Aga Khan University Examination Board

Notes from E-Marking Centre on SSC-I General Mathematics Examination May 2018

Introduction:

This document has been produced for the teachers and candidates of Secondary School Certificate (SSC) Part – I (Class IX) General Mathematics. It contains comments on candidates' responses to the 2018 SSC-I Examination indicating the quality of the responses and highlighting their relative strengths and weaknesses.

E-Marking Notes:

This includes overall comments on candidates' performance on every question and *some* specific examples of candidates' responses which support the mentioned comments. Please note that the descriptive comments represent an overall perception of the better and weaker responses as gathered from the e-marking session. However, the candidates' responses shared in this document represent some specific example(s) of the mentioned comments.

Teachers and candidates should be aware that examiners may ask questions that address the Student Learning Outcomes (SLOs) in a manner that require candidates to respond by integrating knowledge, understanding and application skills they have developed during the course of study. Candidates are advised to read and comprehend each question carefully before writing the response to fulfil the demand of the question.

Candidates need to be aware that the marks allocated to the questions are related to the answer space provided on the examination paper as a guide to the length of the required response. A longer response will not in itself lead to higher marks. Candidates need to be familiar with the command words in the SLOs which contain terms commonly used in examination questions. However, candidates should also be aware that not all questions will start with or contain one of the command words. Words such as 'how', 'why' or 'what' may also be used.

Key observations:

This year shown that candidates had problems with conversion of verbal phrases into the mathematical operations to solve problems. In general, questions based on ratio and proportion, profit and loss, laws of logarithm were not well attempted. However, questions related to zakat and usher, simple interest, operation on sets, indices, statistics and Venn diagrams were generally well attempted.

Detailed Comments:

Constructed Response Questions (CRQs)

Question 1:

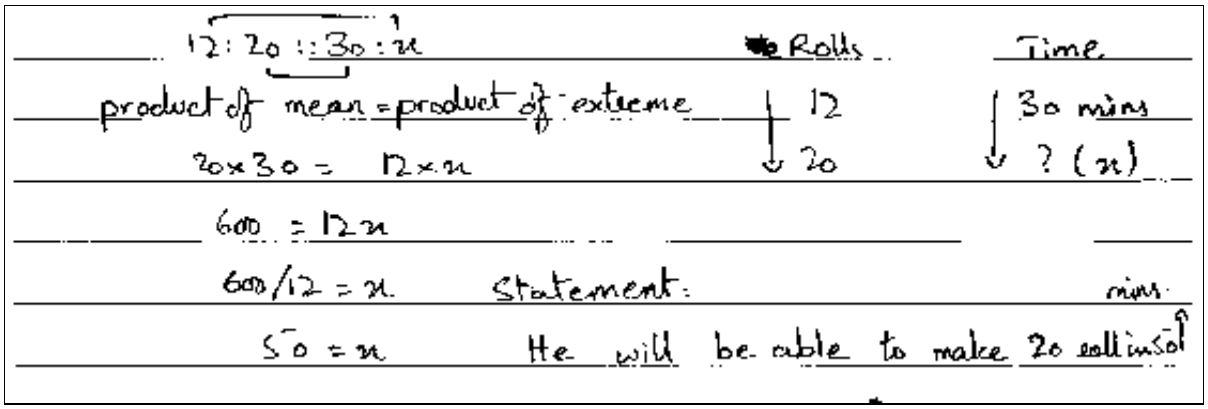
For a gathering of 8 people, a chef makes 12 vegetable rolls in 30 minutes.

a. He plans to make 20 rolls for the same number of people at the next party. If he works at the same rate, how long will it take him to make the rolls?

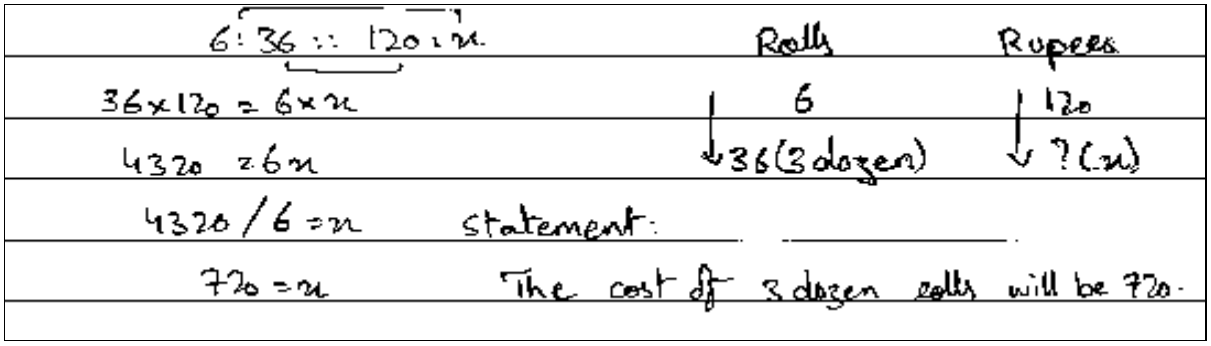
b. If 6 of these rolls are sold for Rs 120, then what will be the cost of 3 dozen rolls?

Better responses in part **a** reflected clear understanding of ratio and proportion. Candidates formed the condition $12 : 20 :: 30 : x$ successfully which helped them to get the required answer. Similarly in part **b**, they were very much comfortable in making the correct condition $6 : 36 :: 120 : x$. Finally, they got the required cost.

Example:

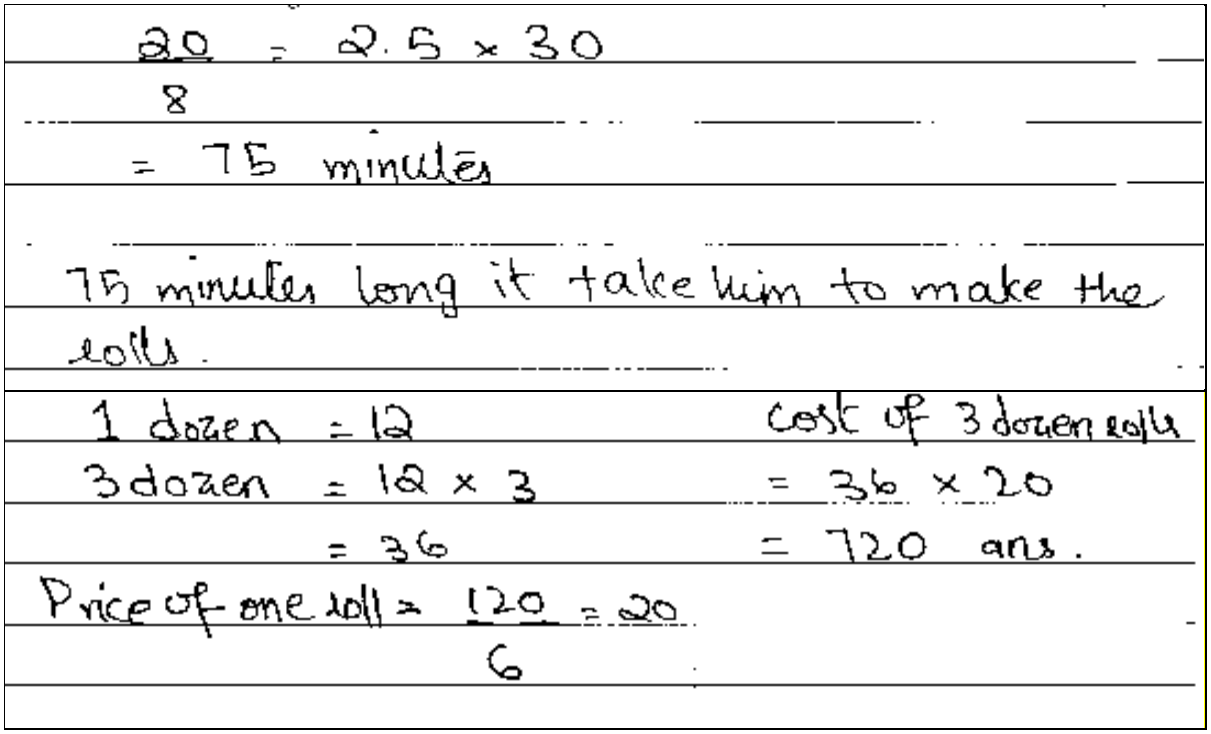


Example:



Weaker responses reflected that candidates could not understand both the question which showed the lack of practice. Some candidates used the given data correctly but made minor mistakes in finding the answer. It was also noticed that fewer candidates only managed to get the answer of part **b**.

Example:



Question 2:

This question offered a choice between part **a** and part **b**. Both parts were attempted equally but the performance in part **a** was better as compared to part **b**.

Question 2a:

Rashida owns gold of mass 95 grams for the past one year. The rate of gold is Rs 38,000 per 10 grams. She also has annual savings of Rs 30,500. What is the total amount of Zakat she should pay?

(**Note:** Rate of Zakat is 2.5% of annual savings.)

Better responses reflected the understanding of calculation of Zakat on annual savings. Candidates were able to find the amount of zakat when they were given annual savings.

Example:

10 per grams = 38,000

1 per gram = 3,800

95 × 3800 = 361,000 + 30,500 = 391,500

ZAKAT × RATE

391,500 × 2.5 /.

391.500 × 2.5 / 100

3,915 × 2.5

= 9,787.5 = Amount of zakat she should Pay.

Weaker responses exhibited that candidates did not understand how to use the given information to extract the answer. They just calculated total saving by finding gold price for 95 grams rather than to add with the amount of annual savings. As a result, they could not find the correct amount of zakat.

Example:

38000

+ 30500

68500

2/5 × 68500 = 1712.5

1000

1712.5 the total amount of zakat she should pay

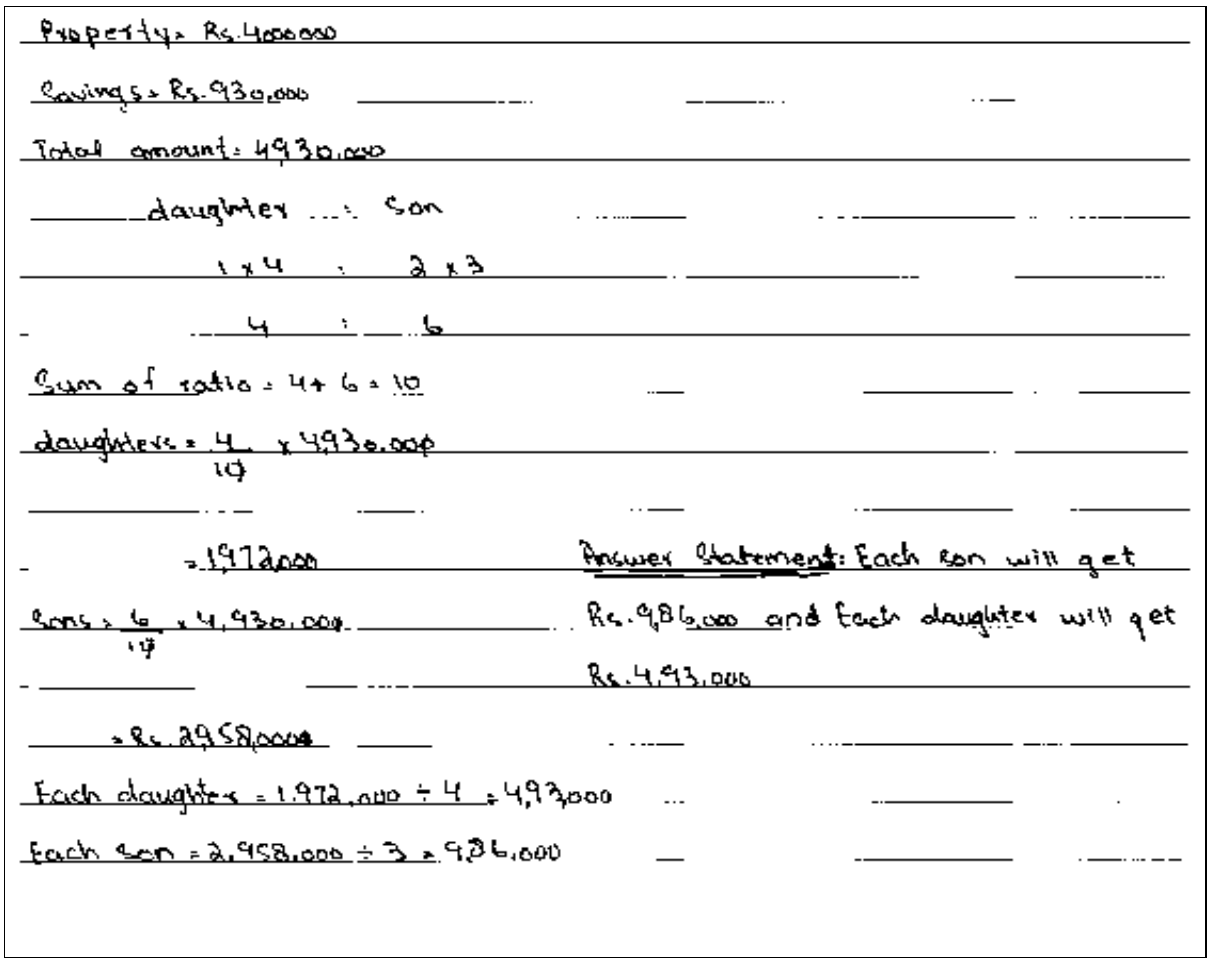
Question 2b:

Sajid wants to divide his property and savings among his 4 daughters and 3 sons. He owned a house which he sold for Rs 4,000,000 and he has savings of Rs 930,000. Find the share of each son and daughter.

(**Note:** The son gets two times as much as a daughter gets.)

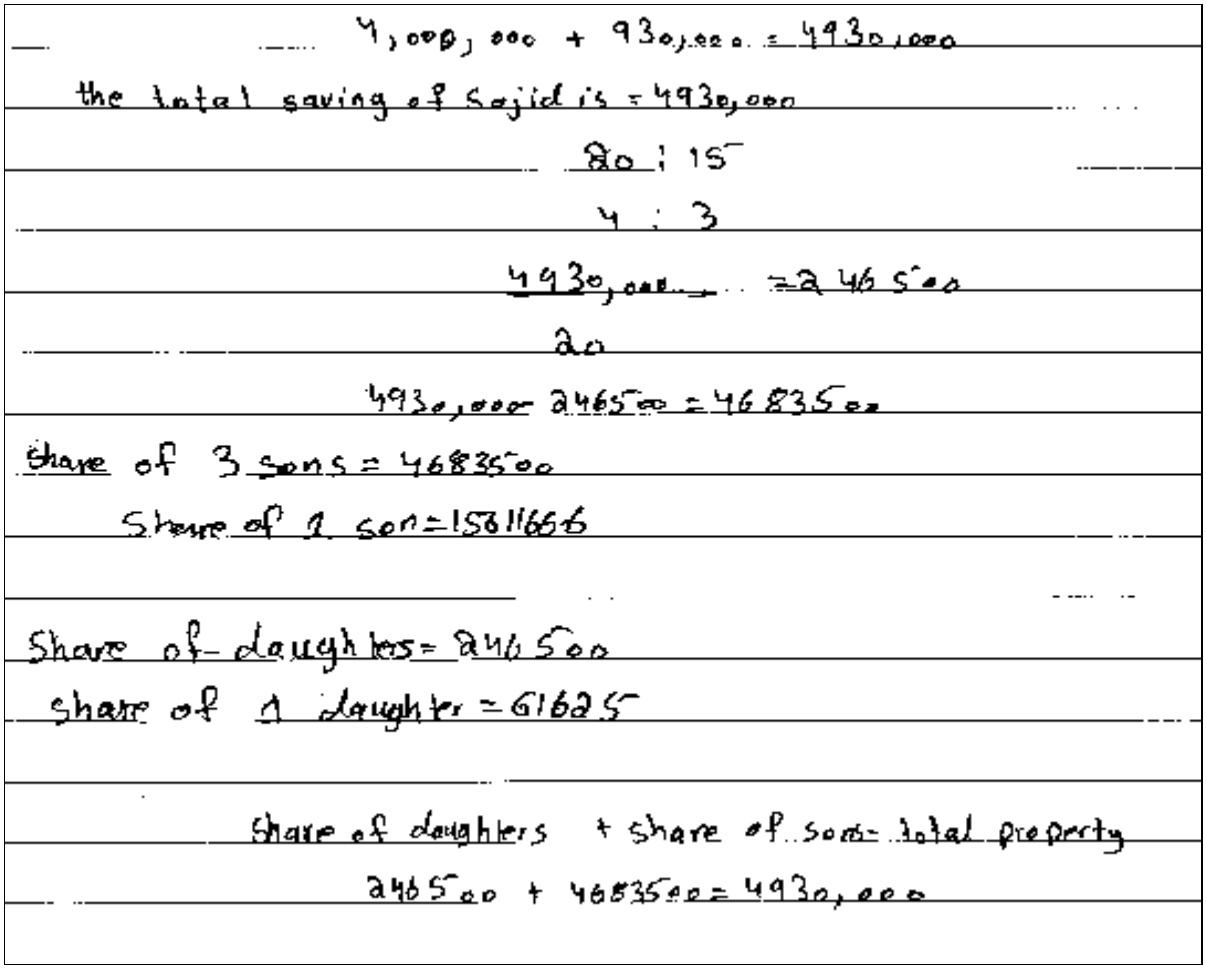
Better responses indicated that candidates did well to understand the question as they were able to find the sum of ratios correctly. This helped candidates in proceeding further to get the share of each son and daughter.

Example:



Weaker responses reflected that candidates had difficulty in deciding the ratio because they could not express the condition 'The son gets two times as much as a daughter gets' mathematically. Most of the candidates found the correct ratio for son but could not find the correct ratio for daughters.

Example:



Question 3:

This question offered a choice between part **a** and part **b**. Both parts were almost equally attempted but the performance in both parts was average.

Question 3a:

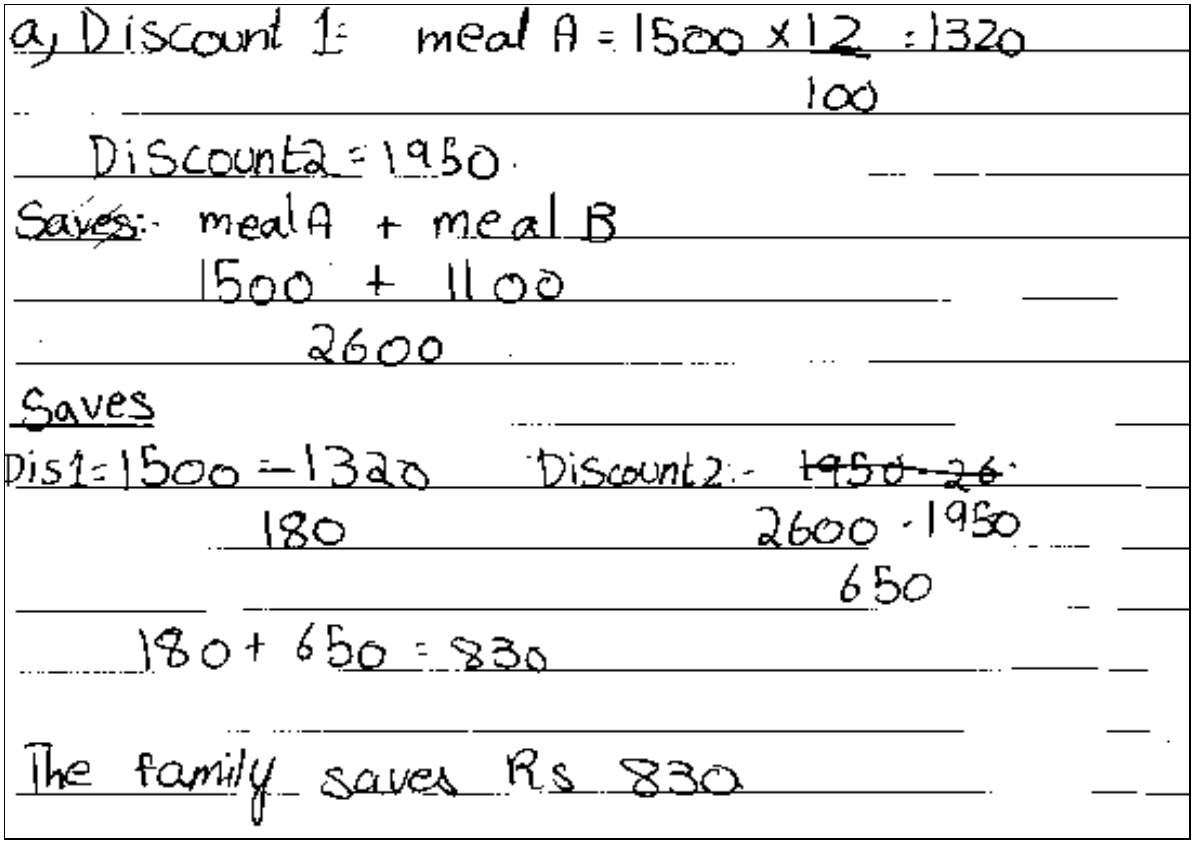
A cafeteria offers two family meals: meal *A* and *B*. The price of family meal *A* and *B* is Rs 1,500 and Rs 1,100 respectively. The cafeteria offers following discounts during holidays.

DISCOUNT OFFER 1:	BUY MEAL *A* OR *B*, GET 12% OFF
DISCOUNT OFFER 2:	BUY MEAL *A* AND *B* FOR Rs 1,950

A family visits this cafeteria during holidays and buys 2 meals *A* and 1 meal *B*. If they avail both discount offers, what is the amount of money they save?

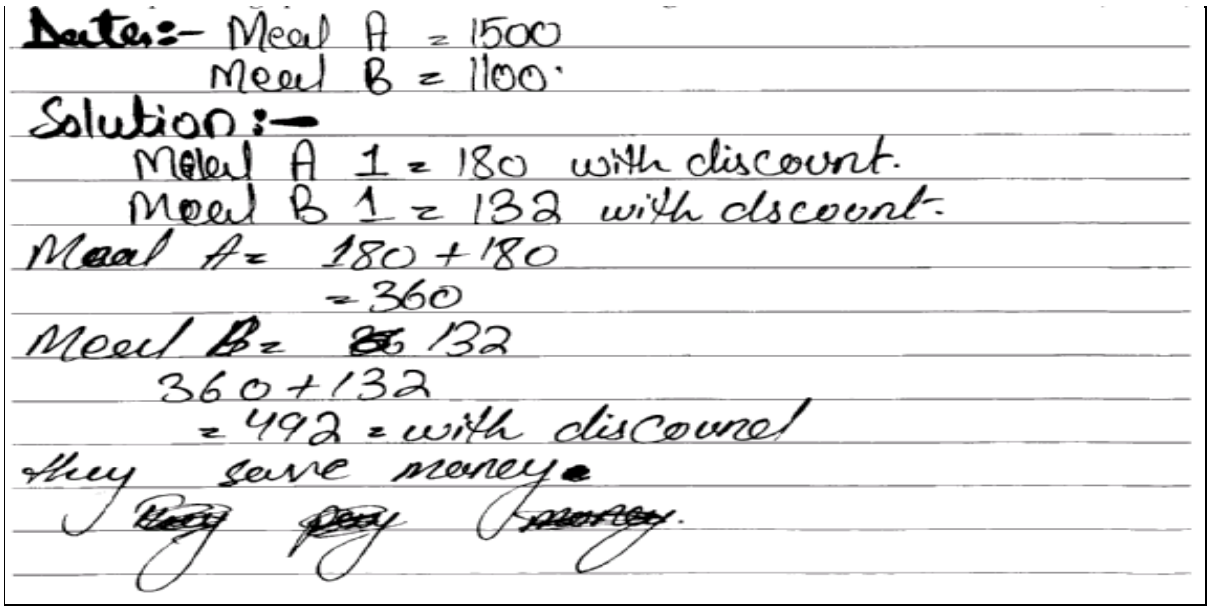
Better responses demonstrated that candidates were able to understand the given discount offers and how the family used these offers in their order. They were at ease to calculate savings from each discount offers and finally add them to get the required answer.

Example:



Weaker responses reflected that most of the candidates used incorrect mathematical models to find the answer. While fewer candidates just managed to calculate 12% of 1,500 for meal *A* and 12% of 1,100 for meal *B* and failed to go further in calculation. Consequently they could not reach the required result. Some very irrelevant responses were observed as well.

Example:



Question 3b:

A man bought two motorbikes for Rs 70,000 each. He sells one of these bikes at a loss of 20% and the other bike at a profit of 25%.

Find the

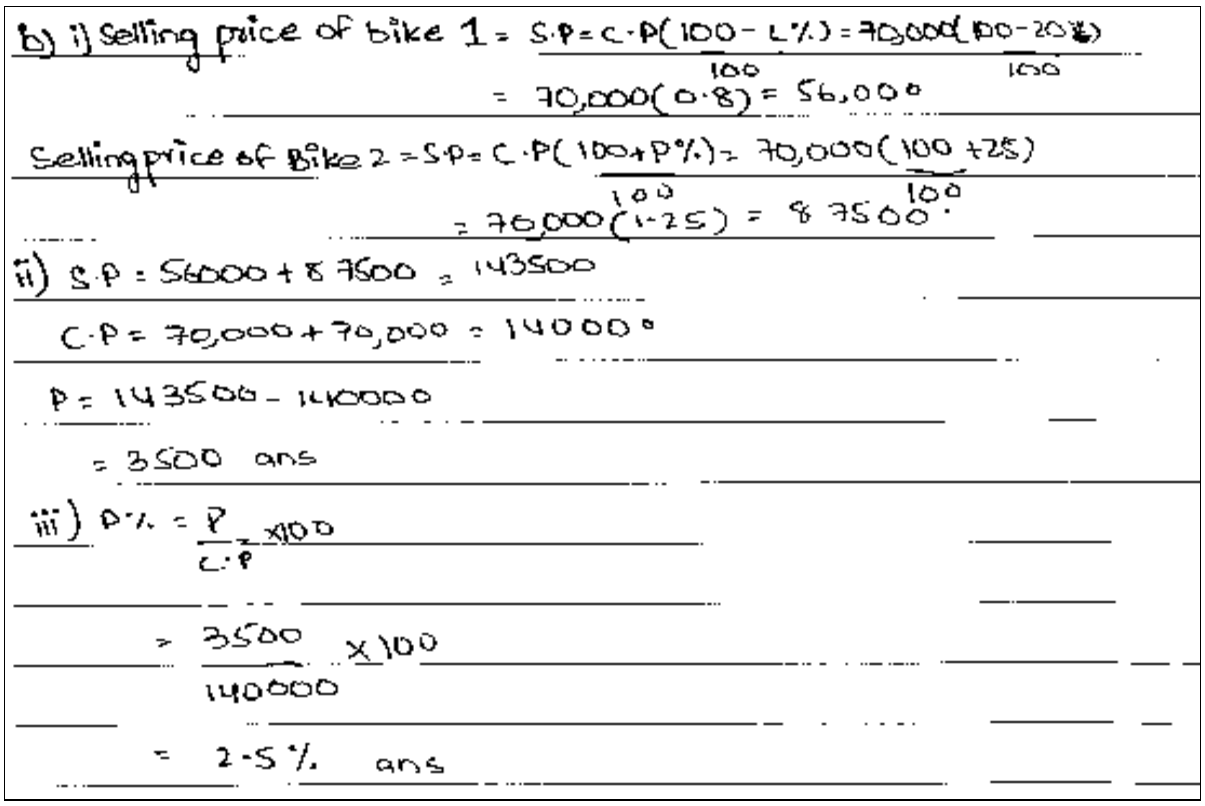
i. selling price of each bike.

ii. total profit or loss he made from selling the two bikes.

iii. percentage profit or loss he made from selling the two bikes.

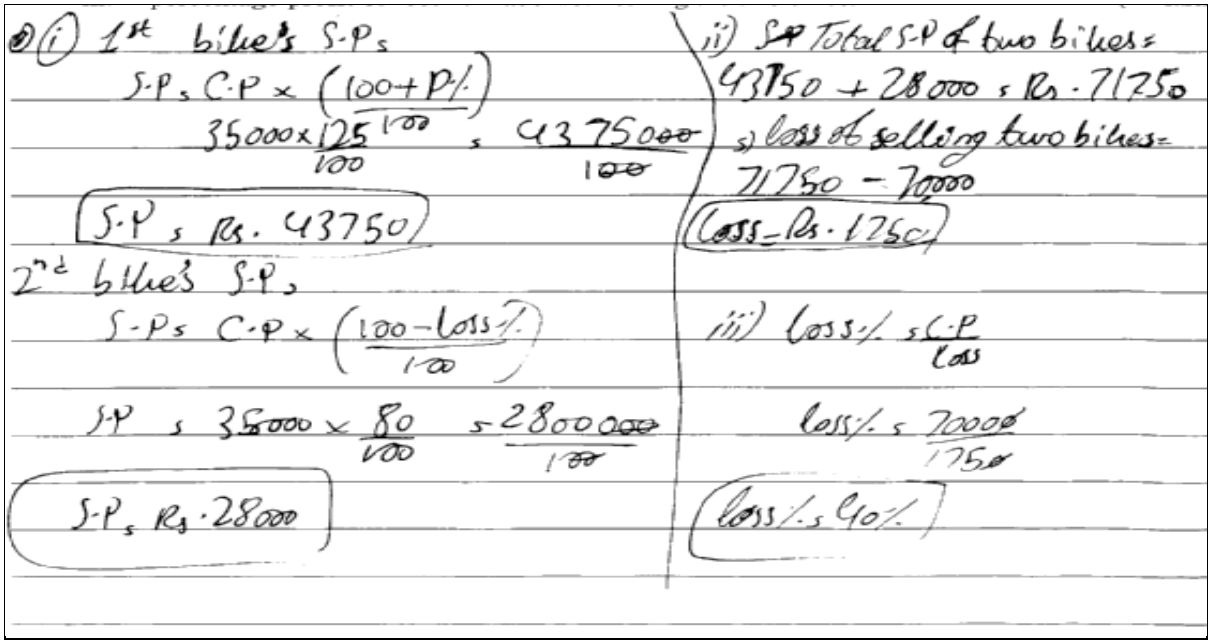
Better responses exhibited that the candidates, who correctly translated the given condition mathematically were able to get the solution. They used the given condition very well in order to manage all the three parts accordingly. They correctly found the selling price of each bike followed by the total profit and percentage profit.

Example:



Weaker responses revealed that candidates just used the percentages given in the question, i.e., loss of 20% and profit of 25% but got stuck to find the selling price of each bike. Because of this, rest of the parts were totally blank. It was evident from candidates' responses that they were not able to correctly render the situation mathematically. Hence, a lot of guess work was also seen.

Example:



Question 4:

Candidates exhibited average performance in this question.

Question 4:

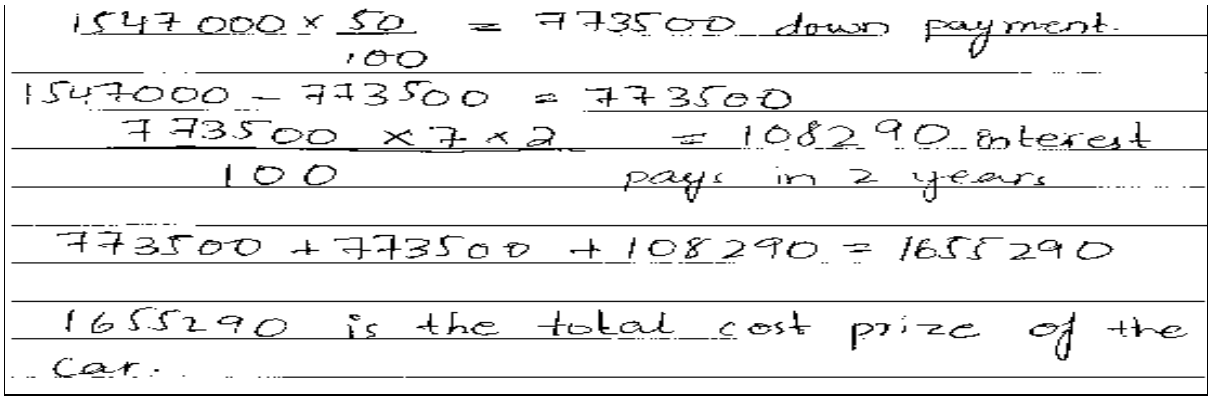
Samar leased a car worth Rs 1,547,000 with a down payment of 50%. If the rate of simple interest on the remaining amount is 7% per annum for a period of 2 years, find the

a. total interest Samar pays in 2 years.

b. total cost of the car.

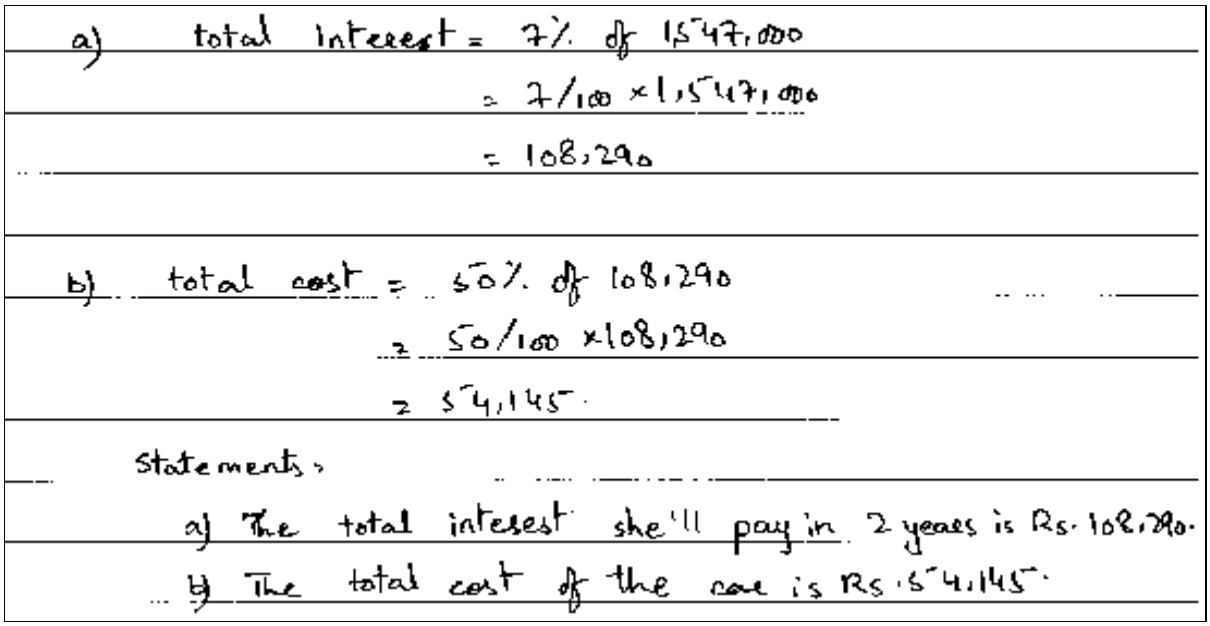
Better responses testified the understanding of down payment followed by the calculation of simple interest on the remaining amount. Candidates used the given data to first find 50% down payment. In addition, they grasped the question well to determine the interest on the remaining amount. Also, they were able to calculate the total cost of the car.

Example:



Weaker responses reported that candidates had faced difficulty in formulating the situation mathematically given in question. They just used the percentages given in question to calculate the interest and total cost which was actually wrong. Whilst fewer candidates only managed to find the 50% down payment and got perplexed to go further. Consequently they lost their marks.

Example:


a) total interest = 7% of 1547,000
= 7/100 × 1,547,000
= 108,290

b) total cost = 50% of 108,290
= 50/100 × 108,290
= 54,145.

Statements:
a) The total interest she'll pay in 2 years is Rs. 108,290.
b) The total cost of the car is Rs. 54,145.

Question 5:

Candidates showed average performance in this question.

Question 5:

Rubab, Zahra and Naveed work for a software development company.

Rubab works on contract according to which she is required to complete 23 hours working week. She is paid at an hourly rate of Rs 2,000.

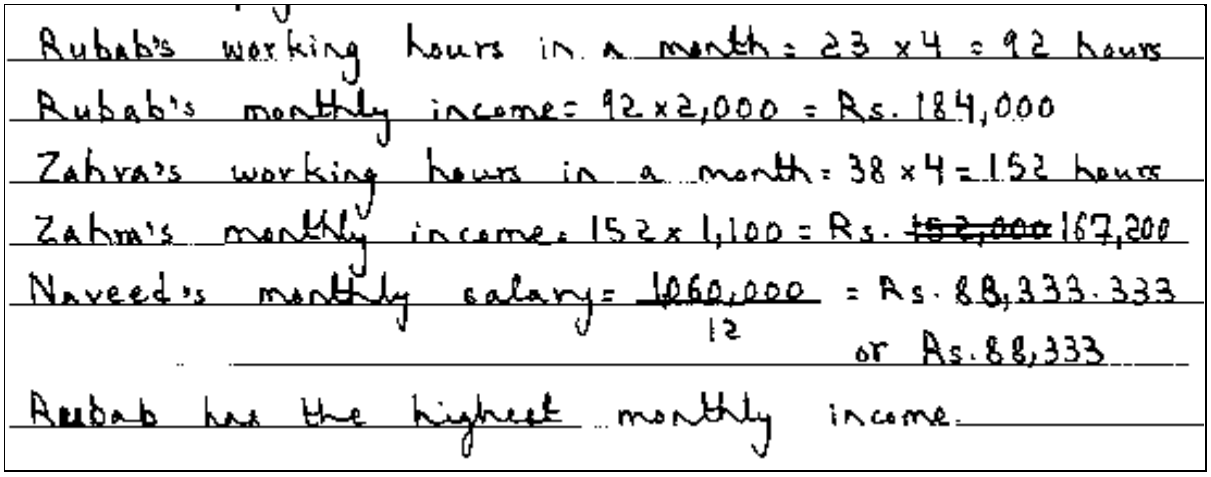
Zahra works on contract according to which she is required to complete 38 hours working week. She is paid at an hourly rate of Rs 1,100.

Naveed's annual salary is Rs 1,060,000.

Assuming that there are exactly 4 weeks in a month, find the monthly income of each person and state which person has the highest monthly income?

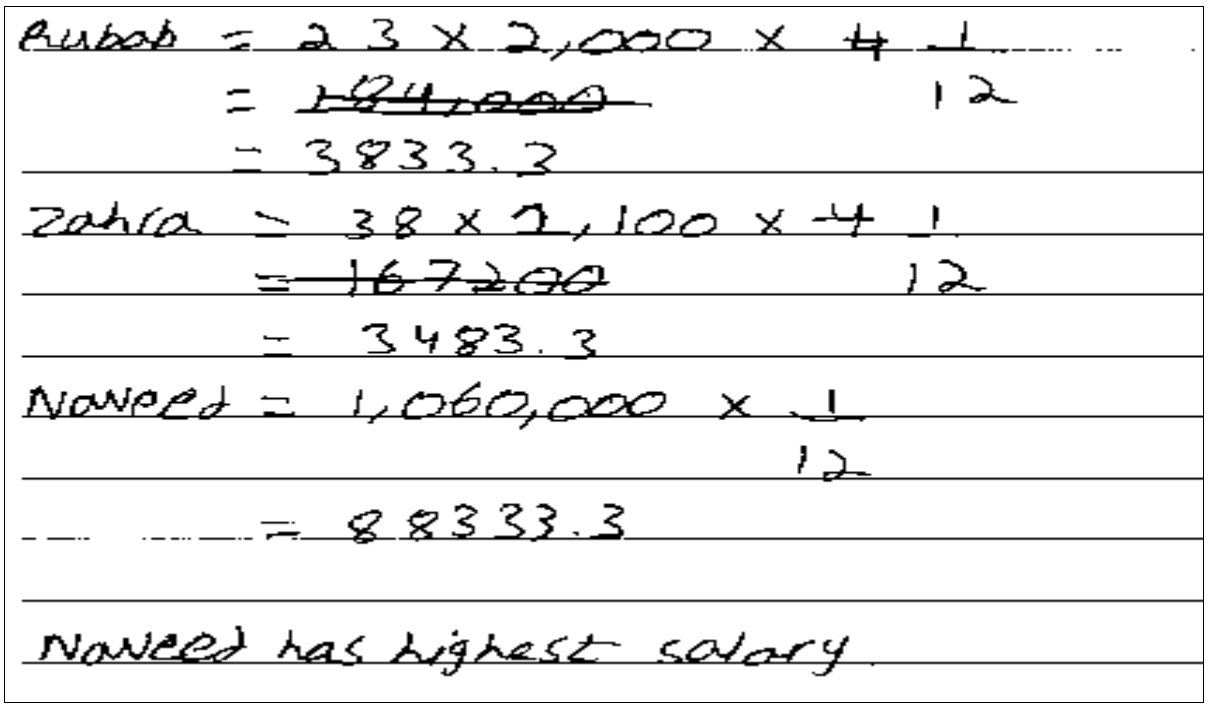
Better responses testified clear understanding of question which enables candidates to calculate the monthly income of each person and concluded the result as well. They used the given data in the required manner and subsequently they were able to calculate the monthly income of each person followed by the correct conclusion.

Example:


Rubab's working hours in a month = 23 x 4 = 92 hours
Rubab's monthly income = 92 x 2,000 = Rs. 184,000
Zahra's working hours in a month = 38 x 4 = 152 hours
Zahra's monthly income = 152 x 1,100 = Rs. ~~152,000~~ 167,200
Naveed's monthly salary = 1060,000 / 12 = Rs. 88,333.333 or Rs. 88,333
Rubab has the highest monthly income.

Weaker responses displayed that the candidates were confused in order to connect the question with the right concept. As a result, they were neither able to get the required answer nor concluded their result. It was seen that some of the candidates made mistakes in calculating the income as they mixed up the monthly income with the yearly income which directed to the wrong path to get the answer and finally received no credit in terms of marks.

Example:


Rubab = 23 x 2,000 x 4 x 1/12
= ~~184,000~~
= 3833.3
Zahra = 38 x 1,100 x 4 x 1/12
= ~~167200~~
= 3483.3
Naveed = 1,060,000 x 1/12
= 88333.3
Naveed has highest salary

Question 6:

This question offered a choice between part **a** and part **b**. Candidates chose to attempt part **b** more than part **a**. In part 6a**i** and 6**aii**, candidates' performance was not up to the mark. On the other hand, their performance was comparatively good enough in part 6**bi** and 6**bii**.

Question 6a:

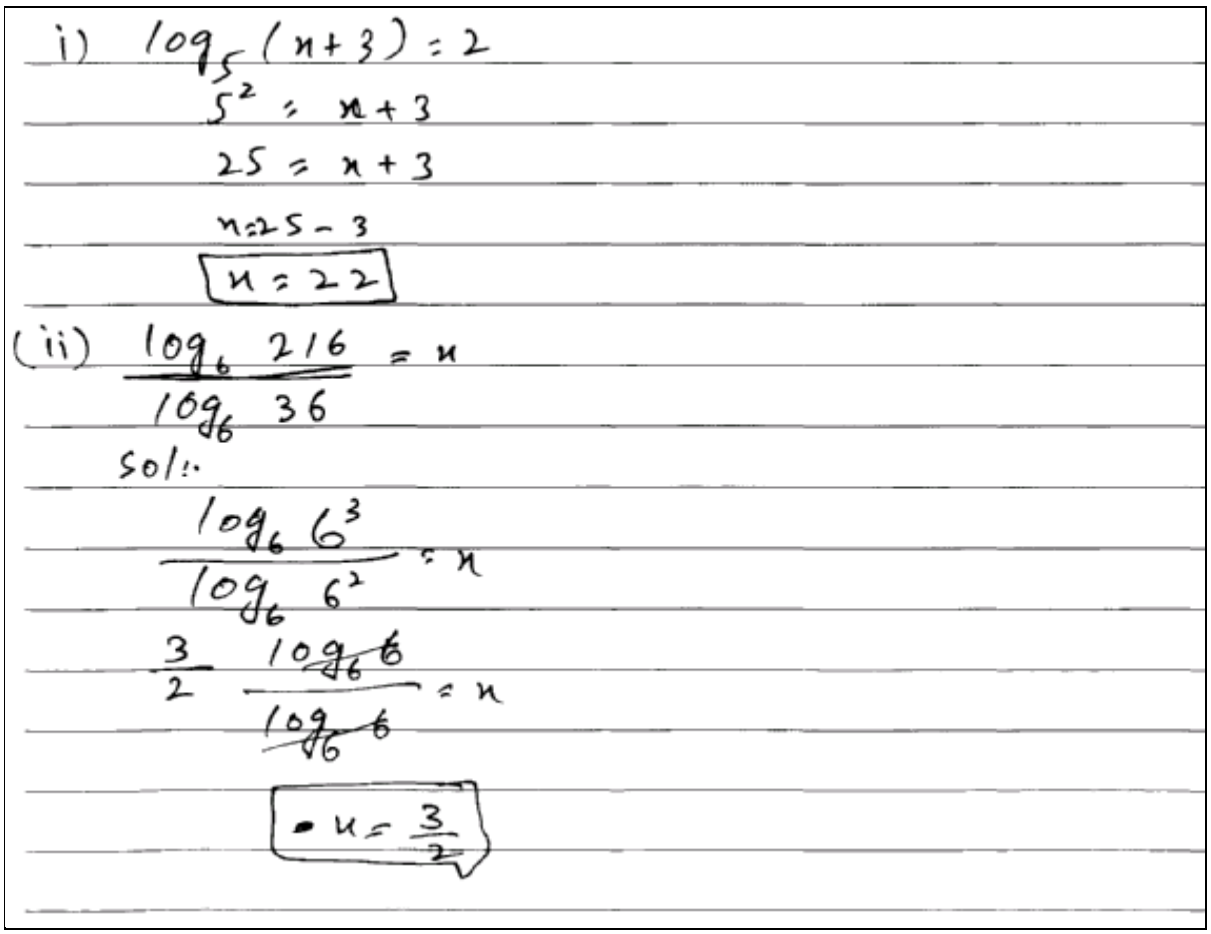
Find the value of x for the following logarithmic equations.

i. $\log_5(x+3) = 2$

ii. $\dfrac{\log_6 216}{\log_6 36} = x$

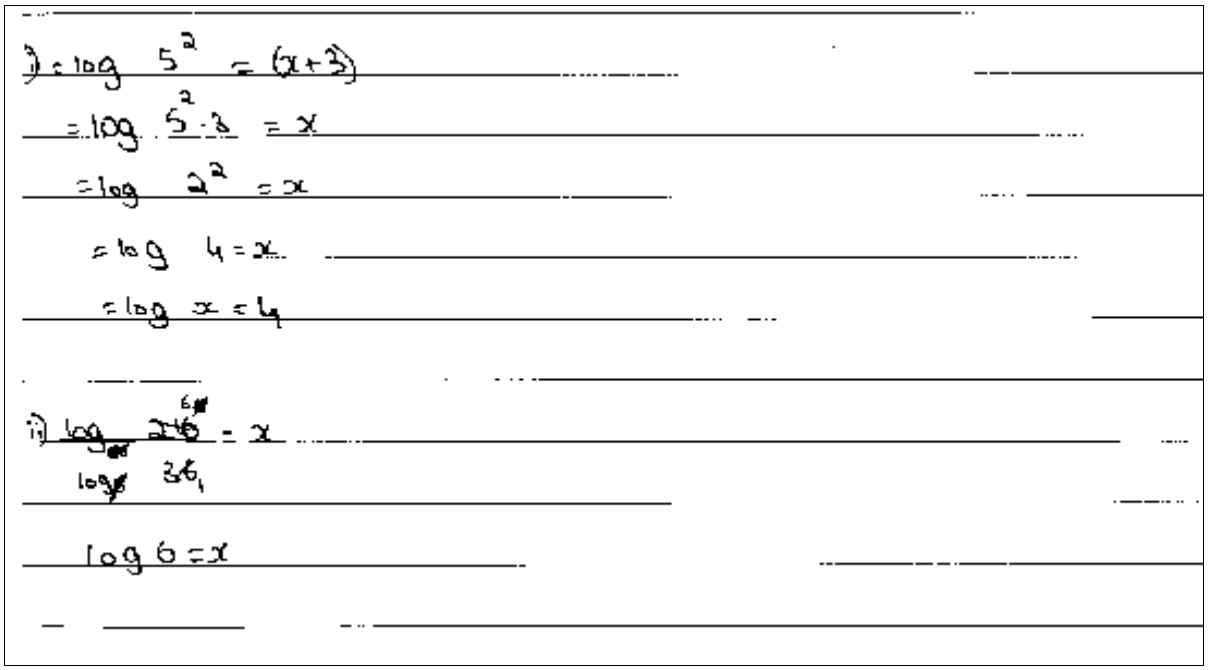
Better responses of part **i** exhibited the correct conversion of logarithmic form into index form. They were able to write $x + 3 = 5^2$ and hence got the answer. In part **ii**, candidates evaluated $\log_6 216, \log_6 36$ and used very smartly $\log_a a^n = n \log_a a$ and $\log_a a = 1$ in order to achieve the desired answer.

Example:



Weaker responses of part **i** reflected misconceptions about the conversion of logarithmic form to index form. They wrote incorrectly $x + 3 = 2^5$ instead of $x + 3 = 5^2$ which directed candidates to a wrong path and consequently they lost their marks. On the other hand in part **ii** there was a great confusion about the laws of logarithm as they anticipated $\frac{\log a}{\log b} = \log a - \log b$ which was actually incorrect. As a result, they could not reach the required answer. It was also seen that candidates in part **ii** just cancelled out the log operator and the numbers written in fraction which highlighted their lack of practice and ambiguous understanding.

Example:



Question 6b:

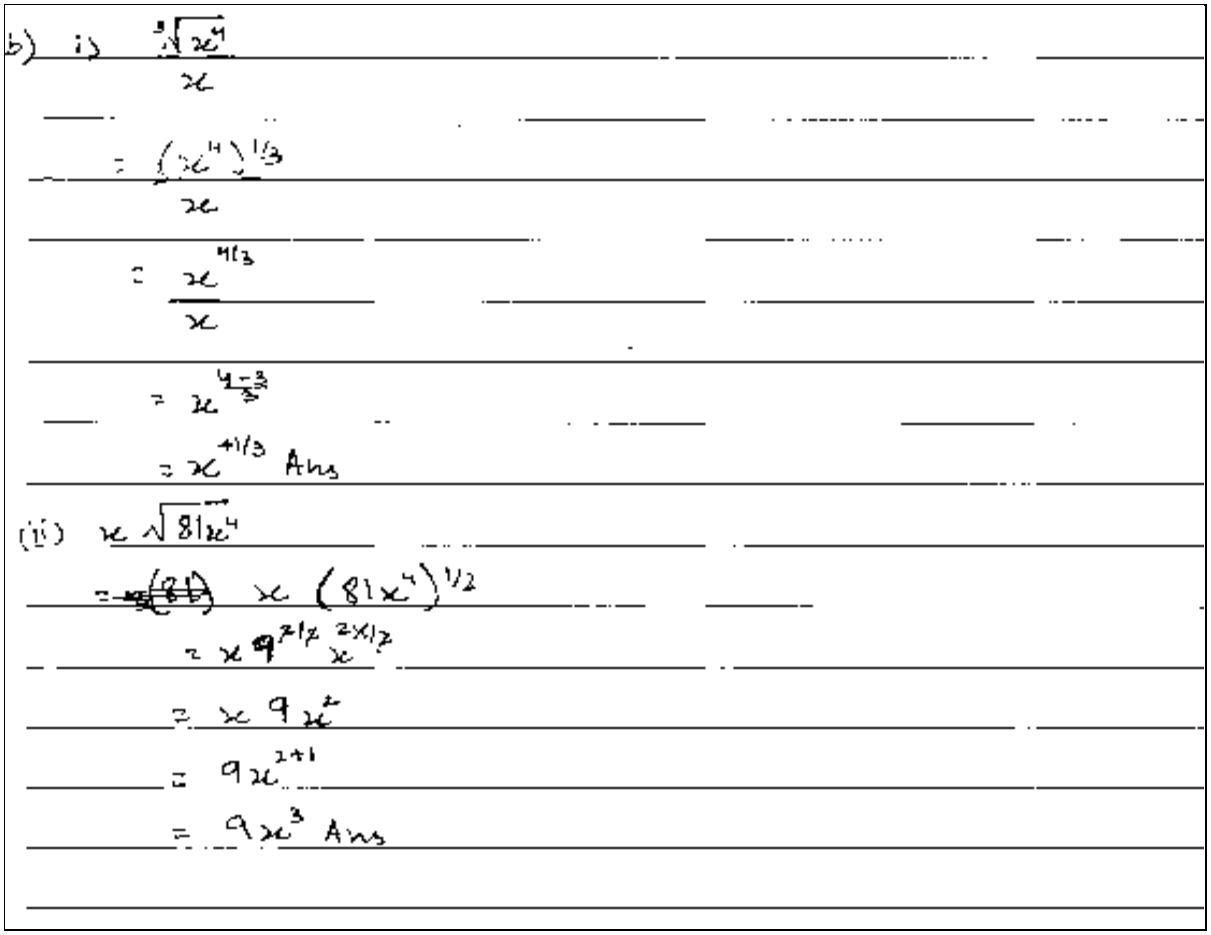
Express the following expressions in their simplest form in terms of *x*.

i. $\frac{\sqrt[3]{x^4}}{x}$

ii. $x\sqrt{81x^4}$

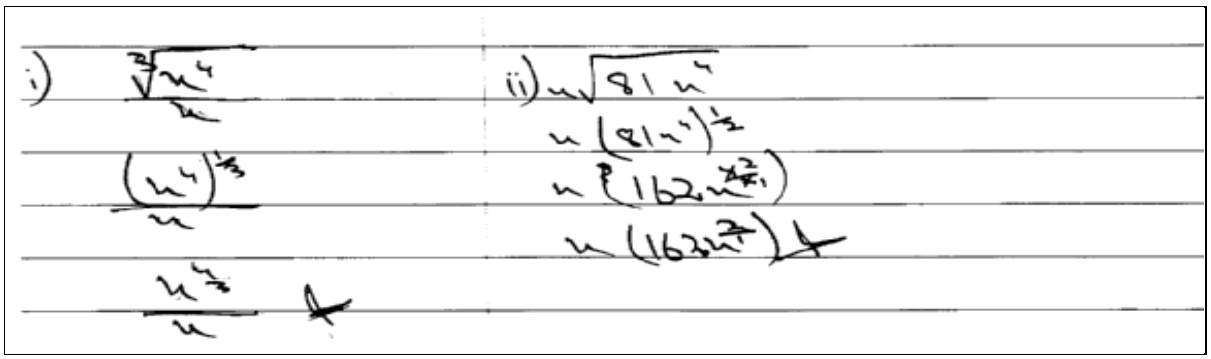
Better responses revealed that in both the parts, candidates were able to use the laws of exponents quite well. In part **i,** they wrote correctly $\sqrt[3]{x^4}$ equal to $x^{\frac{4}{3}}$ and then, used $\frac{x^a}{x^b} = x^{a-b}$ accordingly to get the desired answer. Similarly in part **ii** candidates performed well by applying the laws of exponents in $\sqrt{81x^4}$ and got the result $9x^2$. This helped candidates by applying exactly the law of exponent $x^a \times x^b = x^{a+b}$ to achieve the answer $9x^3$.

Example:



Weaker responses in both parts failed to initialize the laws of exponents appropriately. They faced difficulty in converting the radical form into index form as they expressed $\sqrt{81x^4} = 162x^8$ erroneously. As a result, they could not get the desired result. It was also noted that some of them in part **i** only managed to use the law of exponent but failed to express the answer in correct form.

Example:



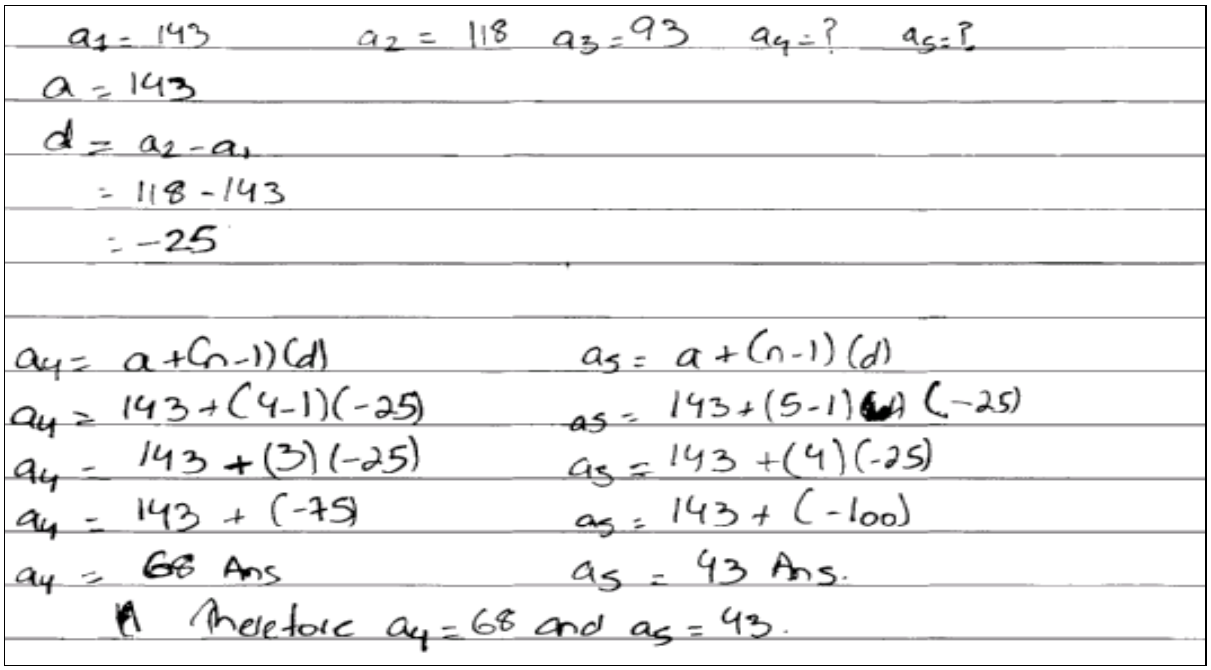
Question 7:

An office building has 5 floors. It accommodates 143 employees on the first floor, 118 employees on the second floor and 93 employees on the third floor. If the number of employees on each floor follows an arithmetic sequence, find the number of employees that can be accommodated on the 4^{th} and 5^{th} floor of the building.

This question was easy and attempted well by the candidates.

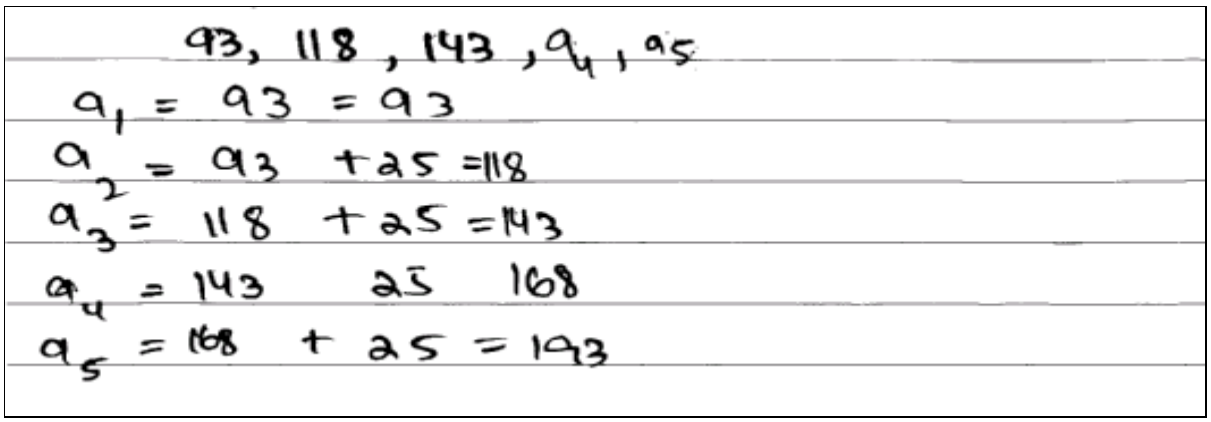
Better responses testified that most of the candidates had good knowledge of general term of arithmetic sequence. They used the given data very well to write the sequence and hence they were capable of finding 4^{th} and 5^{th} term of the sequence easily. It was also observed that fewer candidates directly noted down the data given in the question and since they had knowledge regarding arithmetic sequence, they found the correct terms very easily by just checking the difference of terms in the sequence.

Example:



Weaker responses represented that candidates were not capable of grasping the question. They were confused in identifying whether the given data is arithmetic or geometric which clearly depicted the lack of practice. Hence, they were unable to get the required answer.

Example:



Question 8:

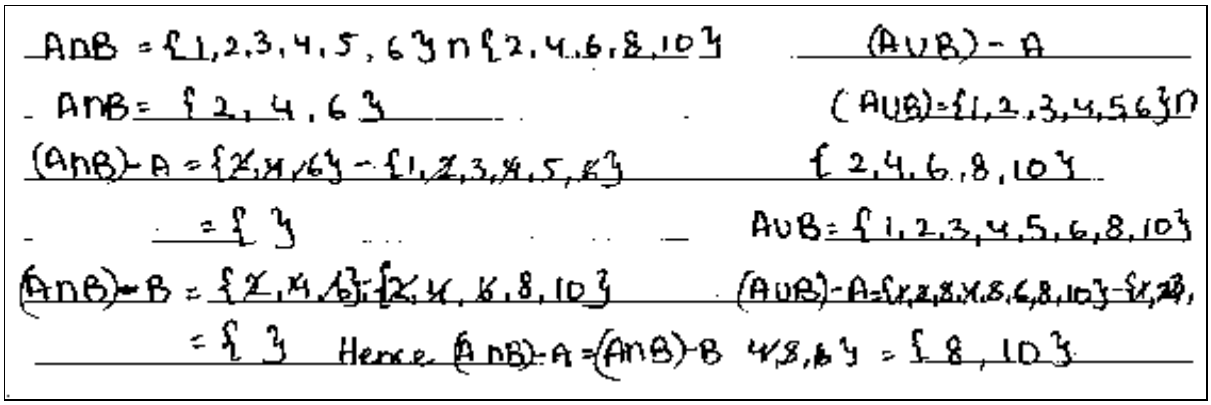
This question offered a choice between part **a** and part **b**. A vast majority of candidates chose part **a** which was also attempted better than part **b**.

Question 8a:

For sets $A = \{1, 2, 3, 4, 5, 6\}$ and $B = \{2, 4, 6, 8, 10\}$, verify that $(A \cap B) - A = (A \cap B) - B$. Also find $(A \cup B) - A$.

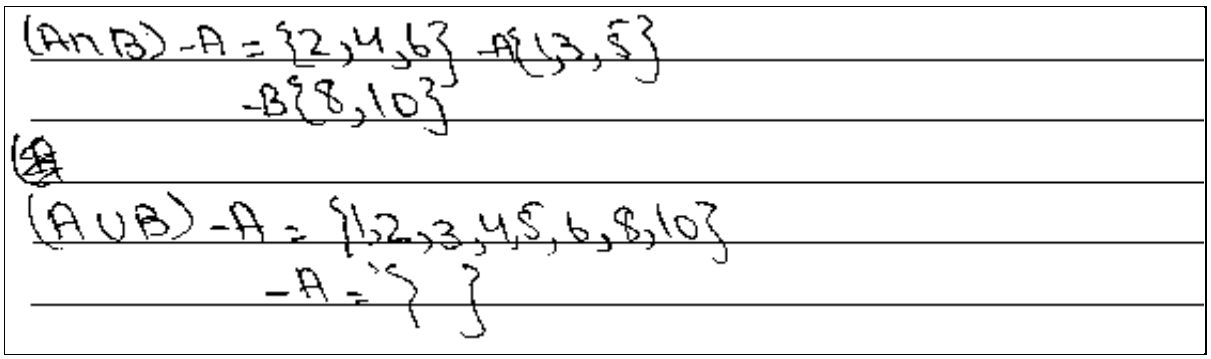
Better responses identified that candidates had understanding of operations on sets. The left hand side and right hand side of the equation was solved separately, both came out as { }. In addition, they were very much capable of finding $(A \cup B)$ followed by $(A \cup B) - A$.

Example:



Weaker responses displayed that candidates made careless errors while solving the two sides $(A \cap B) - A$ and $(A \cap B) - B$. Union was often replaced with intersection. Errors in finding difference of sets were common as well.

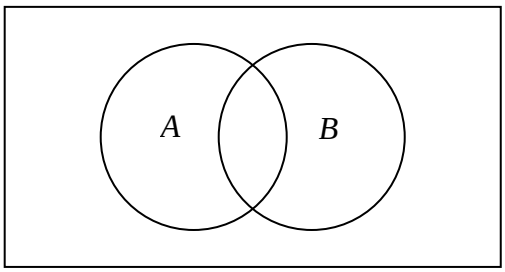
Example:



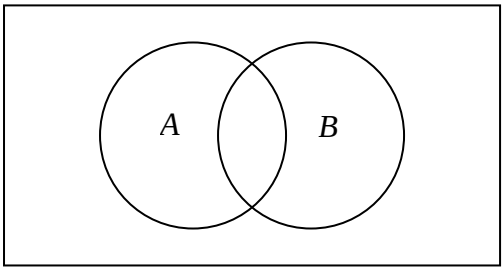
Question 8b:

If A and B are any two non-empty and mutually overlapping sets, then represent the following by shading the given Venn diagrams.

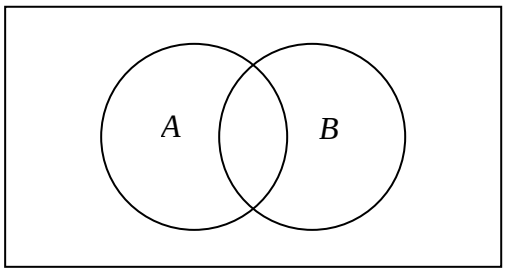
i. $A \cup B$



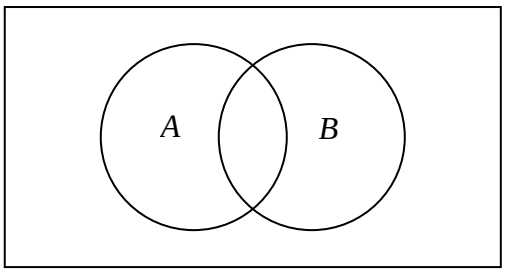
ii. $A \cap B$



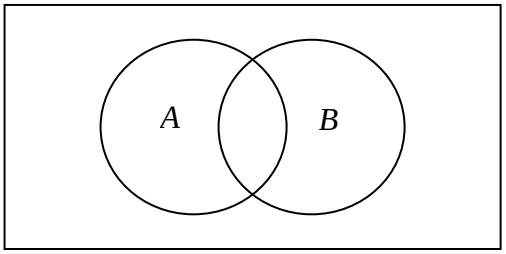
iii. $B - A$



iv. $A - B$

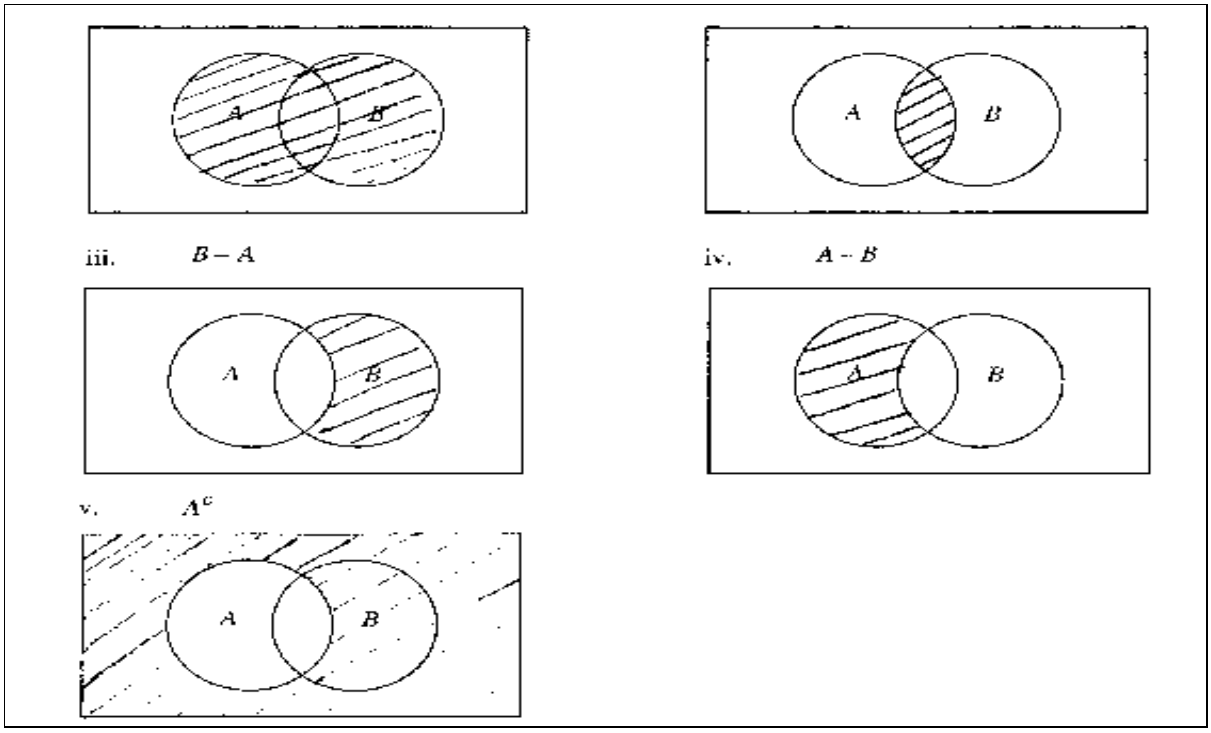


v. A^c



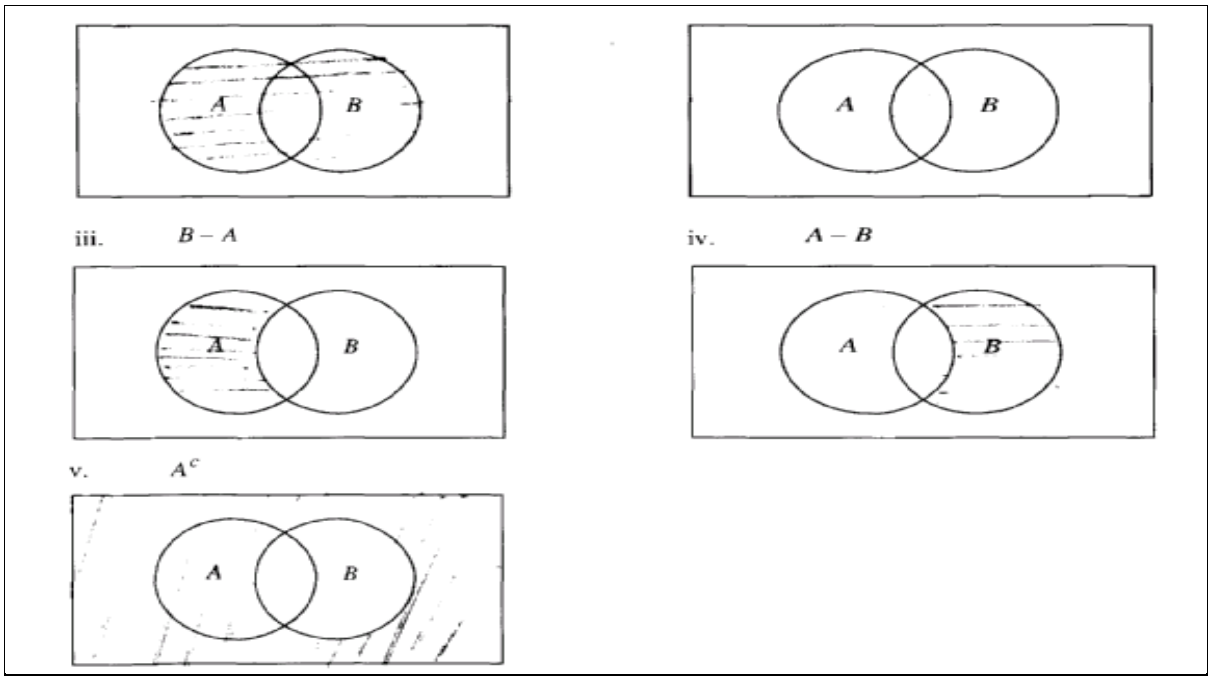
Better responses indicated that candidates did well in shading the given Venn diagram for the sets shown in the question. As a result, they got full credit in terms of marks.

Example:



Weaker responses depicted lack of understanding in shading the Venn diagram. They were perplexed which led them to incorrect shading. Some of them were totally blank and left without shading.

Example:



Question 9:

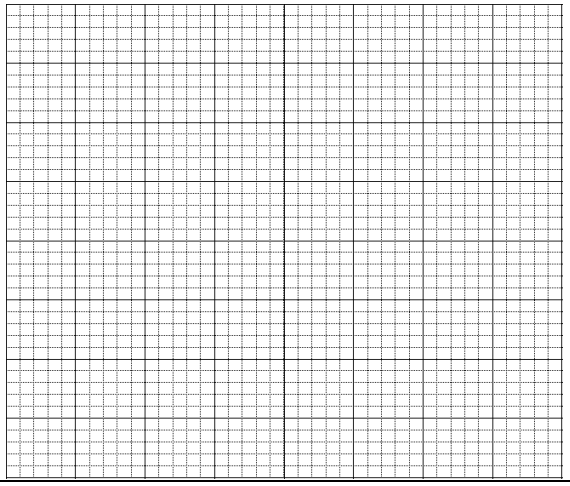
In the given graph, draw the following lines.

a. $y = 2$

b. $y = 2x$

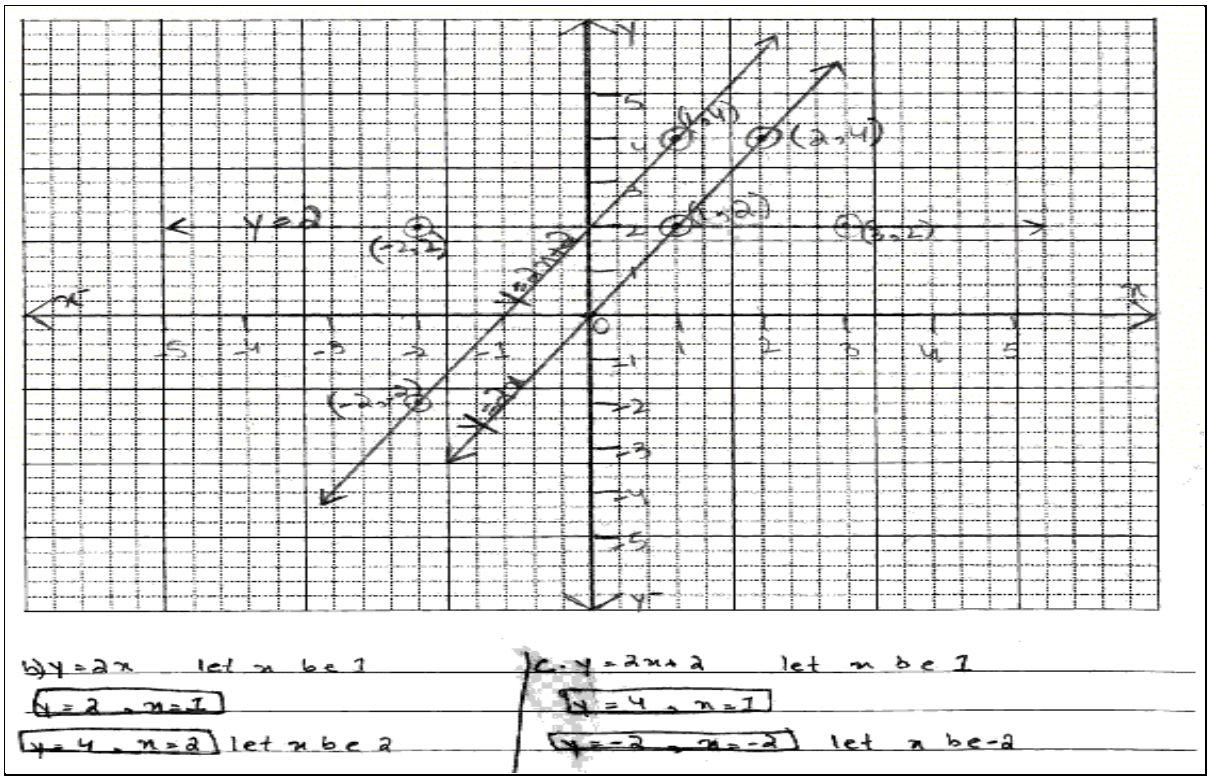
c. $y = 2x + 2$

(**Note:** For part b and c, find two points only for plotting each line.)



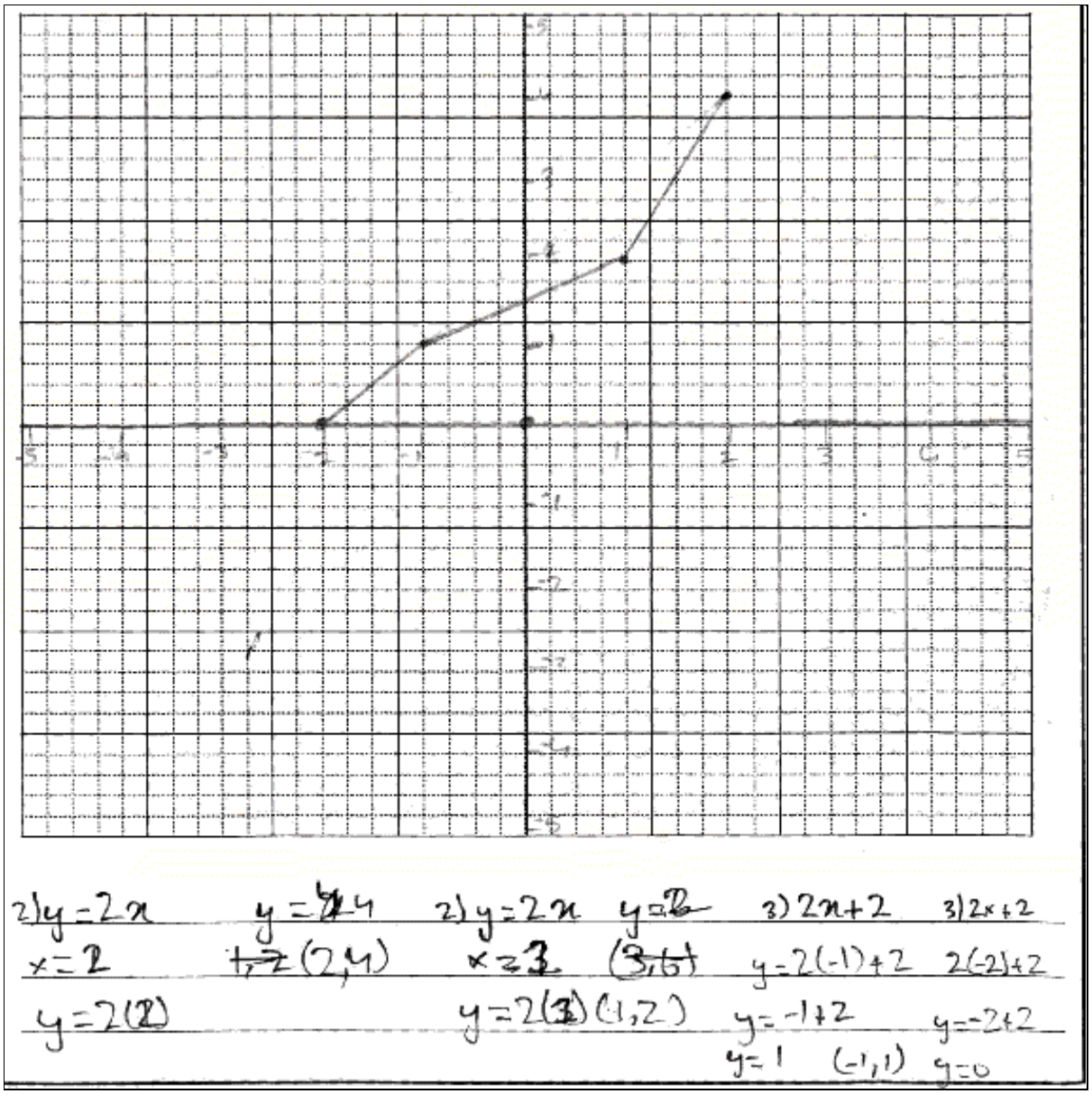
Better responses plotted the points for the lines correctly on the given graph. The *x*-axis and *y*-axis were made with proper scaling too. With this approach, they were able to get maximum marks and reflected their immaculate understanding.

Example:



Weaker responses reflected weak skills of plotting on a graph paper. The positive part of *x*-axis was left hand side instead of right hand side. The same was observed for *y*-axis. The given ordered pairs were plotted incorrectly because, candidates took the ordered pair as (*y*, *x*) instead of the standard (*x*, *y*). It was also noticed that some candidates joined all the lines which was needless, though some points were plotted correctly.

Example:



Question 10:

This question offered a choice between part **a** and part **b**. Candidates chose to attempt part **a** more than part **b**. Both parts were well-attempted.

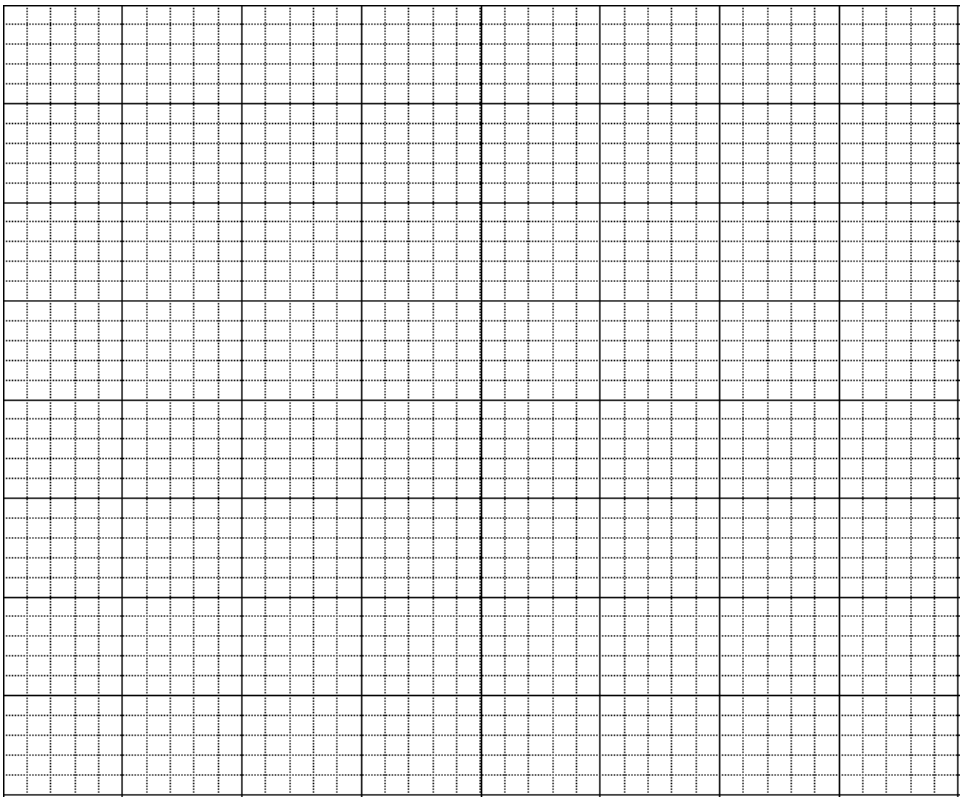
Question 10a:

a. The given table shows the length (in centimetres) of 28 leaves.

i. Find the class boundaries in the given table.

Length (cm)	1 – 5	6 – 10	11 – 15	16 – 20	21 – 25
Class Boundary					
Frequency	2	5	10	8	3
Cumulative Frequency	2	7	17	25	28

ii. After completing the table in part i, draw cumulative frequency curve of the given data and estimate the median graphically.



Better responses in part **i** displayed clear concepts of class boundary for the given grouped data. Part **ii** displayed correct drawing of cumulative frequency curve. Candidates took class intervals on *x*-axis and cumulative frequency on *y*-axis to plot the cumulative frequency that they found from the given data. This helped candidates to estimate the median from the graph very easily.

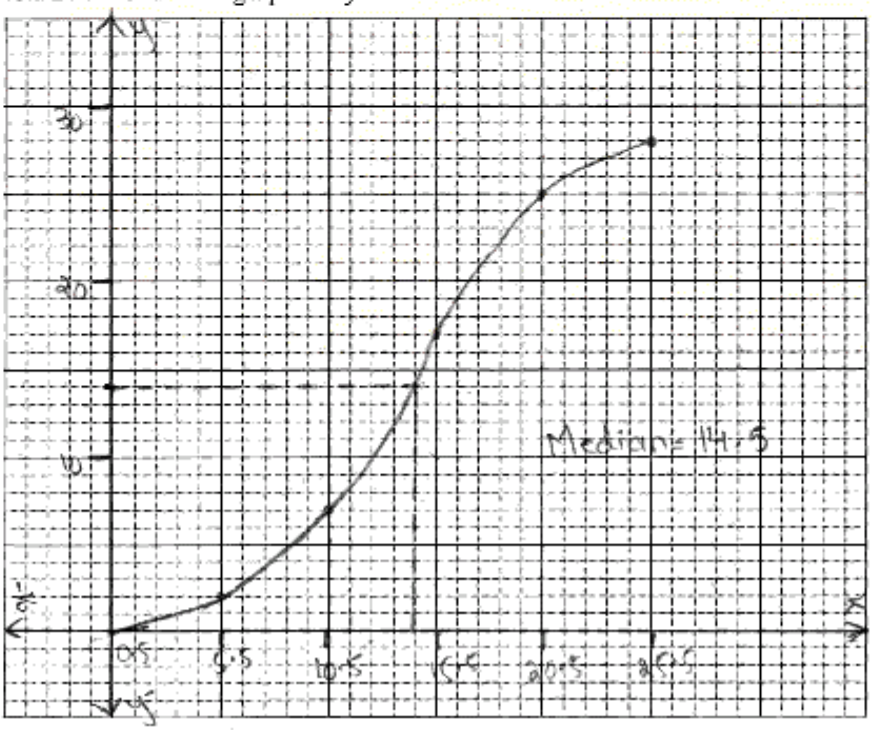
Example:

Length (cm)	1 – 5	6 – 10	11 – 15	16 – 20	21 – 25
Class Boundary	0.5-5.5	5.5 - 10.5	10.5 - 15.5	15.5 - 20.5	20.5-25.5
Frequency	2	5	10	8	3
Cumulative Frequency	2	7	17	25	28

Upper class boundary = 5.5 , 10.5 , 15.5 , 20.5 , 25.5

$\frac{n}{2} = \frac{28}{2} = 14$

ii. After completing the table in part i, draw cumulative frequency curve of the given data and estimate the median graphically. (5 Marks)



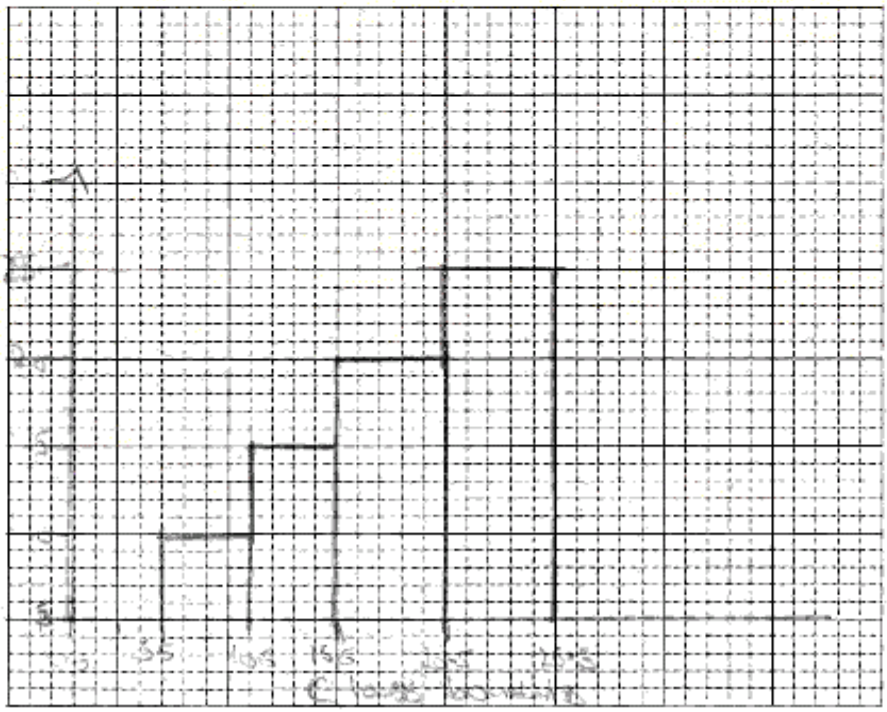
Weaker responses of part **i** reflected that candidates could not identify what is to be found in the blank columns. Some candidates found mid-point while others left blank but failed to find.

Part **ii** demonstrated the misconception among candidates that class boundaries were not required to draw the cumulative frequency curve (since the class intervals are not continuous, class boundaries are required). There were errors in scaling of graph such as taking cumulative frequency on *x*-axis and class intervals on *y*-axis. Many candidates plotted frequency curve, frequency polygon, histogram and cumulative frequency polygon instead of the required cumulative frequency curve. With these errors, they could not estimate the median graphically.

Example:

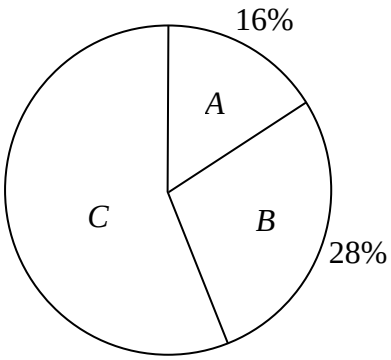
Length (cm)	1 – 5	6 – 10	11 – 15	16 – 20	21 – 25
Class Boundary	0.5 – 5.5	5.5 – 10.5	10.5 – 15.5	15.5 – 20.5	20.5 – 25.5
Frequency	2	5	10	8	3
Cumulative Frequency	2	7	17	25	28

ii. After completing the table in part i, draw cumulative frequency curve of the given data and estimate the median graphically. (5 Marks)



Question 10b:

In a survey, 400 employees of a company were asked their preferred lunch menu from choices *A*, *B* and *C*. The results are represented in the given pie chart.



NOT TO SCALE

Use the given information to complete the given table.

Menu	Percentage of Employee	Number of Employee	Angle of Sector
A	16%		
B	28%		
C			

Better responses indicated candidates' reading skills of Pie chart which helped them to achieve the maximum marks. They used the given information reasonably well in order to fill the required table.

Example:

Menu	Percentage of Employee	Number of Employee	Angle of Sector
A	16%	64	57.6°
B	28%	112	100.8
C	56	224	201.6

16% + 28% + 56% = 100%

$\frac{16}{100} \times 400 = 64$ $\quad 16 \times \frac{360}{100} = 57.6$

$\frac{28}{100} \times 400 = 112$ $\quad \frac{28}{100} \times 360 = 100.8$

$\frac{56}{100} \times 400 = 224$ $\quad \frac{56}{100} \times 360 = 201.6$

Weaker responses identified the lack of candidates' reading skills of Pie chart followed by incorrect working. A few candidates were able to find the percentage of employee for menu *C*. After that they got confused in finding the rest of entities as shown in the table.

Example:

Menu	Percentage of Employee	Number of Employee	Angle of Sector
A	16%	40	A
B	28%	100	B
C	56 %	260	C

400 employees, lunch menu A, B, C, % of employees :-
16 % + 28 % = 44% - 100 % = 56 %.
A % 16, B % 28, C % 56, No. of employees :-
A = 40, B = 100, C = 260 A + B + C => 40 + 100 + 260 =
400 employees.