 \]

i.e., the minimum number of notes = 22

(iii) If the ATM machine dispenses three 500 rupee notes, for the total number of notes less than or equal to 20, notes of 200 rupee denominations has to be maximum.

\[ 500 \times 3 + 200 \times 17 + 100 \times 1 = 5000 \]

i.e., the minimum number of notes = 21

(iv) If the ATM machine dispenses four 500 rupee notes, for the total minimum number of notes, notes of 200 rupee denominations has to be maximum.

\[ 500 \times 4 + 200 \times 15 = 5000 \]

i.e., the minimum number of notes = 19

Therefore, if the ATM dispenses 4 notes of 500 rupees then it can serve a maximum of 12 customers with 50 notes. Hence, [2].

Q.8)

In order to have the total number of notes to be dispensed is the smallest possible, notes of denomination Rs. 500 has to be maximum.

The ATM machine could have dispensed 10 notes of 500 rupee to the customers who gave 500 rupee notes as their preference.

Therefore, the number of 500 rupee notes required to serve these 50 customers = 10 \times 50 = 500

The ATM machine could have dispensed 10 notes of 100 rupee and 8 notes of 500 rupee to the customers who gave 100 rupee notes as their preference.

Therefore, the number of 500 rupee notes required to serve these 50 customers = 8 \times 50 = 400

Total number of 500 rupee notes required = 500 + 400 = 900

Hence, [1].
Q.9)

70% of 20 = 14
Qualified candidate score 14 or more marks in two or more sections.
Composite scores of few students:
Chetna: $2(19) + 4 + 12 = 54$
Ester: $2(12) + 18 + 16 = 58$
Falak: $2(15) + 7 + 10 = 47$
From (6), Jatin scored 20 marks in DI. Therefore, his Composite score is $2(20) + 16 + 14 = 70$
Therefore, Indu’s Composite score = 60
If Indu scored 20 marks in DI, her score in GA = $60 - 2(20) - 8 = 12$.
In this case, Indu scored less than 70% in WE and GA. But from (4) Indu was recruited. Therefore, this case is not valid. This means she must have scored 100% marks in GA i.e., 20 marks in GA.

$\therefore$ Indu’s marks (out of 20) in DI $= \frac{60 - 8 - 20}{2} = \frac{32}{2} = 16$
From (5), Danish and Harini also scored 20 marks in GA.
Therefore, his Composite score = $2(8) + 15 + 20 = 51$
From (2), Ajay must have scored more than 18 marks. Assuming his score in WE as 19, composite score would be $2(8) + 19 + 16 = 51$. This cannot be true as Danish’s composite score was 51. Thus, Ajay’s score in WE = 20 and his composite score $2(8) + 20 + 16 = 52$.
Bala, Chetna and Falak scored less than 70% marks in at least two sections and hence were disqualified.
From (4), Geeta had the lowest score. Maximum composite score of Harini $= 2(5) + 20 + 20 = 50$
Ajay(52), Danish(51), Ester(58), Indu(60) and Jatin(70) are definitely qualified.
So, Ester(58), Indu(60) and Jatin(70) were top three scorers. Geeta must have scored more than 52 marks. Therefore marks scored by her in WE $\geq 53 - 2(14) - 6$ i.e., marks scored by her in WE $\geq 19$
If she had scored 20 marks in WE, her composite marks would be $2(14) + 20 + 6 = 54$
But Chetna’s composite score = 54. So, Geeta’s marks in WE = 19 and her composite score = 53
Thus we have

<table>
<thead>
<tr>
<th>Candidate</th>
<th>DI</th>
<th>WE</th>
<th>GA</th>
<th>Composite Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ajay</td>
<td>8</td>
<td>20</td>
<td>16</td>
<td>52</td>
</tr>
<tr>
<td>Bala</td>
<td>d</td>
<td>9</td>
<td>11</td>
<td>(2d + 20)</td>
</tr>
<tr>
<td>Chetna</td>
<td>19</td>
<td>4</td>
<td>12</td>
<td>54</td>
</tr>
<tr>
<td>Danish</td>
<td>8</td>
<td>15</td>
<td>20</td>
<td>51</td>
</tr>
<tr>
<td>Ester</td>
<td>12</td>
<td>18</td>
<td>16</td>
<td>58</td>
</tr>
<tr>
<td>Falak</td>
<td>15</td>
<td>7</td>
<td>10</td>
<td>47</td>
</tr>
<tr>
<td>Geeta</td>
<td>14</td>
<td>19</td>
<td>6</td>
<td>53</td>
</tr>
<tr>
<td>Harini</td>
<td>5</td>
<td>a</td>
<td>20</td>
<td>(30 + a)</td>
</tr>
<tr>
<td>Indu</td>
<td>16</td>
<td>8</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Jatin</td>
<td>20</td>
<td>16</td>
<td>14</td>
<td>70</td>
</tr>
</tbody>
</table>

‘a’ denotes marks of Harini in WE while ‘d’ denote marks of Bala in DI.
Jatin’s composite score = 70 and Danish’s composite score = 51
Thus, statement 1 is true.
Indu’s score in DI = 16 and Chetna’s score in DI = 19
Thus, statement 2 is true.
Jatin’s score in GA = 14 and Indu’s score in GA = 20
Thus, statement 3 is false.
Hence, [1].

Q.10)

70% of 20 = 14
Qualified candidate score 14 or more marks in two or more sections.
Composite scores of few students:
Chetna: 2(19) + 4 + 12 = 54
Ester: 2(12) + 18 + 16 = 58
Falak: 2(15) + 7 + 10 = 47

From (6), Jatin scored 20 marks in DI. Therefore, his Composite score is 2(20) + 16 + 14 = 70
Therefore, Indu’s Composite score = 60
If Indu scored 20 marks in DI, her score in GA = 60 – 2(20) – 8 = 12.
In this case, Indu scored less than 70% in WE and GA. But from (4) Indu was recruited. Therefore, this case is not valid. This means she must have scored 100% marks in GA i.e., 20 marks in GA.

\[ \text{Indu’s marks (out of 20) in DI} = \frac{60 - 8 - 20}{2} = \frac{32}{2} = 16 \]

From (5), Danish and Harini also scored 20 marks in GA.
Therefore, his Composite score = 2(8) + 15 + 20 = 51
From (2), Ajay must have scored more than 18 marks. Assuming his score in WE as 19, composite score would be 2(8) + 19 + 16 = 51. This cannot be true as Danish’s composite score was 51. Thus, Ajay’s score in WE = 20 and his composite score 2(8) + 20 + 16 = 52.
Bala, Chetna and Falak scored less than 70% marks in at least two sections and hence were disqualified.
From (4), Geeta had the lowest score. Maximum composite score of Harini = 2(5) + 20 + 20 = 50
Ajay(52), Danish(51), Ester(58), Indu(60) and Jatin(70) are definitely qualified.
So, Ester(58), Indu(60) and Jatin(70) were top three scorers. Geeta must have scored more than 52 marks. Therefore marks scored by her in WE \( \geq 53 - 2(14) - 6 \) i.e., marks scored by her in WE \( \geq 19 \)
If she had scored 20 marks in WE, her composite marks would be 2(14) + 20 + 6 = 54
But Chetna’s composite score = 54. So, Geeta’s marks in WE = 19 and her composite score =53
Thus we have

<table>
<thead>
<tr>
<th>Candidate</th>
<th>Marks out of 20</th>
<th>Composite Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DI</td>
<td>WE</td>
</tr>
<tr>
<td>Ajay</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Bala</td>
<td>d</td>
<td>9</td>
</tr>
<tr>
<td>Chetna</td>
<td>19</td>
<td>4</td>
</tr>
<tr>
<td>Danish</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Ester</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Falak</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>Geeta</td>
<td>14</td>
<td>19</td>
</tr>
<tr>
<td>Harini</td>
<td>5</td>
<td>a</td>
</tr>
<tr>
<td>Indu</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>Jatin</td>
<td>20</td>
<td>16</td>
</tr>
</tbody>
</table>

‘a’ denotes marks of Harini in WE while ‘d’ denote marks of Bala in DI.
Harini’s composite score = (30 + a) and Falak’s composite score = 47
Thus, statement 1 is may not be true for values of ‘a’ more than or equal to 17.
In DI, if Bala’s score is 19 or 20, his composite score would be 58 (or 60). But, no two candidates had the
same composite scores. Therefore, Bala’s score must be less than or equal to 18 and hence his composite score must be less than or equal to 56.
Therefore, Chetna scored more than Bala in DI and Bala’s composite score was less than that of Ester.
Thus, statements 2 and 3 are true.
If Bala scores same as Jatin in DI, Bala’s composite score would be 60. This is not valid.
Hence, statement 4 must be false.
Hence, [4].

70% of 20 = 14
Qualified candidate score 14 or more marks in two or more sections.
Composite scores of few students:
Chetna: 2(19) + 4 + 12 = 54
Ester: 2(12) + 18 + 16 = 58
Falak: 2(15) + 7 + 10 = 47
From (6), Jatin scored 20 marks in DI. Therefore, his Composite score is 2(20) + 16 + 14 = 70
Therefore, Indu’s Composite score = 60
If Indu scored 20 marks in DI, her score in GA = 60 – 2(20) – 8 = 12.
In this case, Indu scored less than 70% in WE and GA. But from (4) Indu was recruited. Therefore, this
case is not valid. This means she must have scored 100% marks in GA i.e., 20 marks in GA.

\[ \therefore \text{Indu’s marks (out of 20) in DI} = \frac{60 - 8 - 20}{2} = \frac{32}{2} = 16 \]

From (5), Danish and Harini also scored 20 marks in GA.
Therefore, his Composite score = $2(8) + 15 + 20 = 51$

From (2), Ajay must have scored more than 18 marks. Assuming his score in WE as 19, composite score would be $2(8) + 19 + 16 = 51$. This cannot be true as Danish’s composite score was 51. Thus, Ajay’s score in WE = 20 and his composite score $2(8) + 20 + 16 = 52$.

Bala, Chetna and Falak scored less than 70% marks in at least two sections and hence were disqualified.

From (4), Geeta had the lowest score. Maximum composite score of Harini = $2(5) + 20 + 20 = 50$

Ajay(52), Danish(51), Ester(58), Indu(60) and Jatin(70) are definitely qualified.

So, Ester(58), Indu(60) and Jatin(70) were top three scorers. Geeta must have scored more than 52 marks. Therefore marks scored by her in WE $\geq 53 - 2(14) - 6$ i.e., marks scored by her in WE $\geq 19$

If she had scored 20 marks in WE, her composite marks would be $2(14) + 20 + 6 = 54$

But Chetna’s composite score = 54. So, Geeta’s marks in WE = 19 and her composite score = 53

Thus we have

<table>
<thead>
<tr>
<th>Candidate</th>
<th>Marks out of 20</th>
<th>Composite Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DI</td>
<td>WE</td>
</tr>
<tr>
<td>Ajay</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Bala</td>
<td>d</td>
<td>9</td>
</tr>
<tr>
<td>Chetna</td>
<td>19</td>
<td>4</td>
</tr>
<tr>
<td>Danish</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Ester</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Falak</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>Geeta</td>
<td>14</td>
<td>19</td>
</tr>
<tr>
<td>Harini</td>
<td>5</td>
<td>a</td>
</tr>
<tr>
<td>Indu</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>Jatin</td>
<td>20</td>
<td>16</td>
</tr>
</tbody>
</table>

‘a’ denotes marks of Harini in WE while ‘d’ denote marks of Bala in DI.

$2d + 20 < 54 = d < 17$

$d \neq 14, 15, 16, 12, 8$ and 5

d can take value 13 or 11 or 9 or 7 or 6 or 4 or 3 or 2 or 1.

For $d = 13$, the composite score = 46

Thus, Bala could have scored 13 marks in DI.

Therefore, the required answer is 13.
Q.12)

70% of 20 = 14
Qualified candidate score 14 or more marks in two or more sections.

Composite scores of few students:
Chetna: 2(19) + 4 + 12 = 54
Ester: 2(12) + 18 + 16 = 58
Falak: 2(15) + 7 + 10 = 47
From (6), Jatin scored 20 marks in DI. Therefore, his Composite score is 2(20) + 16 + 14 = 70
Therefore, Indu’s Composite score = 60

If Indu scored 20 marks in DI, her score in GA = 60 – 2(20) – 8 = 12.
In this case, Indu scored less than 70% in WE and GA. But from (4) Indu was recruited. Therefore, this case is not valid. This means she must have scored 100% marks in GA i.e., 20 marks in GA.

· Indu’s marks (out of 20) in DI = \( \frac{60 - 8 - 20}{2} = \frac{32}{2} = 16 \)

From (5), Danish and Harini also scored 20 marks in GA.
Therefore, his Composite score = 2(8) + 15 + 20 = 51
From (2), Ajay must have scored more than 18 marks. Assuming his score in WE as 19, composite score would be 2(8) + 19 + 16 = 51. This cannot be true as Danish’s composite score was 51. Thus, Ajay’s score in WE = 20 and his composite score 2(8) + 20 + 16 = 52.
Bala, Chetna and Falak scored less than 70% marks in at least two sections and hence were disqualified.

From (4), Geeta had the lowest score. Maximum composite score of Harini = 2(5) + 20 + 20 = 50
Ajay(52), Danish(51), Ester(58), Indu(60) and Jatin(70) are definitely qualified.

So, Ester(58), Indu(60) and Jatin(70) were top three scorers. Geeta must have scored more than 52 marks. Therefore marks scored by her in WE ≥ 53 – 2(14) – 6 i.e., marks scored by her in WE ≥ 19
If she had scored 20 marks in WE, her composite marks would be 2(14) + 20 + 6 = 54
But Chetna’s composite score = 54. So, Geeta’s marks in WE = 19 and her composite score = 53
Thus we have
Q.13)

The sales figures during April, May and June of 2016 form an arithmetic progression. Assuming ‘d’ as common difference, \(40 + (40 + d) + (40 + 2d) = 150\) \(\Rightarrow d = 10\)
Therefore, sales in May was 50 and that in June was 60.

The sales figures during October, November and December of 2016 form an arithmetic progression. Assuming ‘f’ as common difference, \(100 + (100 + f) + (100 + 2f) = 360\) \(\Rightarrow f = 20\)
Therefore, sales in November was 120 and that in December was 140.
Let sales in August 2017 and December 2017 be ‘a’ and ‘b’.
\[\therefore 60 + a + 70 = 220 \text{ and } 150 + 170 + b = 500\]
\[\therefore a = 90 \text{ and } b = 180\]
The values for quarter-wise aggregate sales can be found by simply adding sales values of the corresponding months and for values of for annual sales we need to add either values for all quarter-wise sales of that year or values for all the months of that year.
Thus, we have
Sales in December 2017 = 180 and Sales in December 2016 = 140

\[
\therefore \text{the required percentage} = \frac{180 - 140}{140} \times 100 = 28.57
\]

Hence, [1].

Q.14)

The sales figures during April, May and June of 2016 form an arithmetic progression. Assuming ‘d’ as common difference, \(40 + (40 + d) + (40 + 2d) = 150 \Rightarrow d = 10\)

Therefore, sales in May was 50 and that in June was 60.

The sales figures during October, November and December of 2016 form an arithmetic progression. Assuming ‘f’ as common difference, \(100 + (100 + f) + (100 + 2f) = 360 \Rightarrow f = 20\)

Therefore, sales in November was 120 and that in December was 140.
Let sales in August 2017 and December 2017 be ‘a’ and ‘b’.
\[ \therefore 60 + a + 70 = 220 \text{ and } 150 + 170 + b = 500 \]
\[ \therefore a = 90 \text{ and } b = 180 \]

The values for quarter-wise aggregate sales can be found by simply adding sales values of the corresponding months and for values of for annual sales we need to add either values for all quarter-wise sales of that year or values for all the months of that year.

Thus, we have

<table>
<thead>
<tr>
<th>Year 2016</th>
<th>Year 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month</td>
<td>Monthly sales</td>
</tr>
<tr>
<td>January</td>
<td>80</td>
</tr>
<tr>
<td>February</td>
<td>60</td>
</tr>
<tr>
<td>March</td>
<td>100</td>
</tr>
<tr>
<td>April</td>
<td>40</td>
</tr>
<tr>
<td>May</td>
<td>50</td>
</tr>
<tr>
<td>June</td>
<td>60</td>
</tr>
<tr>
<td>July</td>
<td>75</td>
</tr>
<tr>
<td>August</td>
<td>120</td>
</tr>
<tr>
<td>September</td>
<td>55</td>
</tr>
<tr>
<td>October</td>
<td>100</td>
</tr>
<tr>
<td>November</td>
<td>120</td>
</tr>
<tr>
<td>December</td>
<td>140</td>
</tr>
</tbody>
</table>

It is sufficient to compare ratio

Q1: \( \frac{380}{240} \), Q2: \( \frac{260}{150} \), Q3: \( \frac{225}{225} \) and Q4: \( \frac{500}{350} \)

It can be checked that the value of the ratio of the first quarter is higher. Hence, [1].

Q.15)

The sales figures during April, May and June of 2016 form an arithmetic progression. Assuming ‘d’ as common difference, \[ 40 + (40 + d) + (40 + 2d) = 150 \Rightarrow d = 10 \]
Therefore, sales in May was 50 and that in June was 60.

The sales figures during October, November and December of 2016 form an arithmetic progression. Assuming ‘f’ as common difference, \[ 100 + (100 + f) + (100 + 2f) = 360 \Rightarrow f = 20 \]
Therefore, sales in November was 120 and that in December was 140.

Let sales in August 2017 and December 2017 be ‘a’ and ‘b’.
\[ \therefore 60 + a + 70 = 220 \text{ and } 150 + 170 + b = 500 \]
\[ \therefore a = 90 \text{ and } b = 180 \]

The values for quarter-wise aggregate sales can be found by simply adding sales values of the corresponding months and for values of for annual sales we need to add either values for all quarter-wise sales of that year or values for all the months of that year.
Thus, we have

<table>
<thead>
<tr>
<th>Month</th>
<th>Monthly sales</th>
<th>Quarterly sales</th>
<th>Annual sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>80</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>40</td>
<td>150</td>
<td>975</td>
</tr>
<tr>
<td>May</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>75</td>
<td></td>
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</tr>
<tr>
<td>August</td>
<td>120</td>
<td>225</td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>100</td>
<td>360</td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>140</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2017</th>
<th>Monthly sales</th>
<th>Quarterly sales</th>
<th>Annual sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>120</td>
<td></td>
<td>380</td>
</tr>
<tr>
<td>February</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>160</td>
<td></td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>60</td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>May</td>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>65</td>
<td></td>
<td>1300</td>
</tr>
<tr>
<td>July</td>
<td>60</td>
<td></td>
<td>220</td>
</tr>
<tr>
<td>August</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>70</td>
<td></td>
<td>500</td>
</tr>
<tr>
<td>October</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>170</td>
<td></td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>180</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sales increases in case of options [3] and [4].

Percentage decrease in Q2 of 2016 = \( \frac{90}{240} \times 100 \)

Percentage decrease in Q2 of 2017 = \( \frac{180}{360} \times 100 = \frac{90}{190} \times 100 \)

Clearly, Percentage decrease in Q2 of 2016 < Percentage decrease in Q2 of 2017
Hence, [2].
Q.16)

The sales figures during April, May and June of 2016 form an arithmetic progression. Assuming ‘d’ as common difference, $40 + (40 + d) + (40 + 2d) = 150 \Rightarrow d = 10$

Therefore, sales in May was 50 and that in June was 60.

The sales figures during October, November and December of 2016 form an arithmetic progression. Assuming ‘f’ as common difference, $100 + (100 + f) + (100 + 2f) = 360 \Rightarrow f = 20$

Therefore, sales in November was 120 and that in December was 140.

Let sales in August 2017 and December 2017 be ‘a’ and ‘b’.

$\therefore 60 + a + 70 = 220$ and $150 + 170 + b = 500$

$\therefore a = 90$ and $b = 180$

The values for quarter-wise aggregate sales can be found by simply adding sales values of the corresponding months and for values of for annual sales we need to add either values for all quarter-wise sales of that year or values for all the months of that year.

Thus, we have

<table>
<thead>
<tr>
<th>Month</th>
<th>Monthly sales</th>
<th>Quarter-wise sales</th>
<th>Annual sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>80</td>
<td>240</td>
<td>975</td>
</tr>
<tr>
<td>February</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>40</td>
<td>150</td>
<td></td>
</tr>
<tr>
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<td>50</td>
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<td></td>
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<tr>
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<td></td>
</tr>
<tr>
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<td></td>
</tr>
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<td>170</td>
<td></td>
<td>500</td>
</tr>
<tr>
<td>December</td>
<td>180</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ratios of sales of a month to sales of previous month for the given options are as below.

$\frac{100}{55} > \frac{100}{60} > \frac{100}{70}$

$\frac{100}{55} > \frac{150}{70}$ and $\frac{150}{70} > \frac{160}{100}$

Among $\frac{100}{55}$ and $\frac{150}{70}$ is greater.

Hence, [4].
Q.17) From (1), the institute Z has two female students. From (5), Adriana and Daisy are not the female students from the institute Z. Thus, Bandita and Chitra are the students from the institute Z. Hence, [3].

Q.18) From (2), Y has two male and one female student. Hence, from (1), X has two male and one female student. From (2), female student from Y majors in Operations. Daisy minors in Operations. So Daisy (and also Amit) is not from Y. Therefore, from (5), Adriana and Deb are from the same institute and that has to be institute Y. From (2), both male students from Y minor in Finance. Hence, Deb minor in Finance. Hence, [3].

Q.19) From (2), Y has two male and one female student. Hence, from (1), X has two male and one female student. From (2), both male students from Y minor in Finance and female student from Y majors in Operations. Daisy minors in Operations. So Daisy (and also Amit) is not from Y. Therefore, Amit and Daisy are from institute X. From (4), one female students and two male students major in Finance. We know that a subject in which a student majors is difference from a subject in which he/she minors. Hence, the two male students those majors in Finance must be from institute X. So, Amit major in Finance. Hence, [1].

Q.20) From (2), Y has two male and one female student. Hence, from (1), X has two male and one female student. From (2), female student from Y majors in Operations. Daisy minors in Operations. So Daisy (and also Amit) is not from Y. From (6), X: Amit, Chetan and Daisy Y: Barun, Deb and Adriana Z: Bandita and Chitra From (3) and (7), Daisy minors in Operations and remaining three girls minors in Marketing. From (4), the one female student majors in Finance is Chitra. Hence, Bandita majors in Operations. Hence, [3].
Q.21)

Let number of satellites exclusively serving B be ‘10x’ and number of satellites serving C be ‘x’.
⇒ number of satellites exclusively serving C = number of satellites exclusively serving S = 3a

As the number of satellites serving C = number of satellites serving S, the number of satellites serving C and B but not S = number of satellites exclusively serving S and B but not C = y (assume).

\[ \begin{array}{c}
\text{B} \\
10x \\
\text{C} \\
3x \\
\hline
\end{array} \]

\[ \begin{array}{c}
y \\
100 \\
\hline
z \\
3x \\
D \\
\hline
\end{array} \]

\[ 10x + 2y + 100 + 6x + 2z = 1600 \Rightarrow 8x + y + z = 750 \quad \text{...(i)} \]

From (1), \[ 10x + 2y + 100 - 6x + 2y + 2z + 200 \]
\[ \Rightarrow z = 2x - 50 \quad \text{...(ii)} \]

Thus, the minimum value that 'x' can takes is 25.

From (i) and (ii), \[ 10x + y = 800 \Rightarrow y = 800 - 10x \]

Thus, the maximum value that 'x' can takes is 80.

The number of satellites serving C = \[ 3x + y + z + 100 = 3x + (800 - 10x) + (2x - 50) + 100 = 850 - 5x \]

As value of 'x' is between 25 and 80, value of (850 - 5x) must be between 450 and 725.

Hence, [2].
Q.22)

Let number of satellites exclusively serving B be ‘10x’ and number of satellites serving O be ‘z’.

\[ 10x + 2y + 100 + 6x + 2z = 1600 \Rightarrow 8x + y + z = 750 \]  ...(i)

From (1), \[ 10x + 2y + 100 = 6x + 2y + 2z + 200 \]
\[ \therefore z = 2x - 50 \]  ...(ii)

Thus, the minimum value that ‘x’ can take is 25.

From (i) and (ii), \[ 10x + y = 800 \Rightarrow y = 800 - 10x \]

Thus, the maximum value that ‘x’ can take is 80.

The number of satellites serving B exclusively = 10x.

As minimum value of ‘x’ is 25, minimum value of 10x is 250.

Hence, [1].

Q.23)

Let number of satellites exclusively serving B be ‘10x’ and number of satellites serving O be ‘z’.

\[ 10x + 2y + 100 + 6x + 2z = 1600 \Rightarrow 8x + y + z = 750 \]  ...(i)

From (1), \[ 10x + 2y + 100 = 6x + 2y + 2z + 200 \]
Q.24)

Let number of satellites exclusively serving B be ‘10x’ and number of satellites serving O be ‘z’.

\[
\therefore \text{number of satellites exclusively serving C} = \text{number of satellites exclusively serving S} = 3a
\]

As the number of satellites serving C = number of satellites serving S, the number of satellites serving C and B but not S = number of satellites exclusively serving S and B but not C = y (assume).

\[
\therefore 10x + 2y + 100 + 6x + 2z = 1600 \Rightarrow 8x + y + z = 750 \quad \text{...(i)}
\]

From (i), \(10x + 2y + 100 = 6x + 2y + 2z + 200\)

\[
\therefore z = 2x - 50 \quad \text{...(ii)}
\]

Thus, the minimum value that ‘x’ can takes is 25.

From (i) and (ii), \(10x + y = 800 \Rightarrow y = 800 - 10x\)

Thus, the maximum value that ‘x’ can takes is 80.
The number of satellites serving at least two among B, C and S is 1200
i.e., \(2y + z + 100 \geq 1200\)
\[\Rightarrow 1600 - 20x + 2x - 50 \geq 1100\]
\[\Rightarrow 450 \geq 18x\]
\[\Rightarrow 25 \geq x\]
Earlier we have seen that the minimum value of \(x\) is 25
\[\therefore x = 25\]
[1]: The number of satellites serving B = \(10x + 2y + 100 = 10(25) + 2(800 - 10x) + 100 = 1450\)
Therefore, statement 1 is true.
[2]: \(z = 2x - 50 = 0\) \(\Rightarrow\) All satellites serve B or C or S. Therefore, statement 2 is true.
[3]: The number of satellites serving C
\[= 3x + y + z + 100 = 3x + (800 - 10x) + (2x - 50) + 100 = 850 - 5x = 725\]
Therefore, statement 3 is false.
[4]: The number of satellites serving B exclusively = \(10x = 10 \times 25 = 250\)
Therefore, statement 4 is true.
Hence, [3].

Q.25)

A number say ‘\(x\)’ can be filled in four corner cells. Another number say ‘\(y\)’ can be used in the central cell. Now the remaining cells are middle cells of top row, bottom row, left column and right column. Two more numerals can be used to fill these cells. Assume that ‘\(z\)’ and ‘\(w\)’ are those numerals.

Thus,

\[
\begin{array}{ccc}
  x & z & x \\
  w & y & w \\
  x & z & x \\
\end{array}
\]

Thus, four different numerals are required.
Therefore, the required answer is 4.
A number say ‘x’ can be filled in four corner cells. Another number say ‘y’ can be used in the central cell. Now the remaining cells are middle cells of top row, bottom row, left column and right column. Two more numerals can be used to fill these cells. Assume that ‘z’ and ‘w’ are those numerals. Thus,

\[
\begin{array}{ccc}
  x & z & x \\
  w & y & w \\
  x & z & x \\
\end{array}
\]

So, at least 4 different numerals are required for a 3×3 matrix.

Top row i.e., the first row of the 5×5 matrix can be (x, z, x, z, x). Similarly, other cells from the second and the third row can be filled.

For the first column i.e., the leftmost column, the fourth cell from top can be filled with the number from the second cell from top i.e. w and the bottom cell can be filled with the number from the top most cell of the column i.e., x. Similarly, remaining cells of the remaining columns can be filled. Thus, four different numerals are sufficient to fill a 5×5 matrix.

Therefore, the required answer is 4.

Q.27) As seen earlier, 4 different numerals are required to fill a 5×5 matrix. As one is allowed to make only one mistake, it is possible to change exactly one entry such that all other conditions are not violated. Hence, [3].

Q.28) Assuming that the particular cell is not a cell at one of the corner, it has 8 adjacent cells. Hence, 8 + 1 = 9 different numerals are required to fill the particular cell and the adjacent cells. Earlier we have seen that 4 different numerals are required to fill a 5×5 matrix. Hence, 9 different numerals will be definitely sufficient to fill the 5×5 matrix. Hence, [1].
As each committee has at least one bureaucrat, one educationalist and one politician, the members of each type must be in the range [3, 18].

From (1), ratio of the number of bureaucrats in the research, teaching and administration committees = 3 : 3 : 4

Therefore, the number of bureaucrats = 10

From (2), If there are x educationists in the research committee, there must be (3x) educationists in all.

From (3), ratio of the number of politicians in the research, teaching and administration committees = 1 : 1 : 3

Therefore, there can be 5 or 10 politicians. If there are 10 politicians, number of educationists = 4, which is not a multiple of 3.

Therefore there are 5 politicians and 9 educationists.

Thus, we have

<table>
<thead>
<tr>
<th></th>
<th>Research</th>
<th>Teaching</th>
<th>Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bureaucrats</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Educationists</td>
<td>3</td>
<td>1 or 2</td>
<td>5 or 4</td>
</tr>
<tr>
<td>Politicians</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

[1]: The administration committee has 4 bureaucrats and either 4 or 5 educationists. Therefore, this statement can be true.
[2]: The administration committee has 11 or 12 members. Research committee has 7 members which is definitely less than the members of administration committee. Therefore, this statement is true.
[3]: The teaching committee has 1 or 2 educationalists and 1 politician. Therefore, this statement can be true.
[4]: The teaching committee has 5 or 6 members. The research committee has 7 members which is definitely more than members of the teaching committee. Therefore, this statement is definitely false. Hence, [4].
Q.30)

As each committee has at least one bureaucrat, one educationalist and one politician, the members of each type must be in the range \([3, 18]\).

From (1), ratio of the number of bureaucrats in the research, teaching and administration committees = \(3 : 3 : 4\)

Therefore, the number of bureaucrats = 10

From (2), if there are \(x\) educationalists in the research committee, there must be \((3x)\) educationalists in all.

From (3), ratio of the number of politicians in the research, teaching and administration committees = \(1 : 1 : 3\)

Therefore, there can be 5 or 10 politicians. If there are 10 politicians, number of educationalists = 4, which is not a multiple of 3.

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</tr>
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<td>1</td>
<td>1</td>
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</tr>
</tbody>
</table>

There are 4 bureaucrats in the administration committee.

Therefore, the required answer is 4.

Q.31)

As each committee has at least one bureaucrat, one educationalist and one politician, the members of each type must be in the range \([3, 18]\).

From (1), ratio of the number of bureaucrats in the research, teaching and administration committees = \(3 : 3 : 4\)

Therefore, the number of bureaucrats = 10

From (2), if there are \(x\) educationalists in the research committee, there must be \((3x)\) educationalists in all.

From (3), ratio of the number of politicians in the research, teaching and administration committees = \(1 : 1 : 3\)

Therefore, there can be 5 or 10 politicians. If there are 10 politicians, number of educationalists = 4, which is not a multiple of 3.

Therefore there are 5 politicians and 9 educationalists.

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</tr>
<tr>
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<td>1</td>
<td>1</td>
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</tr>
</tbody>
</table>

There are 3 educationalists in the research committee.

Therefore, the required answer is 3.
As each committee has at least one bureaucrat, one educationalist and one politician, the members of each type must be in the range \([3, 18]\).

From (1), ratio of the number of bureaucrats in the research, teaching and administration committees = \(3 : 3 : 4\)

Therefore, the number of bureaucrats = 10

From (2), if there are \(x\) educationists in the research committee, there must be \((3x)\) educationists in all.

From (3), ratio of the number of politicians in the research, teaching and administration committees = \(1 : 1 : 3\)

Therefore, there can be 5 or 10 politicians. If there are 10 politicians, number of educationists = 4, which is not a multiple of 3.

Therefore there are 5 politicians and 9 educationalists.

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</tr>
</tbody>
</table>

Statements 1, 3 and 4 can be uniquely determined. The size of teaching committee can be 5 or 6. Thus, statement 2 cannot be uniquely determined.

Hence, [2].

A number say ‘\(x\)’ can be filled in four corner cells. Another number say ‘\(y\)’ can be used in the central cell. Now the remaining cells are middle cells of top row, bottom row, left column and right column. Two more numerals can be used to fill these cells. Assume that ‘\(z\)’ and ‘\(w\)’ are those numerals.

Thus,

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(x)</td>
<td>(z)</td>
<td>(x)</td>
</tr>
<tr>
<td>(w)</td>
<td>(y)</td>
<td>(w)</td>
</tr>
<tr>
<td>(x)</td>
<td>(z)</td>
<td>(x)</td>
</tr>
</tbody>
</table>

So, at least 4 different numerals are required for a \(3\times3\) matrix.
OP \perp PQ \text{ and } OQ \perp AB

Let \( OP = x \text{ cm} \)

\( OC = OB \)

\[ \therefore \text{Radius} = \sqrt{(PC)^2 + (PO)^2} = \sqrt{(QB)^2 + (QO)^2} \]

\[ \therefore \sqrt{3^2 + (x)^2} = \sqrt{(2)^2 + (x + 1)^2} \]

\[ \therefore \sqrt{9 + (x)^2} = \sqrt{4 + (x)^2 + 2x + 1} \]

\[ \therefore 9 = 5 + 2x \]

\[ \therefore x = 2 \]

\[ \therefore \text{Radius} = \sqrt{(9)^2 + (2)^2} = \sqrt{13} \]

Hence, [2].
Q.2)

Let A completes \((100w)\) units of work per day and he works for \((100x)\) days.

Total work done = \(10000xw\)

To complete this work, B alone takes \((125x)\) days and hence, he completes \(\frac{10000xw}{125x} = 80w\) units of work per day.

While working together, the two complete \((100w + 80w) = 180w\) units per day.

While working alone, A finishes 50% of the work i.e., \(5000xw\) in \(50x\) days and B completes 5% of the work i.e., \(500xw\) in \(\frac{125x}{20}\) days.

To complete remaining 45% of the work i.e., \(4500xw\) the two working together need \(\frac{4500xw}{180w} = 25x\)

By the given conditions,

\[50x + \frac{125x}{20} + 25x = 13\]

\[\therefore \frac{1625x}{20} = 13 \Rightarrow x = \frac{20}{1625}\]

\[\therefore 125x = 20\]

Thus, B alone can finish the entire job in 20 days.

Hence, [4].
Q.3)

As the digits appear in ascending order, there is only one way in which selected group of integers can be arranged.

Thus for two digit number, we need to select two digits.

This can be done in $^9C_2 = 36$ ways

As $^nC_m = ^nC_{n-m}$, $^9C_2 = ^9C_7$ =

Number of ways in which number can have 2 or 7 digits = $^9C_2 = ^9C_7 = 36$ ways

Number of ways in which number can have 3 or 6 digits = $^9C_3 = 84$ ways

Number of ways in which number can have 4 or 5 digits = $^9C_4 = 126$ ways

Number of ways in which number can have 8 digits = $^9C_8 = 8$ ways

Number of ways in which number can have 9 digits = 1 ways

$1 + 8 + 2(36) + 2(84) + 2(126) = 502$ numbers have 2 or more distinct digits such that the digits appear in ascending order.

Therefore, the required answer is 502.
Q.4)

Let cost of tea A and B be \(a\) and \(b\) respectively.

If 3 kg of tea A is mixed with 2 kg of tea B,
\[(3a + 2b) \times 1.1 = 40 \times 5 = 200\]

If 2 kg of tea A is mixed with 3 kg of tea B,
\[(2a + 3b) \times 1.05 = 40 \times 5 = 200\]

Therefore,
\[(3a + 2b) \times 1.1 = (2a + 3b) \times 1.05\]

\[
\therefore 3.3a + 2.2b = 2.1a + 3.15b
\]

\[
\therefore \frac{a}{b} = \frac{19}{24}
\]

Hence, [4].
Consider $\triangle ABC$ (i.e. $T_1$) and $\triangle DEF$ (i.e., $T_2$).

$D$ and $E$ are midpoints of $AB$ and $AC$ respectively. Therefore, $BC = 2 \times DE$

Side of $T_2 = \frac{1}{2} \times$ Side of $T_1$

\[
\text{Area of } T_1 = A(T_1) = \frac{\sqrt{3}}{4} \times 24^2
\]

Similarly, $A(T_2) = \frac{\sqrt{3}}{4} \times 12^2, A(T_3) = \frac{\sqrt{3}}{4} \times 6^2 \ldots$ and so on

Sum of areas of infinitely many $T_i$'s

\[
= \frac{\sqrt{3}}{4} \times 24^2 + \frac{\sqrt{3}}{4} \times 12^2 + \frac{\sqrt{3}}{4} \times 6^2 + \cdots
\]

\[
= \frac{\sqrt{3}}{4} \left( 24^2 + 12^2 + 6^2 + \cdots \right)
\]

Here, $(24^2 + 12^2 + 6^2 + \cdots)$ is infinite series with $r = \frac{1}{4}$

\[
\frac{\sqrt{3}}{4} \left( \frac{24^2}{1 - \frac{1}{4}} \right) = 192\sqrt{3}
\]


Q.6)

For \( x = -2 \), \( 2^x = 0.25 \) and \( x = 7 \) is the largest value that \( x \) can take for \( 2^x \leq 200 \).

For \( x = -2 \) and \( -1 \), \( (2^x + 2) \) is not an integer.

For \( x = 0 \), \( (2^x + 2) = 3 \) i.e., divisible by 3.

For \( x = 1 \), \( (2^x + 2) = 4 \) i.e., divisible by 4.

For \( x = 2 \), \( (2^x + 2) = 6 \) i.e., divisible by 3.

For \( x = 3 \), \( (2^x + 2) = 10 \) i.e., neither divisible by 3 nor by 4.

For \( x = 4 \), \( (2^x + 2) = 18 \) i.e., divisible by 3.

For \( x = 5 \), \( (2^x + 2) = 34 \) i.e., neither divisible by 3 nor by 4.

For \( x = 6 \), \( (2^x + 2) = 66 \) i.e., divisible by 3.

For \( x = 7 \), \( (2^x + 2) = 130 \) i.e., neither divisible by 3 nor by 4.

Thus, for \( x = 0, 1, 2, 4 \) and \( 6 \), \( 2^x + 2 \) is perfectly divisible by either 3 or 4.

Therefore, the required answer is 5.
Q.7)

Let distance between A and P be ‘x’ units. Therefore, distance between P and B = (3x) units

Let car 1 reaches point P in ‘t’ minutes. Therefore, car 2 takes (t + 60) minutes to reach P.

\[
\begin{array}{c|c|c}
A & x & 3x \\
\hline
P & t & t + 1 \\
\hline
B & & \\
\end{array}
\]

Speed of car 1 = \( \frac{x}{t} \) and speed of car 2 = \( \frac{3x}{(t+60)} \)

By the given condition,

\[
\frac{x}{2t} = \frac{3x}{(t+60)}
\]

Solving this, we get

\( t = 12 \) minutes

Therefore, the required answer is 12.

Q.8)

As \( \square ABCD \) is a rectangle, \( AC = DB = 2 \times 13 = 26 \) cm

\( AB^2 + BC^2 = 26^2 = 676 \)

\((24^2 + 12^2)\) and \((25^2 + 10^3)\) do have units digit as 6 and hence options [1] and [3] can be eliminated.

\(24^2 + 10^3 = 676\)

Hence, [2].
Q.9)

Let the part of principal amount in the first instalment be Rs. $X$.

Interest for the first year on Rs. $2,10,000 = 210000 \times 0.1 = 21,000$

Therefore, the first instalment = $(21000 + X)$

Remaining part of the principal = $(210000 - X)$

Interest on this principal $(210000 - X) = (210000 - X) \times 1.1 = 231000 - 1.1X$

Therefore,

$21000 + X = 231000 - 1.1X$

Solving this, we get $X = 1,00,000$

∴ Each instalment = $100000 + 21000 = Rs. 1,21,000$

Therefore, the required answer is 121000.

Q.10)

For positive value of $x$, $(2x^2)$ is increasing.

As value of $x$ increases, value of $(52 - 5x)$ decreases.

$2x^2 = 52 - 5x$, for $x = 4$ and $-6.5$

At $x = 4$, function attains maximum value for positive real value of $x$.

∴ at $x = 4$, $g(x) = 32$

Therefore, the required answer is 32.
Q.11)

Let the common ratio be ‘k’.

\[ x = \frac{y}{k} \text{ and } z = yk \]

As \( 5x = \frac{5y}{k}, 16y \) and \( 12z = 12yk \) are in arithmetic progression,

\[ 2 \times 16y = \frac{5y}{k} + 12yk \]

\[ \therefore 32 = \frac{5}{k} + 12k \]

\[ \therefore 12k^2 - 32k + 5 = 0 \]

\[ \therefore (2k - 5)(6k - 1) = 0 \]

\[ \therefore k = \frac{5}{2} \text{ or } \frac{1}{6} \]

As \( x < y < z \), \( k \) has to be greater than 1.

\[ \therefore k = \frac{5}{2} \]

Hence, [2].
Q.12)

Let $OC = OD = x$

$$A(\triangle OCD) = \frac{\sqrt{3}}{4} x^2$$

$$A(\text{sector } O - AB) = \frac{\pi (1)^2}{6} = \frac{\pi}{6}$$

By the given condition,

$$\frac{\sqrt{3}}{4} x^2 = \frac{1}{2} \times \frac{\pi}{6}$$

$$\therefore x^2 = \frac{\pi}{3\sqrt{3}}$$

$$\therefore x = \left(\frac{\pi}{3\sqrt{3}}\right)^{\frac{1}{2}}$$

Hence, [2].
Q.13)

Let work-done by a human and a robot in a day are ‘h’ and ‘r’ respectively.

Total work = 30(15h + 5r) = 60(5h + 15r)

∴ 15h + 5r = 10h + 30r

∴ h = 5r

Let fifteen humans take ‘y’ days to finish the job.

∴ 30(15h + 5r) = y × 15h
∴ 30(15h + h) = y × 15h
∴ y = 32

Hence, [2].

Q.14)

Let a filling pipe fills the tank at ‘a’ liters per hour and a draining pipe drains at ‘b’ liters per hour.

Therefore,
6(6a – 5b) = 60(5a – 6b)
∴ 6a – 5b = 50a – 60b
∴ 44a = 55b
∴ a = \frac{5}{4}b

Let the tank gets filled completely in ‘m’ hours when one draining pipe and two filling pipes are on.

∴ m(2a – b) = 6(6a – 5b)
∴ m \left( 2 \times \frac{5}{4}b - b \right) = 6 \left( 6 \times \frac{5}{4}b - 5b \right)
∴ m \left( \frac{5}{2}b - b \right) = 6 \left( \frac{15}{2}b - 5b \right)
∴ m \left( \frac{3}{2}b \right) = 6 \left( \frac{15}{2}b - 5b \right)

Solving this, we get m = 10

Therefore, the required answer is 10.
Q.15)

Let distance between X and Y be ‘d’ km and train T travels at speed ‘s’ kmph.

Therefore, speed of train S = \( \left( \frac{3}{4} s \right) \) kmph

At 4 pm, T must have covered ‘s’ km.

Therefore, distance between the two = (d – s) km

Time taken for the two to cover this distance = \( \frac{(d-s)}{s + \left( \frac{3}{4} s \right)} = \frac{4(d-s)}{7s} \)

Distance covered by train T by now = \( s + \frac{4(d-s)}{7s} \times s = \frac{3s+4d}{7} \)

By the given condition,

\[ \frac{3s + 4d}{7} = \frac{3}{5}d \]

Solving this, we get \( d = 15s \)

To travel from X to Y, train T takes \( \frac{15s}{s} = 15 \) hours

Therefore, the required answer is 15.

Q.16)

Let \( x \) is average age of 30 people whose age is 51 years and above. Clearly, \( x \geq 51 \)

Let \( y \) is average age of 39 people whose age is less than 51 years.

\[ \therefore 30x + 39y = 69 \times 38 \]

\[ \therefore 10x + 13y = 874 \]

\[ x \geq 51 \Rightarrow 10x \geq 510 \Rightarrow 10x + 13y \geq 510 + 13y \Rightarrow 874 \geq 510 + 13y \Rightarrow 364 \geq 13y \Rightarrow 28 \geq y \]

Thus, the largest possible average age of the people whose ages are below 51 years is 28 years.

Hence, [2].
Q.17)

Assume that the wholesaler bought peanut at Rs. X per kg.

\[
\therefore \text{Cost price of walnuts} = \text{Rs. } 3X \text{ per kg}
\]

The wholesaler sold peanuts at Rs. 1.1X per kg and walnuts at Rs. 3.6X per kg.

Total cost of 8 kg peanuts and 16 kg walnuts for the shopkeeper

\[
= 8 \times 1.1X + 16 \times 3.6X = 66.4X
\]

Shopkeeper overall profit was 25%

Therefore, revenue = 66.4X \times 1.25

He sold \((8 - 3) = 5\) kg peanuts and \((16 - 5) = 11\) kg walnuts after mixing at Rs. 166 per kg

Therefore,

\[
66.4X \times 1.25 = 16 \times 166
\]

Solving this, we get

\[X = 32\]

Cost price of walnuts for the wholesaler = \(3 \times 32 = \text{Rs. } 96\)

Hence, [4].
Q.18)

Let the 10 litres of mixture has ‘Y’ litres of A and \((10 – Y)\) litres of B. Let cost of paint B be Rs. \(X\) and that of A be Rs. \((X + 8)\).

We know that, \(Y \geq (10 – Y) \Rightarrow y \geq 5\)

The trader makes 10% profit by selling this mixture at Rs. 264.

\[ \therefore \text{Cost price of the mixture} = \frac{264}{1.1} = \text{Rs. 240} \]

\[ \therefore (X + 8) \times Y + (10 – Y) \times X = 240 \]

\[ \therefore 10X + 8Y = 240 \]

\[ \therefore X = 24 – 0.8Y \]

For maximum value of \(X\), we need to consider minimum value of \(X\).

\[ \therefore X = 24 – (0.8 \times 5) = \text{Rs. 20} \]

Hence, [1].

Q.19)

The minimum number of students who like only burger = 134 – 105 = 29

We can eliminate options [1] and [4].

The maximum number of students who like only burger = 200 – 105 = 95

We can eliminate option [2].

Thus, it can be concluded that the number of students who like only burger can possibly be 93.

Hence, [3].
Q.20)

\[ \text{Area of parallelogram} = \text{base} \times \text{height} \]

\[ \therefore A(\square ABCD) = CD \times AP \]

\[ \therefore 72 = 9 \times AP \]

\[ \therefore AP = 8 \]

Consider \( \triangle APD \).

\[ PD = \sqrt{16^2 + 8^2} = 8\sqrt{3} \]

\[ A(\triangle APD) = \frac{1}{2} \times 8\sqrt{3} \times 8 = 32\sqrt{3} \text{ sq. cm} \]

Hence, [4].
Q.21)

Let the time taken by Narayan to cover 60 km be ‘t’ hours.

Therefore, Partha takes \( (t + 4) \) hours to cover 60 km.

Parth takes \( (t - 2) \) hours to cover half the distance.

So, to cover remaining distance i.e., 30 km, he takes \( (t + 4) - (t - 2) = 6 \) hours.

\[ \therefore \text{Partha’s speed} = \frac{30}{6} = 5 \text{ km/hr} \]

Hence, [4].

Q.22)

Let there be ‘n’ tests and their average be ‘x’.

By the given conditions,

\[ \frac{nx - 200}{(n - 10)} = x + 1 \]

\[ \frac{nx - 300}{(n - 10)} = x - 1 \]

\[ \therefore \frac{nx - 200}{(n - 10)} - 1 = \frac{nx - 300}{(n - 10)} + 1 \]

\[ \therefore \frac{nx - 200}{(n - 10)} - \frac{nx - 300}{(n - 10)} = 2 \]

\[ \therefore \frac{100}{(n - 10)} = 2 \]

\[ \therefore n = 60 \]

Therefore, the required answer is 60.
\[ \log_{12} 81 = p \Rightarrow 81 = 12^p \]
\[ \Rightarrow 3^{(4 - p)} = 2^{2p} \]

Taking log on both the sides,

\[ (4 - p) \log 3 = (2p) \log 2 \]

\[ : \frac{\log 3}{\log 2} = \frac{2p}{(4 - p)} \]

\[ \therefore \frac{\log 3 + \log 2}{\log 2} = \frac{2p + (4 - p)}{(4 - p)} \quad \text{(by componendo)} \]

\[ \therefore \frac{\log 3 + \log 2}{\log 2} = \frac{(4 + p)}{(4 - p)} \]

\[ \therefore \frac{\log 6}{\log 2} = \frac{(4 + p)}{(4 - p)} \]

\[ \therefore \frac{(4 - p)}{(4 + p)} = \frac{\log 2}{\log 6} \]

\[ \therefore 3 \times \frac{(4 - p)}{(4 + p)} = \frac{\log 2}{\log 6} = \frac{\log 2^2}{\log 6} = \frac{\log 8}{\log 6} = \log_6 8 \]

Hence, [3].
Q.24)

\[ 2^x = 3^{\log_5 2} \]

Taking log on both the sides,

\[ x \log 2 = (\log_2 3)(\log 5) \]

\[ \therefore x = \frac{(\log_2 3)(\log 5)}{\log 2} = \frac{(\log 2)(\log 3)}{\log 5}(\log 2) = \frac{(\log 3)}{(\log 5)} = \log_5 3 \]

[1]: \[ 1 + \log_3 \frac{5}{3} = 1 + \frac{\log \frac{5}{3}}{\log 3} = 1 + \frac{\log 5 - \log 3}{\log 3} = \frac{\log 5}{\log 3} = \log_3 5 \]

[2]: \[ \log_5 9 = 2(\log_5 3) \]

[3]: \[ \log_5 8 = 3(\log_5 2) \]

[4]: \[ 1 + \log_5 \frac{3}{5} = 1 + \frac{\log \frac{3}{5}}{\log 5} = 1 + \frac{\log 3 - \log 5}{\log 5} = 1 + \frac{\log 3}{\log 5} = 1 + \log_5 3 \]

Hence, [4].

Q.25)

\[ f(15) = f(14) + f(13) \]

\[ = f(13) + f(12) + f(13) \]

\[ = 2 \times f(13) + f(12) \]

\[ = 2[f(12) + f(11)] + f(12) \]

\[ = 3 \times f(12) + 2 \times f(11) \]

\[ = 3[f(11) + f(10)] + 2 \times f(11) \]

\[ = 5 \times f(11) + 2 \times f(10) \]

\[ \therefore 617 = 5 \times 91 + 3 \times f(10) \]

Solving this we get, \( f(10) = 54 \)

Therefore, the required answer is 54.
Q.26)

\[ \log_2(5 + \log_3a) = 3 \]
\[ \therefore (5 + \log_3a) = 2^3 = 8 \]
\[ \therefore \log_3a = 3 \]
\[ \therefore a = 3^3 = 27 \]

\[ 4a + 12 + \log_2b = (4 \times 27) + 12 + \log_2b = 120 + \log_2b \]
\[ \log_2(4a + 12 + \log_2b) = \log_2(120 + \log_2b) = 3 \]
\[ \therefore (120 + \log_2b) = 5^3 = 125 \]
\[ \therefore \log_2b = 5 \]
\[ \therefore b = 2^5 = 32 \]

Therefore, \( a + b = 27 + 32 = 59 \)
Hence, [3].

Q.27)

Let Raju and Lalitha originally had \((4x)\) and \((9x)\) marbles. Later Lalitha gave \((y)\) marbles to Raju.
Therefore,
\[ \frac{4x + y}{9x - y} = \frac{5}{6} \]

Solving this, we get
\[ y = \frac{21}{11}x \]

The required fraction \[\frac{\frac{21}{11}x}{9x} = \frac{7}{33} \]
Hence, [3].
\[ \frac{x^{2018}y^{2017}}{x^{2016}y^{2019}} = \frac{\frac{1}{2}}{4} = \frac{1}{16} \]

\[ x^2 = \frac{y^2}{16} \]

\[ x^{2018} \times y^{2017} = (x^2)^{1009} \times y^{2017} = \left(\frac{y^2}{16}\right)^{1009} \times y^{2017} = \left(\frac{y^{4035}}{16^{1009}}\right) = \frac{1}{2} \]

\[ \therefore y^{4035} = \frac{1}{2} \times 16^{1009} \]

\[ \therefore y^{4035} = 2^{4035} \]

\[ \therefore y = 2 \]

\[ x^{2018} \times y^{2017} = \frac{1}{2} \Rightarrow x^{2016} \times 2^{2017} = \frac{1}{2} \Rightarrow x^{2018} = \frac{1}{2} \Rightarrow x = \frac{1}{2} \]

\[ \therefore x^2 + y^3 = \frac{1}{4} + 8 = \frac{33}{4} \]

Hence, [2].
Q.29)

As 36 marks are short of the pass marks by 68%,

\[36 = (100 - 68)\% \text{ of } 45\% \text{ of } N\]

\[\therefore 36 = 0.32 \times 0.45 \times N\]

\[\therefore N = \frac{36}{0.32 \times 0.45} = 250\]

Hence, [3].

Q.30)

Let ‘a’ and ‘c’ denote the number of students studying only H and only E respectively while ‘b’ denote the number of students studying H and P (but not E) and ‘d’ denote the number of students studying E and P (but not H).

\[
\begin{align*}
a + b + c + d + 30 &= 74 \Rightarrow a + b + c + d = 44 \\
\text{We know that } a + b &= c + d \\
\therefore a + b &= c + d = 22
\end{align*}
\]

\[\therefore \text{ the number of students studying in H} = 22 + 30 = 52\]

Therefore, the required answer is 52.
Q.31)

\[ u^2 + (u - 2v - 1)^2 = -4v(u + v) \]
\[ u^2 + (u - 2v - 1)^2 + 4v(u + v) = 0 \]
\[ (u - 2v - 1)^2 + u^2 + 4uv + 4v^2 = 0 \]
\[ (u - 2v - 1)^2 + (u + 2v)^2 = 0 \]

\[ \therefore u - 2v - 1 = 0 \text{ and } u + 2v = 0 \]

Solving the two equations, we get
\[ u = \frac{1}{2} \text{ and } v = -\frac{1}{4} \]

\[ u + 3v = \frac{1}{2} + \left( -\frac{3}{4} \right) = -\frac{1}{4} \]

Hence, [2].
y > x

*Side of smaller square* = \( \sqrt{x^2 + y^2} \)

By the given condition,
\[
x^2 + y^2 = \frac{5}{8} (x + y)^2
\]

\[
8x^2 + 8y^2 = 5x^2 + 5y^2 + 10xy
\]

\[
3x^2 + 3y^2 - 10xy = 0
\]

\[
3 \left( \frac{x}{y} \right)^2 - 10 \left( \frac{x}{y} \right) + 3 = 0
\]

\[
\frac{x}{y} = \frac{10 \pm \sqrt{10^2 - 4(3)(3)}}{6} = \frac{10 \pm 8}{6} = \frac{9}{3} or \frac{1}{3}
\]

As \( y > x \), \( \frac{x}{y} < 1 \)

\[ \therefore x : y = 1 : 3 \]

Hence, [4].
Q.33)

Let X and Y are the two real numbers.

\[ X \times Y \times 73 - X \times Y \times 37 = 720 \]
\[ X \times Y \times (73 - 37) = 720 \]
\[ X \times Y \times 36 = 720 \]
\[ X \times Y = 20 \]

\[ \text{AM}(X^2, Y^2) \geq \text{GM}(X^2, Y^2) \]

\[ \therefore \frac{X^2 + Y^2}{2} \geq \sqrt{X^2 \times Y^2} = XY = 20 \]

\[ \therefore (X^2 + Y^2) \geq 40 \]

Therefore, the required answer is 40.
\( \triangle ABE \sim \triangle ACD \)

AB = 3 ft, AC = 12 ft and CD = 4 ft \( \Rightarrow \) BE = 1 ft

The required volume of the cone

\[
= \frac{1}{3} \pi \times 4^2 \times 12 - \frac{1}{3} \pi \times 1^2 \times 3
\]

\[
= \frac{1}{3} \pi (192 - 3) = \frac{1}{3} \times \frac{22}{7} \times 189
\]

\[
= 198 \text{ cubic ft.}
\]

Therefore, the required answer is 198.