2.1.4 Expected answers for Paper I, Marking scheme, Observations, Conclusions and Suggestions.

The details related to the questions in Paper I are taken from the graph 1 found on page 8 and the table found on page 16.

Part A

- Only 1 mark is allocated for each question from question No. 1 to No. 10. Here, only the basic concepts are tested, and hence even the final answer is accepted.
- 2 marks are allocated for each question from question No. 11 to No. 30. Candidates should be encouraged not to write only the final answer. It is important to write the correct steps which will secures partial marks even if the final answer is wrong. Candidates should also be educated to write the units in standard form.

1. Express 2 000 metres in kilometres.

Expected Answer 2 **1 mark**

Observations and conclusions

This question tests the knowledge and ability in converting units. The facility of the question is 88%. It is the question which is answered best out of the 30 questions in Paper I.

2. Solve: $5x = 20$

Expected Answer $x = 4$ or 4 **1 mark**

Observations and conclusions

This is a simple equation which can be solved in a single step. The facility of the question is 84%. Candidates should practice verifying the answer by substituting the obtained value in the original equation.

3. Simplify: $5a \times a^2$

Expected Answer $5a^3$ **1 mark**

Observations and conclusions

This question has been set to test the ability in using the basic laws of indices. The facility of the question is 60%. Candidates should practice simplifying indices using the basic laws of indices.

4. Find 60% of Rs 20.

Expected Answer Rs. 12 or 12 **1 mark**

Observations and conclusions

This question with facility of 75% tests the ability in calculating a certain percentage of a given quantity. The high facility is a favourable tendency.

5. If A = {integer multiples of 2} and B = {integer multiples of 3}, then write down one element of $A \cap B$.

Expected Answer Integral multiple of 6 **1 mark**

Observations and conclusions

This question tests the understanding on set operations and the ability to identify multiples of a given number. Its facility is 65%. It is important to emphasize the accurate procedure in answering questions related to sets.

6. Write down 101_{two} in base ten.

Expected Answer 5 **1 mark**

Observations and conclusions

This question tests the ability in converting a binary number into a decimal number. 33% of the candidates have answered this correctly. Here it is important to use the place value of the digits of the binary number accurately.

7. Make p the subject of the formula $pq - r = u$.

Expected Answer $p = \frac{u + r}{q}$ **1 mark**

Observations and conclusions

This question is set to measure the ability in making a required term the subject of a given formula. Only 58% have answered this question correctly. This skill can be enhanced by practicing making any term the subject of a formula.

8. Simplify: $\log_3 9$

Expected Answer 2 **1 mark**

Observations and conclusions

This question with facility of 33% tests the ability in calculating the logarithm of a number to a given base. A majority had failed to obtain the correct answer due to not identifying $9 = 3^2$, though they identified $9 = 3 \times 3$. It is important to train candidates to state the given expression as a logarithmic equation and understand the relationship between the logarithmic equation and the corresponding index equation.

9. Find the time taken by a vehicle travelling at a uniform speed of 100 kilometres per hour to travel a distance of 25 kilometres.

Expected Answer $\frac{1}{4}$ hr or $\frac{1}{4}$ 15 minutes or 15 **1 mark**

Observations and conclusions

This question can be answered using the unitary method or proportions. Facility of this question is 57%. Solving this type of questions should be practiced as it is necessary in day to day life.

10. If the sum of two interior angles of a triangle is 100°, write down the magnitude of the remaining interior angle in degrees.

Expected Answer 80° **1 mark**

Observations and conclusions

This is a simple geometrical problem based on the fact that the sum of the three interior angles of a triangle is 180°. Its facility is 81%.

11. The profit made by a trading company on Sunday is 20% more than the profit made on Monday. If the profit on Monday is Rs 8 000, then find the profit on Sunday.

Expected Answer Rs. 9600 or 9600 ..... (2) **2 marks**

$8000 \times \frac{120}{100}$ or $8000 \times \frac{20}{100}$ 1

Observations and conclusions

The facility of this question which has been given to test the knowledge on percentages is 60%. The knowledge on percentages should be further enhanced. This problem can also be solved by using the unitary method.

12. Find the least common multiple of the two algebraic expressions $x(x + 2)$ and x^2.

Expected Answer $x^2 (x + 2)$ **2 marks**

Observations and conclusions

This question which measures the ability in finding the L.C.M. of algebraic expressions has a low facility of 20%. This low facility level is due to the lack of familiarity with the method of finding the L.C.M. of algebraic terms and expressions. Therefore, it is important to get the candidates engaged in doing more exercises for a better understanding.

13. Find the factors: $x^2 + 3x - 10$

Expected Answer $(x + 5)(x - 2)$ ..... (2) **2 marks**

$x^2 + 5x - 2x - 10$ 1

Observations and conclusions

This question on factorizing a trinomial quadratic expression has a facility of 49%. The lack of understanding on simplifying integers and not expressing $3x$ as $5x - 2x$ has resulted in the failure to obtain the answer. Exercises should be done with an understanding of the rules of simplifying integers.

14. If the two events A and B are mutually exclusive and $P(A) = P(B) = \frac{1}{5}$, then find $P((A \cup B)')$.

Expected Answer $\frac{3}{5}$ ..... (2)

$P(A \cup B) = \frac{1}{5} + \frac{1}{5}$ ..... 1 **2 marks**

Observations and conclusions

The facility of this question is 22%. The candidates seem to have forgotten the requirement for two events to be mutually exclusive and the fact that the sum of the probability of an event and the probability of its complement is one.

15. The first Rs 500 000 of the annual income of a person is free of income tax and the next Rs 500 000 is subject to 4% income tax. Find the income tax that should be paid by a person who earns an annual income of Rs 600 000.

Expected Answer Rs. 4000 or 4000 ..... (2) **2 marks**

Identifying Rs. 100 000 1

Observations and conclusions

The facility of this question is 31%. Attention has not been paid to the tax free income and this has caused the low facility. This weakness can be overcome by solving more exercises related to calculating income taxes.

16. If a bank pays an annual compound interest rate of 10%, find the total amount of money at the end of two years, in an account opened with a deposit of Rs 100 in this bank.

Expected Answer Rs. 121 ..... (2) **2 marks**

$100 \times \frac{110}{100}$ or $100 + 100 \times \frac{10}{100}$ or

$100 \times \frac{110}{100} \times \frac{110}{100}$ 1

Observations and conclusions

This problem on compound interest has a facility of 49%. Obtaining the interest by calculating the simple interest for two years was a common weakness witnessed here. The fact that the method of calculating compound interest differs from that of simple interest, should be understood and practiced.

17. The second and third terms of a geometric progression are 6 and 18 respectively. Find its

(i) common ratio

(ii) first term.

Expected Answer (i) 3 ..... (1)

(ii) 2 ..... (1) **2 marks**

Observations and conclusions

The facility of this simple geometric progression problem is 52% due to not using the method of obtaining the common ratio accurately. Problems related to finding the common ratio and another term using given consecutive terms should be practiced more.

18. Solve the inequality $1 - 2x \leq 7$.

Expected Answer $x \geq -3$ ..... (2)

$-2x \leq 7 - 1$ or $1 - 7 \leq 2x$ ..... 1 **2 marks**

Observations and conclusions

The facility of this question on solving an inequality is 31%. It is mainly due to the unawareness of the fact that the inequality changes when divided by a negative integer. More exercises that consolidate the features of inequalities should be done to minimize this weakness.

19. If the straight line given by the equation $y = 2x + c$ passes through the point $(1, 5)$, then find the value of c.

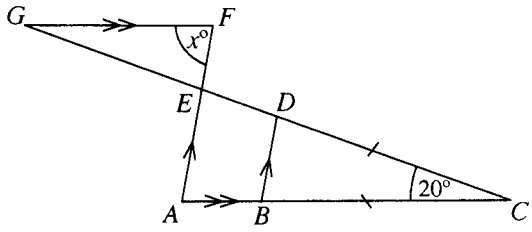
Expected Answer 3 ..... (2)

$5 = 2 \times 1 + c$ ..... 1 **2 marks**

Observations and conclusions

The facility of this question on finding the intercept of the graph of a straight line is 29%. The inability to identify that the co-ordinates of a point on a straight line satisfy the equation is the reason for this low facility. Candidates should be involved in exercises to establish the fact that by substituting the co-ordinates of a given point in the equation of the function m or c can be found.

20. Using the information given in the figure, find the value of x.



Expected Answer

80 or 80° ..... (2)

Identifying $\hat{CBD}$, $\hat{CDB}$, $\hat{BAE}$ or

$\hat{DEA} = 80^\circ$ or x°

or identifying $\hat{FGE} = 20^\circ$ 1

2 marks

Observations and conclusions

The facility of this question on angles related to parallel lines and isosceles triangles is 51%. This is due to not identifying alternate angles and corresponding angles and the angles in an isosceles triangle. This weakness can be overcome by encouraging candidates to do different exercises on angles related to parallel lines as well as triangles.

21. Given that $\begin{pmatrix} -1 & 0 \\ x & y \end{pmatrix} + \begin{pmatrix} 3 & 2 \\ 0 & x \end{pmatrix} = 2\begin{pmatrix} 1 & 1 \\ 2 & 6 \end{pmatrix}$, find the values of x and y.

Expected Answer $x = 4$ ..... (1)

$y = 8$ ..... (1)

2 marks

Observations and conclusions

This question which tests the knowledge on adding matrices and multiplying a matrix by a whole number has a facility of 39%. The correct answer can be achieved by identifying corresponding elements correctly and building up relationships between x and y.

22. The circumference of the base of a cone is 16π centimetres. Find

(i) the radius of the base

(ii) the perpendicular height if the slant height is 10 cm.

Expected Answer (i) 8 cm or 8 ..... (1)

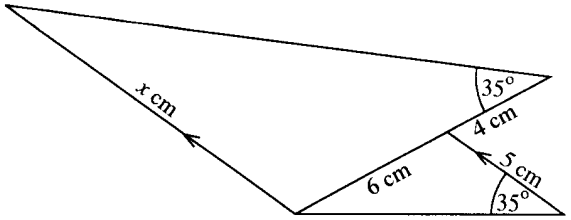
(ii) 6 cm or 6 ..... (1)

2 marks

Observations and conclusions

The facility of this question related to measurements is 37%. The inability to visualize the circular base of a cone or not drawing it, could have been the cause for the low facility. The radius of the base can be found using the formula for the circumference while the perpendicular height can be found using Pythagoras' relation. Solving such questions on measurements, is facilitated by the use of diagrams.

23. Using the knowledge on equi-angular triangles and the information given in the figure, find the value of x.



Expected Answer

12 ..... (2)

$\frac{x}{6} = \frac{10}{5}$ or for a suitable equation or suitable ratio 1

2 marks

Observations and conclusions

The facility of this question which tests the knowledge on equiangular triangles is 25%. The principal reason for this is that candidates have not identified the corresponding sides of the equiangular triangles properly. It can be improved by providing more exercises on equiangular triangles of different shapes.

24. Write down an expression, in terms of n, for the sum of the first n terms of a geometric progression whose first term is 1 and common ratio is 2.

Expected Answer $2^n - 1$ or $\frac{1(2^n - 1)}{2 - 1}$ or $\frac{1(1 - 2^n)}{1 - 2}$ ..... (2) **2 marks**

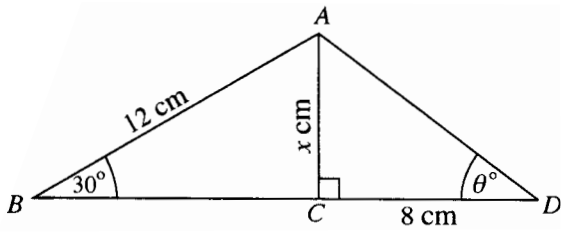
Observations and conclusions

The facility of this question based on geometric progressions under the theme Numbers is 15%. It is important to provide more practice on using the formula for the sum of a geometric progression, as well as using given data appropriately.

25. Using the information given in the figure and the fact that $\sin 30° = \frac{1}{2}$, find

(i) the value of x

(ii) the value of $\tan \theta°$.



Expected Answer

(i) 6 cm or 6 ..... (1)

(ii) $\frac{6}{8}$ or $\frac{3}{4}$ or 0.75 or an equivalent value ..... (1) **2 marks**

Observations and conclusions

The facility of this question is 43%. The candidates have failed to apply the correct trigonometric ratios according to the given data, to obtain the correct answer for this question. One can reach the required achievement level by answering similar exercises constantly.

26. Considering the expansion of $(x - y)^3$, find the value of $2\left(24^3 - 3 \times 24^2 \times 4 + 3 \times 24 \times 4^2 - 4^3\right)$.

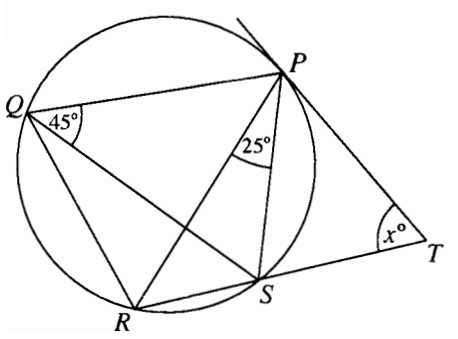
Expected Answer 16 000 ..... (2)

$(24 - 4)^3$ or simplifying each term or 8 000 ..... 1 **2 marks**

Observations and conclusions

This question with 12% facility is the question in part A of paper I answered successfully by the least number of candidates. It is important to enhance the student's ability to solve such questions by paying more attention to finding the cube of an algebraic expression.

27. A tangent is drawn to the circle at P as shown in the figure. Using the given information, find the value of x.



Expected Answer

65 or 65° ..... (2)

$\hat{PRS} = \hat{SPT} = 45^\circ$ or

$\hat{RQS} = 25^\circ$ or $\hat{PST} = 70^\circ$ 1

2 marks

Observations and conclusions

The facility of this question on Geometry is 22%. The candidates have failed to use the theorem correctly. They must be able to identify the geometric theorem related to the question and should be encouraged to do more exercises on such calculations.

28. The surface area of a solid sphere of radius 2 cm is A cm^2. The area of the curved surface of a solid cylinder of radius and height 2 cm each is B cm^2. Find the value of $\frac{A}{B}$. (The surface area of a solid sphere of radius r is $4\pi r^2$ and the area of the curved surface of a solid cylinder of radius r and height h is $2\pi rh$.)

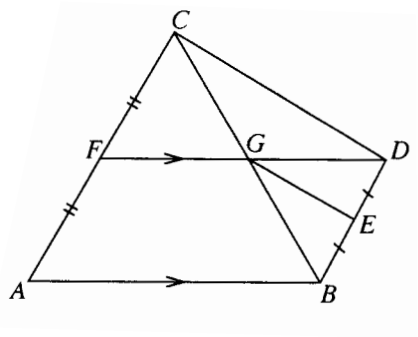
Expected Answer 2 ..... (2)

$A = 4\pi 2^2$ or $B = 2\pi\ (2)(2)$ ..... 1 **2 marks**

Observations and conclusions

The facility of the question is 31%. Although this is an easy question where the answer can be obtained by substituting values into the relevant formula, a majority of the candidates have failed to answer it correctly. Therefore they must learn how to use the knowledge gained from the lesson on measurements correctly and contextually.

29. In the figure, the area of triangle ABC is twice that of triangle BCD. Using the given information, find the ratio of the area of triangle CFG to the area of triangle BEG.



Expected Answer

$2 : 1$ or $BEG\,\Delta : CFG\,\Delta = 1 : 2$ ..... (2)

$1 : 2$ or $4(BEG\,\Delta) = BCD\,\Delta$ or

$4(CFG\,\Delta) = ABC\,\Delta$ or

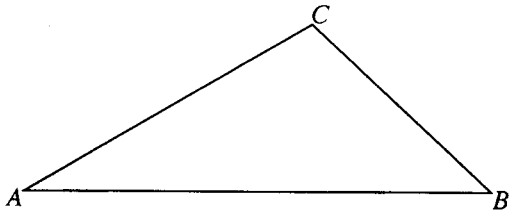
For relationship between the areas of two suitable triangles. 1

2 marks

Observations and conclusions

This question based on the areas of plane figures between two parallel lines has a facility of 32%. The main reason for this is that many candidates dislike geometry. Geometry enhances the logical skills of candidates. Therefore it is important to pay more attention to it.

30. In triangle ABC shown in the figure, draw a sketch of the construction lines required to locate the point D on AB such that $DB = DC$.



Expected Answer

Perpendicular bisector of BC 1

Marking D 1

2 marks

Observations and conclusions

The facility of this question on geometrical loci is 26%. It is more productive to relate questions on loci to natural phenomena for students to practice applying the knowledge on loci to real situations.

Part B

1. Ananda had a small library. $\frac{1}{6}$ of the books in the library were children's story books and $\frac{1}{4}$ were literature books. Ananda donated these children's story books and literature books to the village school.

(i) Find what fraction of the total number of books was donated.

$\frac{1}{4} + \frac{1}{6} = \frac{3+2}{12} = \frac{5}{12}$ $\quad 1 + 1 + 1$ **3 Marks**

- **The number of books donated was 150**

(ii) Find the total number of books that were originally in the library.

$150 \times \frac{12}{5} = 360$ $\quad 1 + 1$ **2 Marks**

- **Of the remaining books, Ananda gave 60 to a neighbour**

(iii) Find what fraction of the total number of books that were originally in the library was given to the neighbour.

$\frac{60}{360}$ or $\frac{1}{6}$ or an equivalent fraction **1 Mark**

- **After giving to the neighbour, Ananda sold $\frac{3}{5}$ of the remaining books.**

(iv) Find what fraction of the total number of books that were originally in the library was sold.

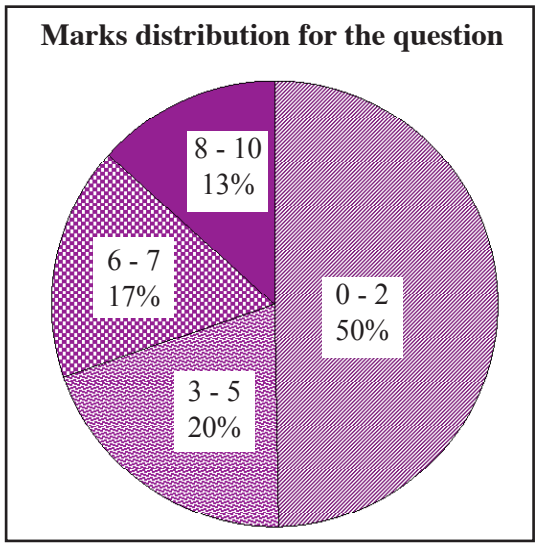
Fraction donated and given to neighbour $= \frac{5}{12} + \frac{1}{6} = \frac{7}{12}$ 1

$\therefore$ Remaining fraction $= \frac{5}{12}$ 1

$\therefore$ Fraction sold $= \frac{5}{12} \times \frac{3}{5}$ 1

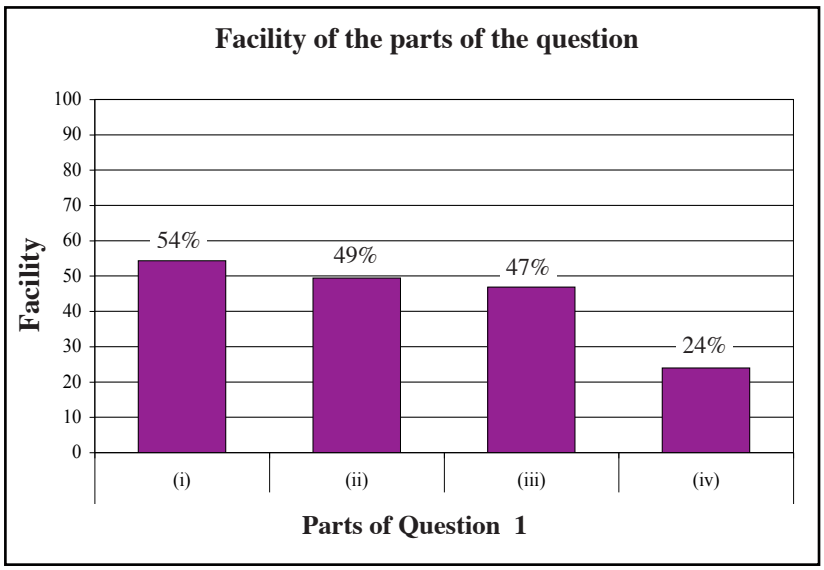
$= \frac{1}{4}$ ..... 1 **4 Marks**

Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Numbers' carries 10 marks. Of the candidates who answered this question,
about 50% have obtained marks in the interval 0 - 2,
about 20% have obtained marks in the interval 3 - 5,
about 17% have obtained marks in the interval 6 - 7,
and about 13% have obtained marks in the interval 8 - 10.

70% of the candidates have obtained 5 marks or less for this question. Only 13% have obtained 8 marks or more.



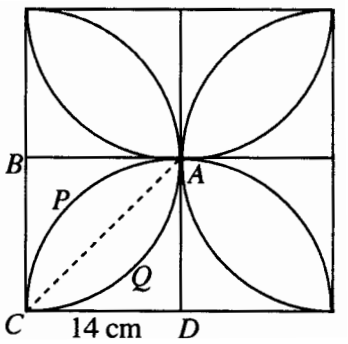
This question consists of 4 parts. The easiest part has been part (i) with a facility of 54%. The most difficult part has been part (iv) with a facility of 24%.

The first question of part B of mathematics Paper I is based on fractions under the theme 'Numbers'. Its facility is 33%.

Part (i) has a facility of 54% and it is given to evaluate the ability in adding fractions. The facility of part (ii) is 49%. Here the reverse calculation in obtaining the answer is at a satisfactory level. The facility of part (iii) is 47%. This part depends on the correct answer to part (ii), so its facility has decreased. The facility of part (iv) is 24%. The answer to this part depends on the correct answer to parts (i) and (ii). Therefore its facility too has decreased.

The candidates should enhance their skills in reading and understanding fraction problems as well as in simplifying fractions, to get the correct answer.

2. A wall decoration, consisting of four equal parts, is shown in the figure. One of the parts is a square $ABCD$, with each side 14 cm long, containing a petal-like shape $APCQ$. Here, $APCD$ and $AQCB$ are sectors with centres D and B respectively.



In the following calculations, take the value of π as $\frac{22}{7}$ wherever necessary.

(i) Find the area of the triangle ABC.

$\frac{1}{2} \times 14 \times 14 = 98 \text{ cm}^2$ 1 + 1 **2 Marks**

(ii) Find the area of the sector $AQCB$.

$\frac{1}{4} \times \frac{22}{7} \times 14 \times 14 = 154 \text{ cm}^2$ 1 + 1 **2 Marks**

(iii) Find the area of the petal-like shape $APCQ$.

Area of AQC = 154 – 98 1

Area of $APCQ$ = 2 × 56 = 112 cm^2 1

(iv) Find the perimeter of the composite figure consisting of only the four petal-like shapes

$2 \times \frac{22}{7} \times 14$ 1

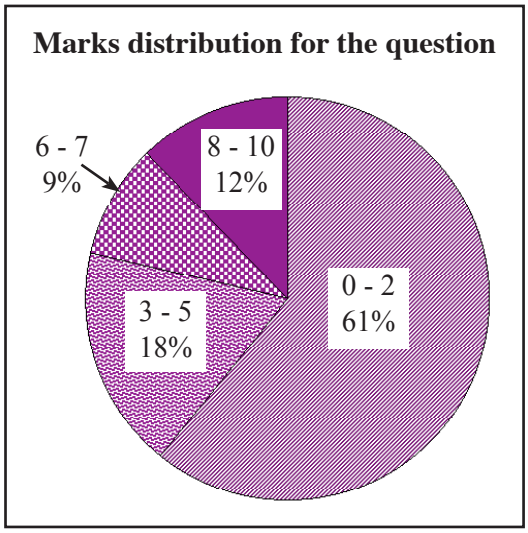
Perimeter = $2 \times (2 \times \frac{22}{7} \times 14) = 176$ cm ..... 1 **2 Marks**

(v) If it is needed to attach beads along the boundary of the composite figure considered in part (iv) above, starting from the point A, and lying 5.5 cm apart when measured along the boundary, find the required number of beads.

29 **2 Marks**

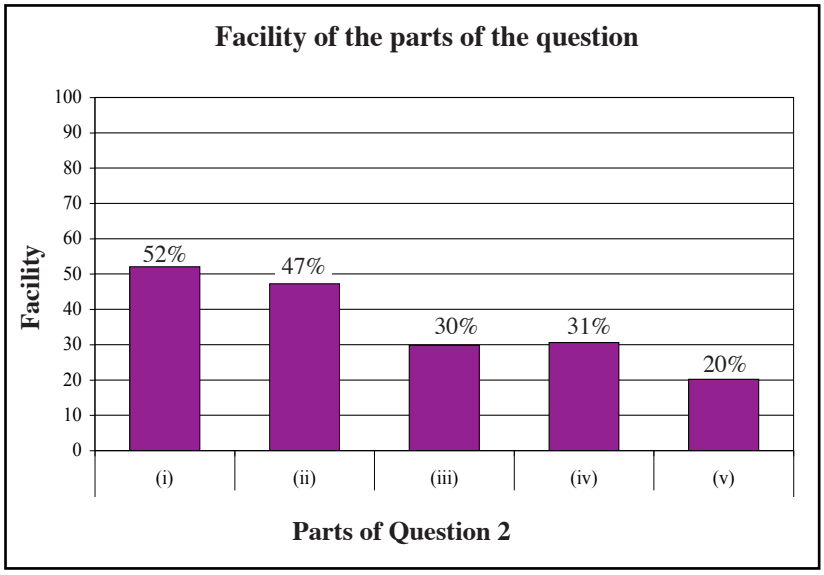
$\frac{22}{5.5}$ or $\frac{176}{5.5}$ or $\frac{44}{5.5}$ 1

Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Measurements' carries 10 marks. Of the candidates who answered this question,
about 61% have obtained marks in the interval 0 - 2,
about 18% have obtained marks in the interval 3 - 5,
about 9% have obtained marks in the interval 6 - 7,
and about 12% have obtained marks in the interval 8 - 10.

79% of the candidates have obtained 5 marks or less for this question. Only 12% have obtained 8 marks or more.



This question consists of 5 parts. The easiest part has been part (i) with a facility of 52%. The most difficult part has been part (v) with a facility of 20%.

The facility of this question on perimeter and area under the theme 'Measurements' is 27%.

The facility of part (i) is 52%. This is due to the failure to identify the right triangle in the diagram, to find the area. The facility of part (ii) is 47%. This is due to the weakness in identifying the right sector in the diagram and due to the incorrect calculation of the area of the sector.

The facility of part (iii) is 30%. The accuracy of this answer depends on obtaining the correct answers to parts (i) and (ii). The area of the whole petal can be found by considering the area of half the petal. The facility of part (iv) is 31%. Lack of observation of the relationship between the shape of a flower petal and the circumference of a circle has caused this low facility level. The facility of part (v) is 20%. This is due to the lack of practice in using classroom knowledge in practical contexts.

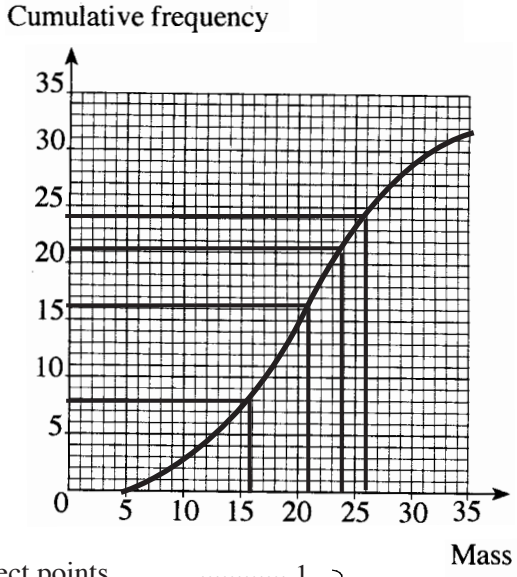
Practice in analyzing diagrams and using mathematical concepts practically will help immensely in answering these types of questions. The ability to use formulae to calculate the area of a sector and the length of an arc needs to be improved.

3. An incomplete table containing information on the masses (in kg) of children brought to a clinic is shown below.

Class interval (mass)	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30	30 – 35
Frequency (number of children)	2	5	8	8	6	3
Cumulative frequency	2	7	15	23	29	32

(i) Complete the cumulative frequency row of the table. **1 mark for two correct values** **2 Marks**

(ii) Using the table, draw the cumulative frequency curve on the given coordinate plane.



for 3 correct points 1
smooth curve 1
connecting curve to point 5 1
3 Marks

Using the cumulative frequency curve, find the following:

(iii) median

$\frac{32}{2}$ = 16^{th} one $\Rightarrow$ 21 kg **1 Mark**

(iv) first quartile, third quartile and the interquartile range

$\frac{32}{4}$ = 8^{th} one $\Rightarrow$ 16 kg 1

$\frac{3}{4} \times 32$ = 24^{th} one $\Rightarrow$ 26 kg 1

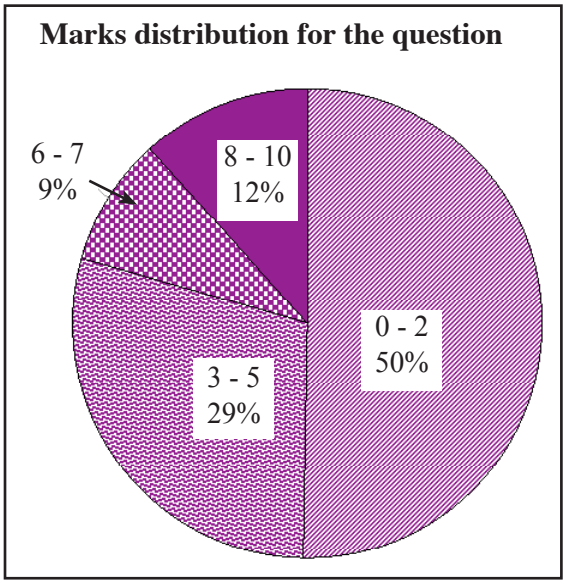
$Q_3 - Q_1 = 26 - 16 = 10$ kg 1

3 Marks

(v) the number of children whose mass is 24 kg or more.

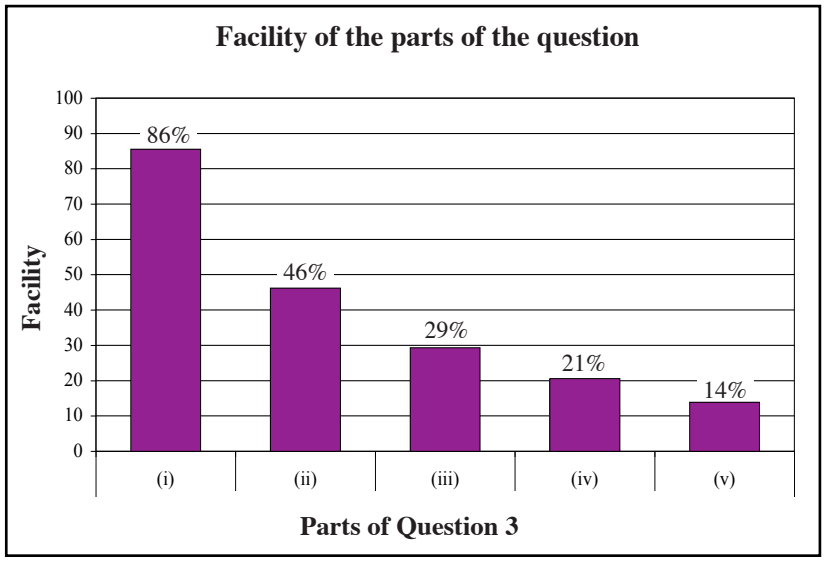
11 **1 Mark**

Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Statistics' carries 10 marks. Of the candidates who answered this question,
about 50% have obtained marks in the interval 0 - 2,
about 29% have obtained marks in the interval 3 - 5,
about 9% have obtained marks in the interval 6 - 7,
and about 12% have obtained marks in the interval 8 - 10.

79% of the candidates have obtained 5 marks or less for this question. Only 12% have obtained 8 marks or more.



This question consists of 5 parts. The easiest part has been part (i) with a facility of 86%. The most difficult part has been part (v) with a facility of 14%.

This question presented under the theme 'Statistics' has a facility of 34%.

Part (i) has a facility of 86%. Knowledge on finding the cumulative frequency is at a satisfactory level. The facility of part (ii) is 46%. Even though they have obtained the correct cumulative frequencies, they have made mistakes when drawing the cumulative frequency curve. Not marking the points, not drawing a smooth curve and not identifying the end points properly have caused this low facility level. The facility of part (iii) is 29%. This is due to not using the correct method in finding the median.

The facility of part (iv) is 21%. This might be due to not knowing the correct concept of quartiles. Only 14% of the candidates have answered part (v) correctly. The reason for it is the weakness in communicating the information in the graph.

Engaging in exercises on drawing cumulative frequency curves and answering questions based on the curves will help to overcome this weakness.

4. (*a*) The ratio of the income from apparel exports to the income from tea exports in Sri Lanka was 10 : 3 in 2006.

(i) In 2006, if the income from tea exports was 90 billion rupees, then find the income from apparel exports in billions of rupees.

$90 \times \frac{10}{3}$ 1

300 ..... 1 **2 Marks**

During the same year, the income from gem exports was 260 billion rupees less than the income from apparel exports.

(ii) Find, in the simplest form, the ratio of the export incomes from tea to apparels to gems.

Income from gem export = 300 – 260 = Rs. 40 billion 1

90 : 300 : 40 1

9 : 30 : 4 ..... 1 **3 Marks**

(*b*) The food stock at a camp is sufficient for 15 days for the 60 soldiers stationed there After 3 days, 20 more soldiers join the camp.

(i) Find for how many days the remaining stock of food is sufficient for the 80 soldiers.

Food stock at the beginning = 60 × 15 = 900 1

Remaining food = 900 – 180

= 720 or 12 × 60 1

Number of days sufficient for 80 = $\frac{720}{80}$ = 9 ..... 1 **3 Marks**

or

Number of days sufficient for 80 = $\frac{12 \times 60}{80}$ 2

= 9 ..... 1 **3 Marks**

After 2 more days, the camp receives a stock of food sufficient for 10 soldiers for 16 days.

(ii) Find for how many days the total stock of food in the camp at present would be sufficient for the 80 soldiers.

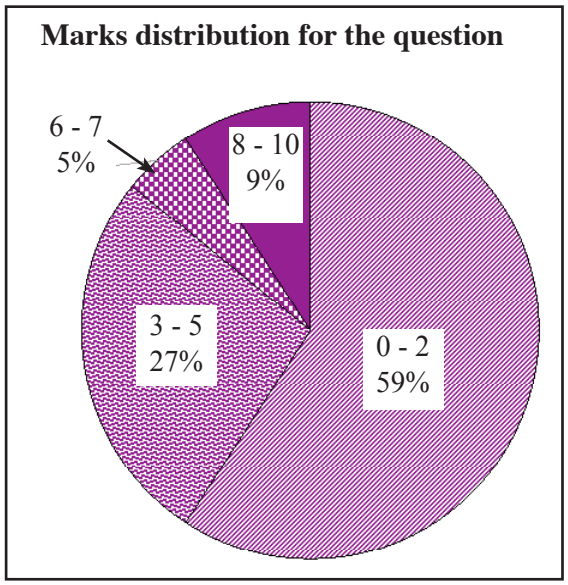
Amount of food stock after 2 more days = 80 × 7 + 10 × 16

= 720 1

Number of days sufficient for 80 = $\frac{720}{80}$

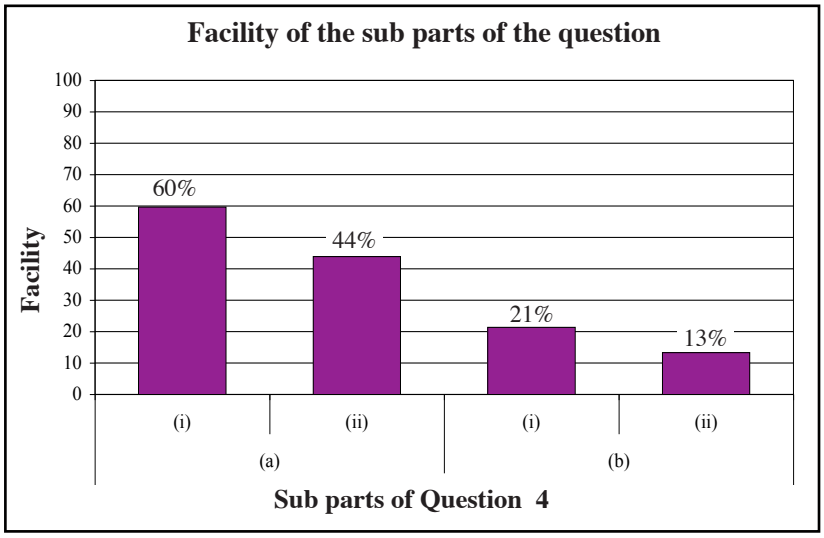
= 9 ..... 1 **2 Marks**

Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Numbers' carries 10 marks. Of the candidates who answered this question,
about 59% have obtained marks in the interval 0 - 2,
about 27% have obtained marks in the interval 3 - 5,
about 5% have obtained marks in the interval 6 - 7,
and about 9% have obtained marks in the interval 8 - 10.

86% of the candidates have obtained 5 marks or less for this question. Only 9% have obtained 8 marks or more.



This question consists of 4 sub parts. The easiest sub part has been sub part (a)(i) with a facility of 60%. The most difficult sub part has been sub part (b)(ii) with a facility of 13%.

This question under the theme 'Numbers' and about ratios and proportions has a facility of 26%.

Part (a)(i) has a facility of 60%. This can be easily answered by using the unitary method. It is at a satisfactory level. The facility of part (a)(ii) is 44%. Not calculating the export income using the given data and lack of competency in manipulating the relationships between the terms of the ratios have caused this decrease.

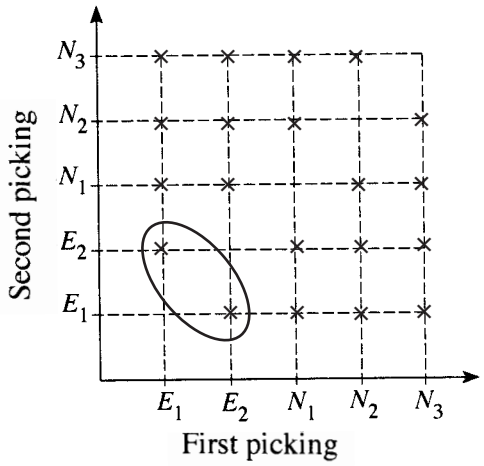
The facility of sub part (b)(i) is 21% and that of sub part (b)(ii) is 13%. These parts are given to test the knowledge on inverse proportions. Not writing the correct proportions when using inverse proportions has caused a low facility level.

To answer this type of question, the candidate's language skills and communication skills need to be at a high level. And they should also engage in doing relevant exercises.

5. In a box, there are 5 bottles of fruit juice of the same type and size. Of them, 2 are expired and the other 3 are nearly expired. A lab assistant picks a bottle from the box randomly and **without replacement**, he picks another bottle randomly.

An incomplete grid prepared to represent the sample space relevant to this random experiment is given in the figure. Here E_1 and E_2 denote the expired bottles and N_1, N_2 and N_3 denote the nearly expired bottles.

(i) Indicate the sample space in the grid using the mark '×'.



For marking the sample space **2 Marks**

(ii) In the grid, enclose the event of "the two bottles picked being expired", and find its probability.

For marking in the grid 1

$\frac{2}{20}$ or equivalent fraction 2

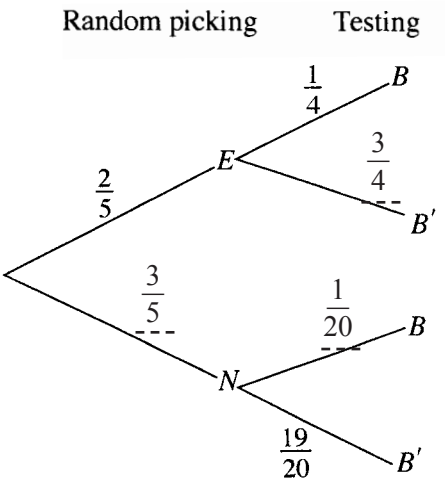
(for numerator of $\frac{2}{20}$ 1
for denominator of $\frac{2}{20}$ ..... 1)

3 Marks

The assistant replaces both bottles in the box. After that, a researcher picks a bottle randomly from the same box and tests the juice in it for the presence of a certain bacteria.

An incomplete tree diagram relevant to this random experiment is shown in the figure below, where E denotes the bottle being expired, N denotes the bottle being nearly expired, B denotes the presence of the bacteria and B' denotes the absence of the bacteria.

(iii) Write down the relevant probabilities in the tree diagram.



For writing correct values in the tree diagram ..... 1 + 1 + 1

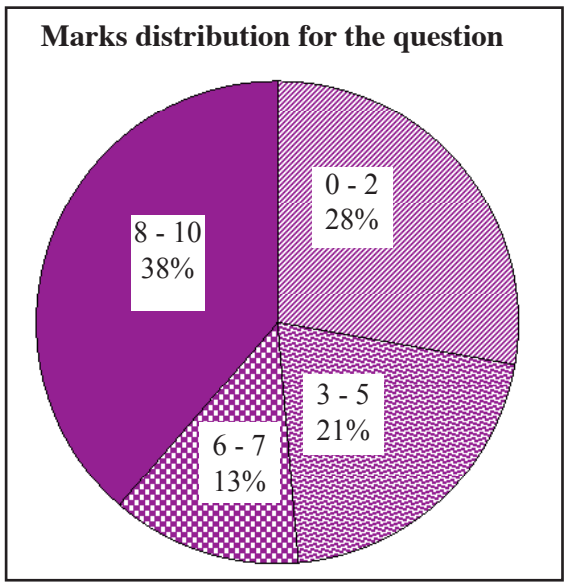
3 Marks

(iv) Find the probability that the juice in the bottle picked contains the bacteria.

$\left(\frac{2}{5} \times \frac{1}{4}\right) + \left(\frac{3}{5} \times \frac{1}{20}\right)$ 1

$\frac{13}{100}$ ..... 1 **2 Marks**

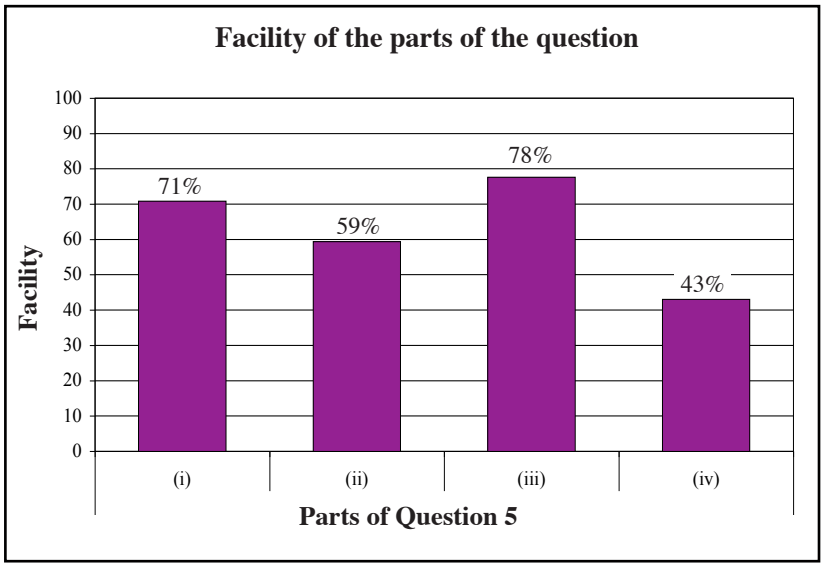
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Sets and Probability' carries 10 marks. Of the candidates who answered this question,

about 28% have obtained marks in the interval 0 - 2,
about 21% have obtained marks in the interval 3 - 5,
about 13% have obtained marks in the interval 6 - 7,
and about 38% have obtained marks in the interval 8 - 10.

49% of the candidates have obtained 5 marks or less for this question. Only 38% have obtained 8 marks or more.



This question consists of 4 parts. The easiest part has been part (iii) with a facility of 78%. The most difficult part has been part (iv) with a facility of 43%.

The facility of this question under the theme 'Probability' is 53%. This is the question in part B of Paper I with the highest facility.

The facility of part (i) is 71%. The ability in marking the sample space in the grid is at a satisfactory level. The facility of part (ii) is 59%. Failure to identify and mark the relevant event on the grid as well as the inability to calculate the probability have caused the low facility. The facility of part (iii) is 78%. Most candidates have marked the relevant probability on the given tree diagram correctly. This is the reason for the satisfactory high facility recorded here. The facility of part (iv) is 43%. Unfamiliarity in using the tree diagram to reach the expected answer for the question has caused this drop in facility.

When the sample space of a random experiment is represented in a grid, it should be correctly identified whether the experiment is done with replacement or not. It is necessary to mark the outcomes of the experiment in the grid correctly. Furthermore how the probability is calculated should be shown. Competency in the multiplication of fractions and the addition of fractions help to overcome these weaknesses.

2.2 Paper II

2.2.1 Structure of Paper II

Time : Two hours and thirty minutes, Marks : 50

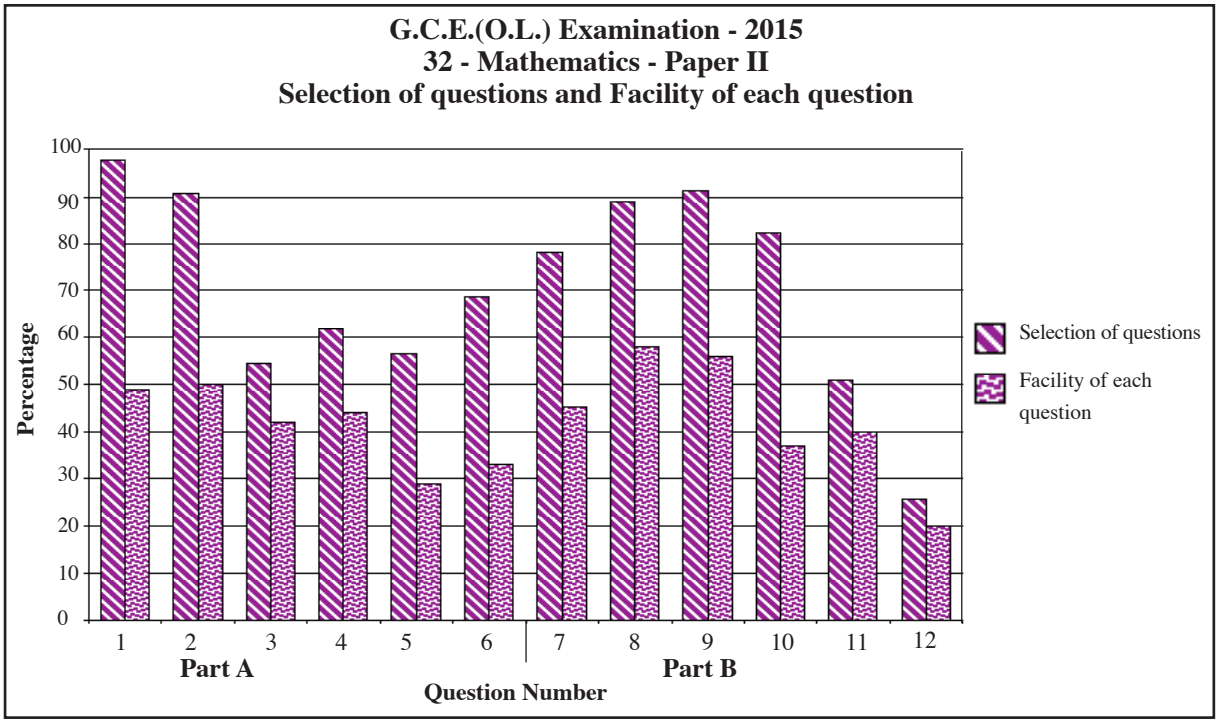
This question paper consists of 12 structured essay type questions based on the six themes Numbers, Measurements, Algebra, Geometry, Statistics, Sets and Probability. It contains two parts, Part **A** and Part **B**. It is expected that answers will be provided for 5 of the 6 questions in Part **A** and 5 of the 6 questions in Part **B**, totaling 10 questions.

10 marks are allocated for each question totaling 100 marks.

Final marks for Paper II = 100 ÷ 2 = 50

2.2.2. Overall observations on the answers to Paper II

Candidates are expected to answer five questions selected from Part **A** which consists of questions number 1 to 6, and another five questions selected from Part **B** which consists of questions number 7 to 12. Total number of questions to be answered is 10.



Graph 7.I (Based on the information gathered from the forms RD/16/02/OL and RD/16/04/OL)

Part A

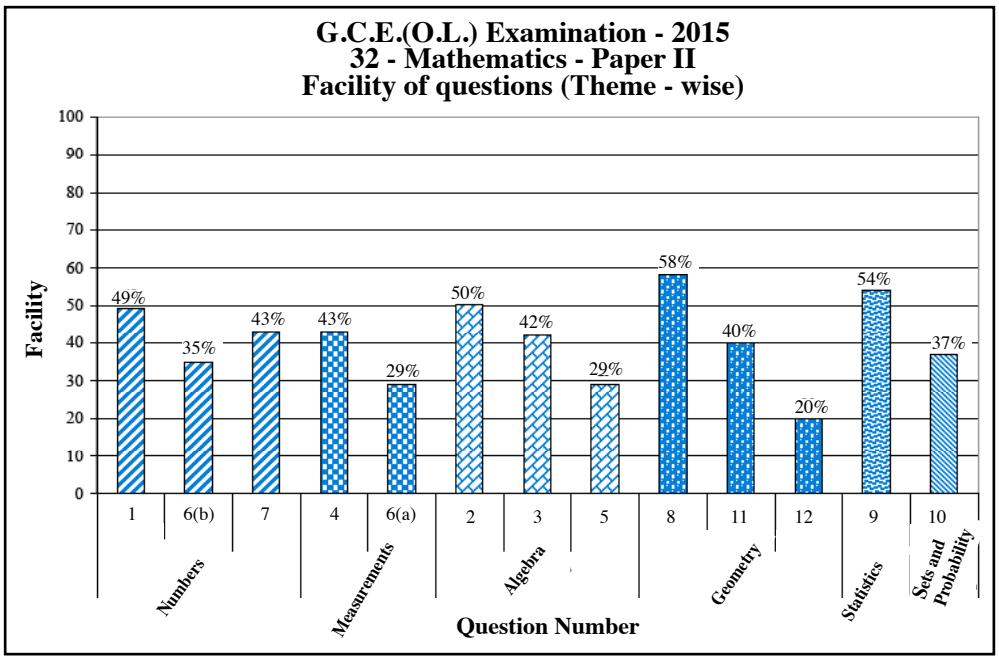
According to this graph, 98% of the candidates have selected question number 1 from the 6 questions in Part A of Mathematics Paper II. Its facility is 49%. This is the question from this part with the highest selection. It comes under the theme 'Numbers' and is based on the subject matter percentages, shares, dividends and compound interest. Question number 3 has the least selection and it is 55%. The facility of question number 3 is 42%. It is based on solving equations using the method of completing the square, under the theme 'Algebra'. Of the 6 questions in Part A, question number 2 has the highest facility and question number 5 has the lowest facility. The facilities of these two questions are 50% and 29% respectively. Question 2 is based on the graph of a quadratic function and question 5 is based on algebraic expressions, and constructing simultaneous equations and solving them. Hence the hardest question and the easiest one in Part A are based on the theme 'Algebra'.

Part B

The questions with the highest selection and the lowest selection in Part B of Mathematics Paper II are questions number 9 and number 12 respectively. Their percentages of selection are 91% and 26% respectively. Of the 6 questions in Part B, the questions with the highest facility and the lowest facility are questions number 8 and 12 respectively. Their facilities are 58% and 20% respectively. Question 9 is on Statistics. It has earned the highest preference in selection. But candidates have gained more marks by answering question number 8 which is based on constructions. Question number 12 which is based on Geometry has the lowest selection. Most of the candidates who have selected question 12 have failed to obtain high marks for it.

When Mathematics Part II is considered overall, question 8 has been the easiest question and question 12 the most difficult. Facility level of 50% or above has been achieved for question numbers 2, 8 and 9 only.

2.2.3. Observations (theme - wise) based on the answers to Paper II

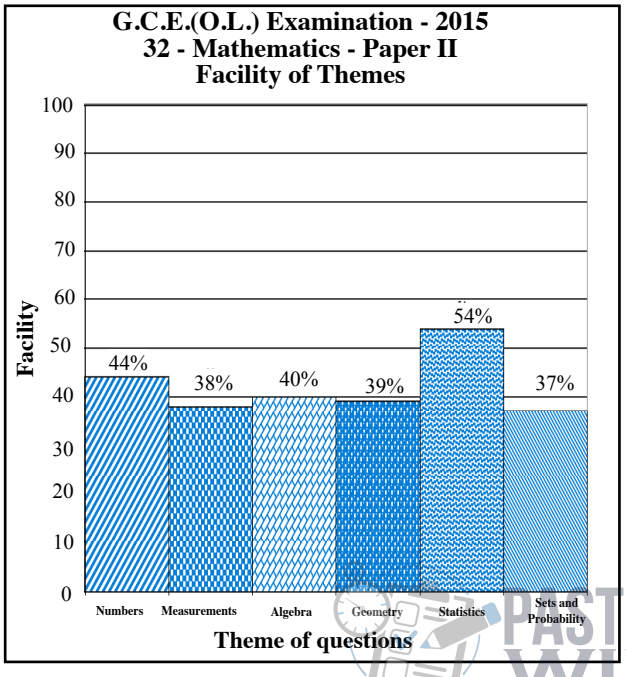


Graph 7.II

Theme	Question of Part A	Question of Part B
1. Numbers	1, 6 (b)	7
2. Measurements	4, 6 (a)	-
3. Algebra	2, 3, 5	-
4. Geometry	-	8, 11, 12
5. Statistics	-	9
6. Sets and Probability	-	10

Graph 8

Of the 12 questions, question number 8 is the one with the highest facility. It comes under the theme 'Geometry'. Question number 12 has the least facility and it also comes under the theme 'Geometry'.



Graph 7.III

The 12 questions in Paper II have been sorted out according to themes and their facilities have been calculated and represented in graph 7. III. According to the graph, the facility of the theme 'Statistics' is the highest and the facility of the theme 'Measurements' is the lowest. Their facilities are 54% and 38% respectively. Only one question from the theme 'Statistics' and one and a half questions from the theme 'Measurements' have been included in Paper II. The themes 'Algebra' and 'Geometry', occupying the largest share of the question paper are of facilities 40% and 39% respectively. The theme 'Geometry' has recorded a higher facility level than the theme 'Measurements' for this year.

Although the facility of each theme has increased, except for the theme 'Statistics' all the others have recorded faciliies of less than 50%.

2.2.4 Expected answers for Paper II, Marking scheme, Observations, Conclusions and Suggestions on the answers.

Observations on the answers to Paper II are based on Graphs 3, 4, 5.I, 5.II, 7.I, 7.II and 7.III. The part of the graph relevant to the question is provided with the observations and conclusions of each question.

Part A

Objectives of Question 1

Competency 5: Carries out transactions successful in the modern commercial world using percentages.

When the amount paid for a quarter as assessment tax and the annual rates percentage of the property are given,

(i) finds the assessment tax.

(ii) finds the annual value of the property.

When the rent amount for a month is given and the advance payment is stated in terms of the number of months of rent,

(iii) finds the advance payment.

When it is given that this advance payment is invested in a company of which the nominal value of a share, market value of a share and annual dividends are known,

(iv) finds the nominal value of the shares and the dividend income received at the end of the year.

(v) states with reasons whether in agreement or not with the given statement related to the annual dividend income and a certain percentage of the annual rent.

1. Palitha pays Rs 750 per quarter as assessment tax for a building he owns. The annual assessment tax charged for the building is 15% of its annual value.

(i) Find the assessment tax Palitha pays per year.

(ii) Find the annual value of the building.

Palitha rents out this building for Rs 20 000 a month. He obtains the rent for 6 months as an advance payment.

(iii) Find the advance payment Palitha obtains.

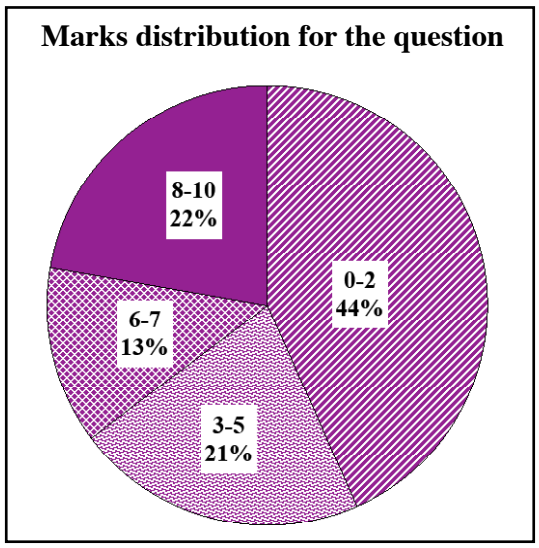
He invests this advance payment to buy shares of a company that pays annual dividends of 25% for its shares. A share of this company of nominal value Rs 100 is sold at Rs 120.

(iv) Find the nominal value of the shares Palitha buys and then find the dividend income he receives at the end of a year.

(v) State, with reasons, whether you agree or not with the statement, "The annual dividend income Palitha receives from investing in the company is more than 10% of the annual rent he receives by renting out the building".

Question Number			Answer	Marks			Other
1.	(i)		750×4 Rs. 3000	1	(1)		
	(ii)		$\frac{3000 \times 100}{15}$ රු. 20 000	1 1	(2)		Give this mark if the answer from part (i) has been used.
	(iii)		$20\,000 \times 6$ Rs. 120 000	1	(1)		
	(iv)		Nominal value of the shares $= \frac{120000}{120} \times 100$ $= $ Rs. 100 000 Dividend income $= 100\,000 \times \frac{25}{100}$ $= $ Rs. 25 000	1 1 1 1	(4)		
	(v)		Value of 10% of the annual rent $= (20\,000 \times 12) \times \frac{10}{100}$ $= $ Rs. 24 000 Since 25 000 > 24 000, I agree with the statement	1 1	(2)	10	For the comparison, correct values should be obtained using the correct methods

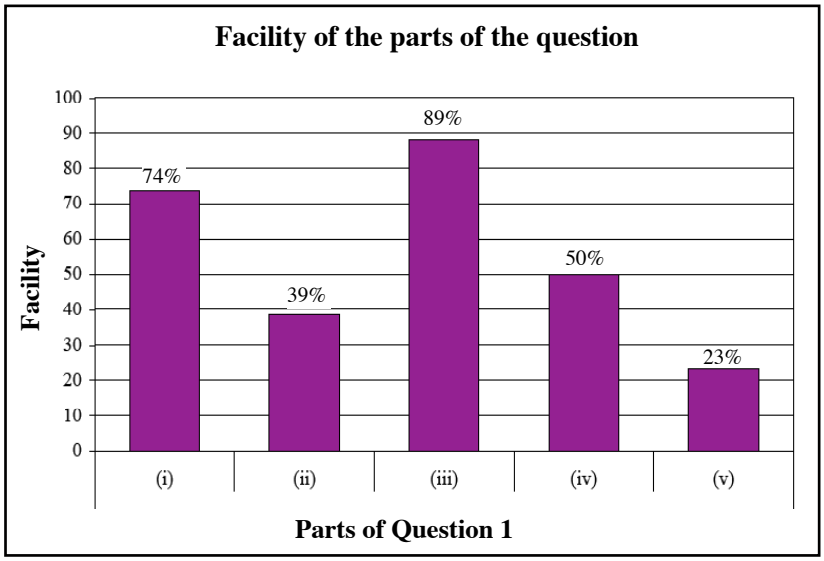
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Numbers' carries 10 marks. 98% of the candidates have selected it. Of these candidates,

about 44% have obtained marks in the interval 0 - 2,
about 21% have obtained marks in the interval 3 - 5,
about 13% have obtained marks in the interval 6 - 7,
and about 22% have obtained marks in the interval 8 - 10.

65% of the candidates have obtained 5 marks or less for this question. Only 22% have obtained 8 marks or more.



This question consists of 5 parts. The easiest part has been part (iii) with a facility of 89%. The most difficult part has been part (v) with a facility of 23%. Overall facility of the question is 49%.

98% of the candidates have selected this question to answer. It consists of 5 parts related to assessment tax and the share market under the theme 'Numbers'.

Part (i) is an easy part on finding the assessment tax and it records a high facility value of 74%.

Part (ii) records a low facility of 39% with a sharp decline due to the candidates' failure in applying the mathematical relationship to find the annual value of the building correctly. Part (iii) which asks to find the rent for 6 months when the monthly rent is given, is very simple and its facility is 89%. This is the highest facility of any part of this question.

Part (iv) which requires candidates to calculate the dividend income from the shares, has been difficult due to their tendency to calculate it as a percentage of the value obtained in part (iii) without using the suitable method.

Part (v) which is given to test the higher order skills of problem solving and providing reasons has secured the lowest facility of 23%. It is necessary to engage students in doing exercises to consolidate the ability to use the correct methodology in such questions.

Objectives of Question 2

Competency 20: Easily communicates the mutual relationships between two variables by exploring various methods.

Expected Learning Outcomes:

When an incomplete table is given to draw the graph of a function of the form of $y = -x^2 + ax + b$; $a, b \in \mathbb{Z}$,

(i) finds the value of y corresponding to the given x value.

(ii) draws the graph using the table provided and according to the given scale.

Using the graph,

(iii) writes down the range of values of x for which $y \geq c$; $c \in \mathbb{Z}^-$.

(iv) writes the co - ordinates of the maximum point and then writes the given function in the form $y = k - (x + h)^2$; $k, h, \in \mathbb{Z}$.

(v) given than $d - \sqrt{e}$; $e \in \mathbb{Z}^+$ is a root of the equation $x^2 - ax - b = 0$, finds an approximate value for $\sqrt{e}$ to the first decimal place.

2. An incomplete table prepared to draw the graph of the function $y = -x^2 + 4x - 1$ is given below.

x	-1	0	1	2	3	4	5
y	-6	-1	2		2	-1	-6

(i) Find the value of y when $x = 2$.

(ii) Using the scale of 10 small divisions as one unit along the x-axis and along the y-axis, draw the graph of the above function on a graph paper.

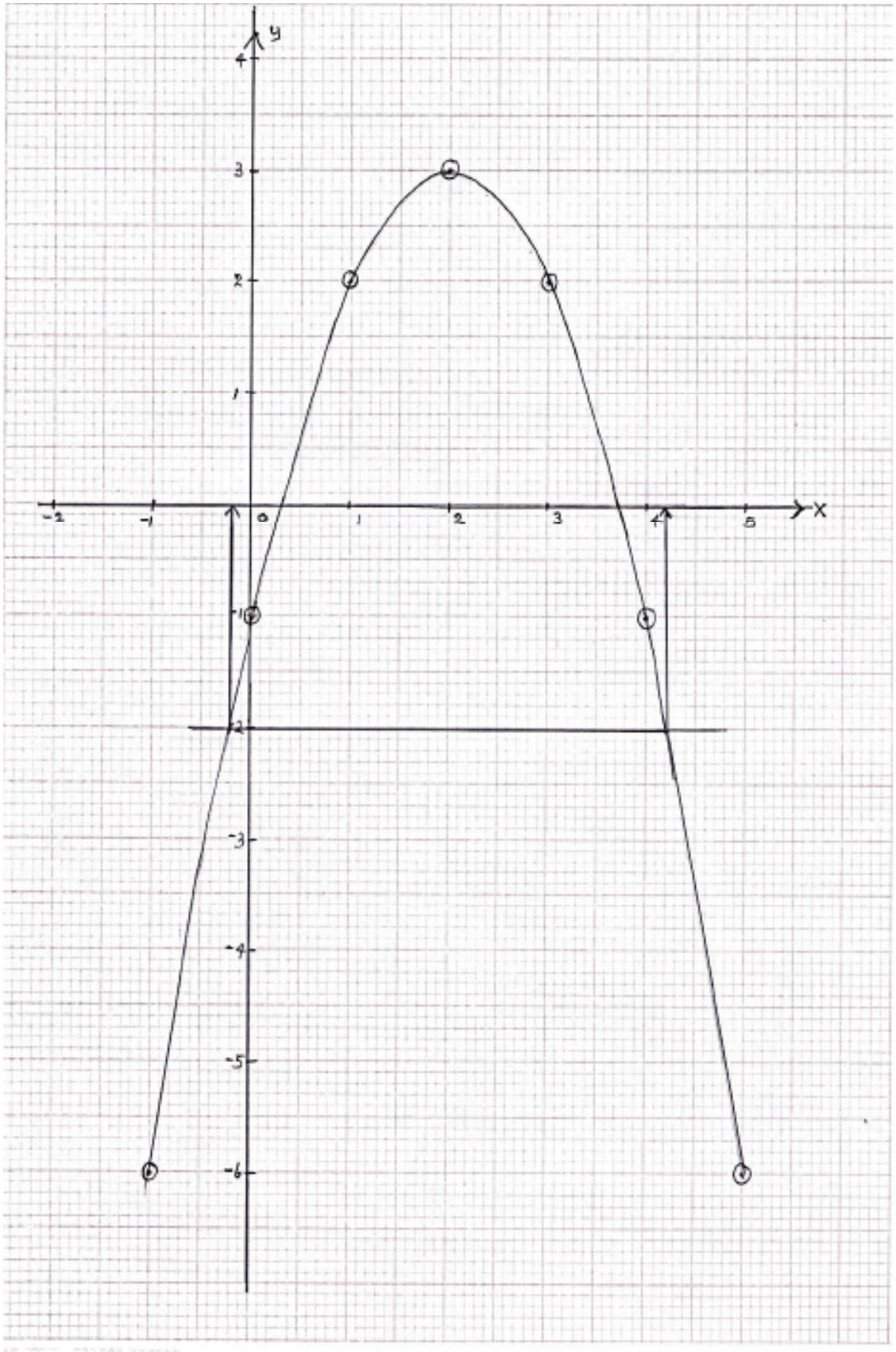
Answer the following questions **using the graph**.

(iii) Write down the range of values of x for which $y \geq -2$.

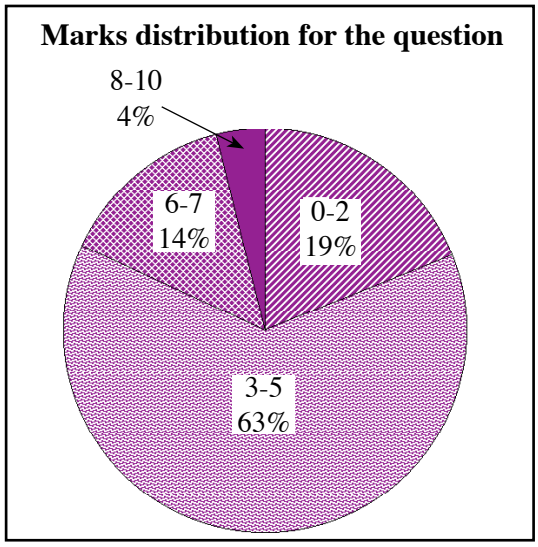
(iv) Write down the coordinates of the maximum point of the graph and thereby write down the given function in the form $y = k - (x - h)^2$, where k and h are constants.

(v) Given that $2 - \sqrt{3}$ is a root of the equation $x^2 - 4x + 1 = 0$, find an approximate value for $\sqrt{3}$ to the first decimal place.

Question Number			Answer	Marks			Other
2.	(i)		3	1	(1)		
	(ii)		Correct axes - 1 Marking at least 6 points correctly - 1 Smooth curve - 1		(3)		
	(iii)		$-0.2 \leq x \leq 4.2$ (± 0.1) or From -0.2 to 4.2 (± 0.1)	1	(1)		Identifying the two points – 1
	(iv)		(2, 3) $y = 3 - (x - 2)^2$	1 1	(2)		
	(v)		$y = 0$ when $x = 0.3$ or $x = 3.7$ $2 - \sqrt{3} = 0.3$ (± 0.1) $\therefore 2 - 0.3 = \sqrt{3}$ $\sqrt{3} = 1.7$ (± 0.1)	1 1	(2)	10	Even if $2 - \sqrt{3} = 3.7$ has been written, disregard it and give 1 mark for $2 - \sqrt{3} = 0.3$



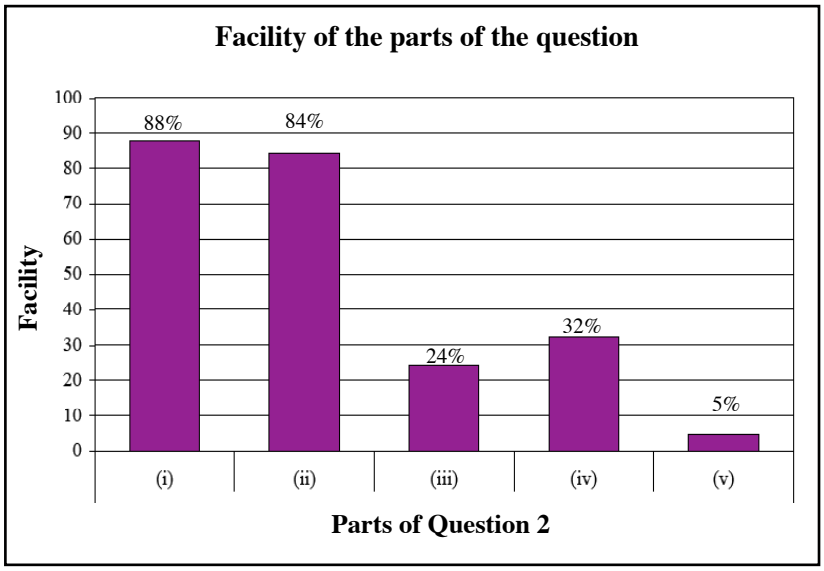
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Algebra' carries 10 marks. 91% of the candidates have selected it. Of these candidates,

about 19% have obtained marks in the interval 0 - 2,
about 63% have obtained marks in the interval 3 - 5,
about 14% have obtained marks in the interval 6 - 7,
and about 4% have obtained marks in the interval 8 - 10.

82% of the candidates have obtained 5 marks or less for this question. Only 4% have obtained 8 marks or more.



This question consists of 5 parts. The easiest part has been part (i) with a facility of 88%. The most difficult part has been part (v) with a facility of 5%. Overall facility of the question is 50%.

91% of the candidates have selected this question which is related to the theme 'Algebra' and tests the knowledge on graphs. Even though this is one of the most popular questions among the candidates, the percentage of candidates who obtained marks in the range 0 - 5 is 82%.

The facilities of parts (i) and (ii) are 88% and 84% respectively and the facility of each of the remaining three parts takes a value less than 35%. This question tests the ability in drawing a graph using the given table of values and the ability in answering questions on the graph.

Observing the accurately drawn graph, the coordinates of the maximum point can be written easily. By using these coordinates the equation of the function can be written. This method should be well mastered to find the answer easily. The candidates should be trained to answer these types of questions with understanding rather than mechanically.

In part (v), most of the candidates had tried to get the answer by solving the quadratic equation. This is not expected for questions of this type. Candidates should follow the given instructions and find the answer by using the graph only.

Objectives of Question 3

Competency 17: Manipulates the methods of solving equations to fulfill the needs of day to day life.

Expected Learning Outcomes:

When a composite figure of a square and a rectangle is given, along with the lengths of the sides of the rectangle and square, expressed in algebraic terms,

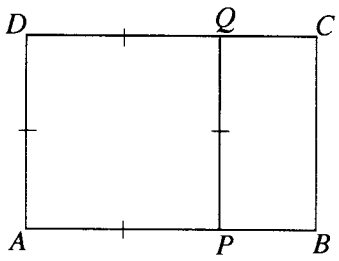
(i) shows that the length of the side named is a given algebraic expression.

(ii) constructs a quadratic equation using the given relationship on the ratios of the sides.

(iii) solves the quadratic equation by using the formulae or any other method and shows that the solution is a given expression,

(iv) shows that one of the solutions of the equation is not a suitable expression for a named length.

3. In the rectangle $ABCD$ given in the figure, $AB = 3x + 2$ cm and $AD = x + 3$ cm. It is given that $APQD$ is a square.



(i) Show that $PB = 2x - 1$ cm.

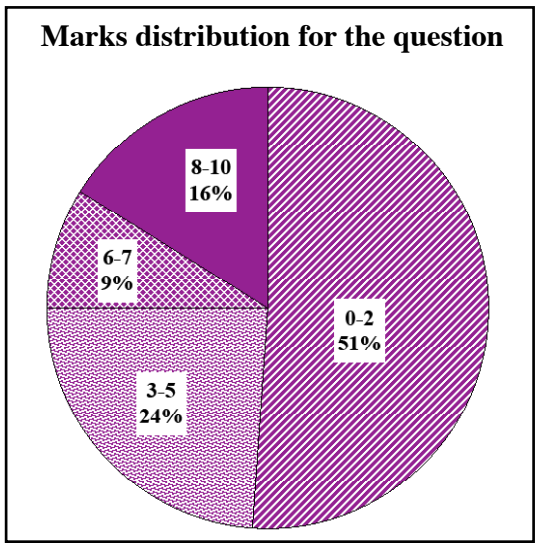
(ii) It is given that $\frac{AB}{AD} = \frac{PQ}{PB}$. Show that $5x^2 - 5x - 11 = 0$.

(iii) Using the formula or by any other method, show that $x = \frac{5 \pm 7\sqrt{5}}{10}$.

(iv) By substituting the solution $x = \frac{5 - 7\sqrt{5}}{10}$ in the expression in part (i) above for the length of PB, show that this solution is **not** suitable.

Question Number			Answer	Marks			Other
3.	(i)		$PB = (3x + 2) - (x + 3)$ $= (2x - 1)$	1	(1)		
	(ii)		$\frac{(3x + 2)}{(x + 3)} = \frac{(x + 3)}{(2x - 1)}$ $(3x + 2)(2x - 1) = (x + 3)^2$ $6x^2 - 3x + 4x - 2 = x^2 + 6x + 9$ $5x^2 - 5x - 11 = 0$	1 1 2	(4)		If one side is correct, give 1 mark If both sides are correct and $5x^2 - 5x - 11 = 0$ is written, give 2 marks.
	(iii)		$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4 \times 5 \times (-11)}}{2 \times 5}$ $= \frac{5 \pm \sqrt{245}}{10}$ $= \frac{5 \pm \sqrt{49 \times 5}}{10}$ $= \frac{5 \pm 7\sqrt{5}}{10}$	1 1 1	(3)		$5x^2 - 5x - 11 = 0$ $(x - \frac{1}{2})^2 = \frac{49}{20}$ $x - \frac{1}{2} = \pm \frac{7}{2\sqrt{5}}$ $x = \frac{1}{2} \pm \frac{7}{2\sqrt{5}}$ $= \frac{5}{10} \pm \frac{7\sqrt{5}}{10}$ $= \frac{5 \pm 7\sqrt{5}}{10}$ (3)
	(iv)		$2\left(\frac{5 - 7\sqrt{5}}{10}\right) - 1$ $= \frac{5}{5} - \frac{7\sqrt{5}}{5} - 1$ $= -\frac{7\sqrt{5}}{5}$ Since $-\frac{7\sqrt{5}}{5} < 0$, this solution is not suitable for the length of PB	1 1	(2)	10	for substitution

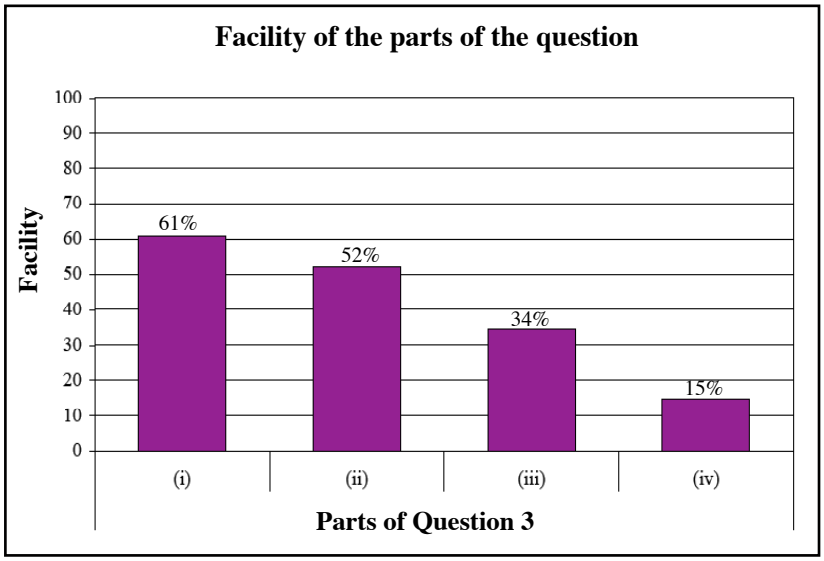
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Algebra' carries 10 marks. 55% of the candidates have selected it. Of these candidates,

about 51% have obtained marks in the interval 0 - 2,
about 24% have obtained marks in the interval 3 - 5,
about 9% have obtained marks in the interval 6 - 7,
and about 16% have obtained marks in the interval 8 - 10.

75% of the candidates have obtained 5 marks or less for this question. Only 16% have obtained 8 marks or more.



This question consists of 4 parts. The easiest part has been part (i) with a facility of 61%. The most difficult part has been part (iv) with a facility of 15%. Overall facility of the question is 42%.

55% of the candidates have selected this question to answer. This question which is related to the theme 'Algebra' tests the ability in solving quadratic equations. It has been presented in a way which deviates from the familiar pattern. Through this question, it is expected to test communication skills and the ability in seeing connections.

The facility of part (i) related to the subtraction of an algebraic expression from a given different algebraic expression is 61%. It is necessary to train the candidates to get the answer by writing the expression to be subtracted within brackets correctly and then carrying out the simplification. Furthermore, by exposing the candidates to more questions related to subtracting algebraic expressions, this competency can be enhanced.

Part (ii) in which it is expected to construct a quadratic equation by using the given data has a facility of 52%. The equation has to be constructed by correctly substituting expressions into the relationship between the lengths of the sides and simplifying.

It is expected to test the skill of solving a quadratic equation by using the formula in part (iii). If the candidates had followed the instructions and done this, they could have easily obtained the answer.

It is evident from the low facility of 15% of part (iv), that candidates have faced difficulty in answering this part which is based on seeing connections. Students need to be taught to answer questions by following instructions. This can be done with suitable exercises and proper guidance.

Objectives of Question 4

Competency 13 : Uses scale drawings in practical situations by exploring various methods.

Expected Learning Outcomes:

When a rough sketch of a horizontal ground, the bearings of three points on the horizontal ground and the distance between two of these points are given,

(i) calculates the magnitudes of the angles named.

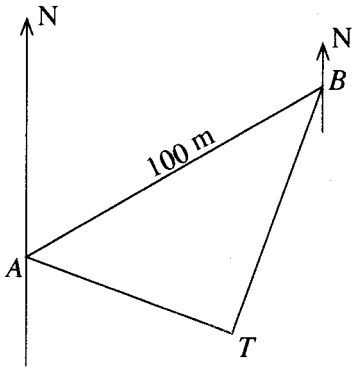
(ii) shows that the magnitude of the angle named is 90°.

(iii) calculates the distance between two places named by using trigonometric tables.

When the location of a place which lies on the line joining two places is given,

(iv) calculates the magnitude of the angle named by using trigonometric tables.

4. A rough sketch of a horizontal ground is shown in the figure. The bearing of the tree T from location A is 110°. Location B is at a distance of 100 metres from A, on a bearing of 060°. Moreover, the bearing of T from B is 200°.



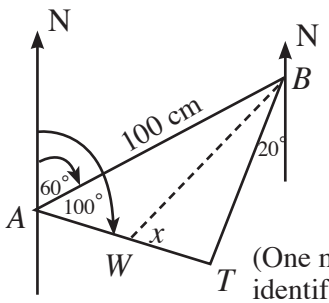
(i) Copy the figure and calculate the magnitudes of $B\hat{A}T$ and $A\hat{B}T$.

(ii) Show that $A\hat{T}B = 90°$.

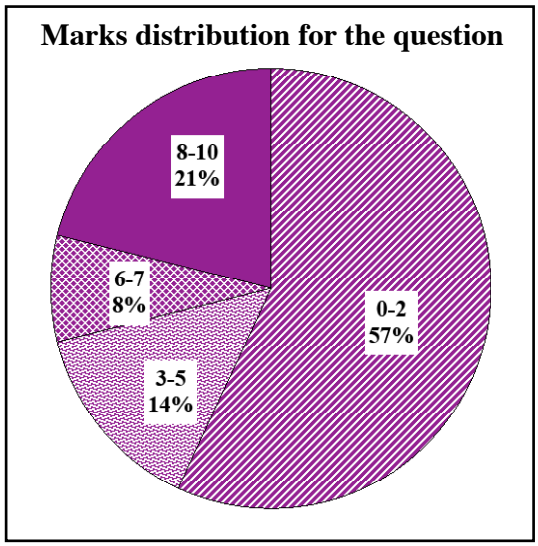
(iii) Using the trigonometric tables, calculate the distance from B to T.

The well W is located on the line AT such that WT = 40 m.

(iv) Using the trigonometric tables, calculate the magnitude of $B\hat{W}T$.

Question Number	Answer	Marks	Other
4.	 (One mark for identifying any one angle correctly 60°, 110°, 200°, 20°)	1	
(i)	$B\hat{A}T = 110° - 60° = 50°$ $A\hat{B}T = 60° - 20° = 40°$	1 1 (3)	
(ii)	$A\hat{T}B = 180° - (50° + 60°) = 90°$	1 (1)	$A\hat{T}B = 70° + 20° = 90°$ (1)
(iii)	$\sin 50^\circ = \frac{BT}{100}$ $100 \times 0.7660 = BT$ $BT = 76.6$ m	1 1 1 (3)	$\cos 40^\circ = \frac{BT}{100}$ $100 \times 0.7660 = BT$ $BT = 76.6$ m (3)
(iv)	$\tan B\hat{W}T = \frac{76.6}{40}$ $\tan B\hat{W}T = 1.915$ $\therefore B\hat{W}T = 62^\circ 26'$	1 1 1 (3)	Writing the value of BT from (iii) above and dividing by 40. 10

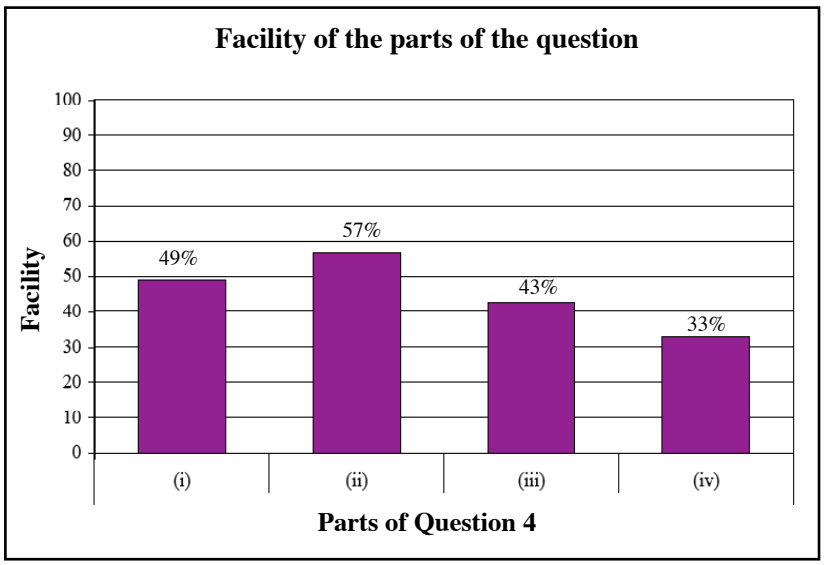
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Measurements' carries 10 marks. 62% of the candidates have selected it. Of these candidates,

about 57% have obtained marks in the interval 0 - 2,
about 14% have obtained marks in the interval 3 - 5,
about 8% have obtained marks in the interval 6 - 7,
and about 21% have obtained marks in the interval 8 - 10.

71% of the candidates have obtained 5 marks or less for this question. Only 21% have obtained 8 marks or more.



This question consists of 4 parts. The easiest part has been part (ii) with a facility of 57%. The most difficult part has been part (iv) with a facility of 33%. Overall facility of the question is 43%.

The percentage of candidates who have selected this question related to Trigonometry and bearings under the theme 'Measurements' is 62%. Part (i) of this question with four parts has a facility of 49%. It is found that candidates have failed to mark the bearings correctly which caused an error in calculating the value of the angle. It will be effective to train the students to pay more attention to the subject matter with better understanding.

Part (ii) is based on the simple geometrical theorem of the sum of the three interior angles of a triangle and its facility is 57%. Part (iii) given to test the ability in finding a length using trigonometric ratios has a facility of 43%.

The lowest facility is for part (iv) which is to calculate an angle using the trigonometric tables and it is 33%. Candidates need to practice writing the trigonometric ratios correctly and finding the values using the trigonometric tables. Candidates should gain knowledge by engaging in questions with alternative calculations and questions related to drawing simple figures and marking the given data.

Objectives of Question 5

Competency 17: Manipulates the methods of solving equations to fulfill the needs of day to day life.

Expected Learning Outcomes:

When the number of meters of cloth in two colours needed to sew uniforms for a group of boys and girls is given,

(i) constructs a pair of simultaneous equations in two unknown terms using the information provided.

(ii) finds the value of the two unknown terms by solving the two equations.

(iii) when the sewing cost for a certain number of blouses and a certain number of skirts is given, where these are expressed in terms of an unknown, writes an expression for the sewing cost of a girl's uniform in terms of the unknown term and simplifies it.

5. The students in a hostel are to get new uniforms. Each girl is to receive a blouse and a skirt, and each boy is to receive a shirt and a pair of trousers. 1 metre of white material is required to sew a blouse and $1\frac{1}{2}$ metres of white material is required to sew a shirt. Moreover, $1\frac{1}{2}$ metres of blue material is required to sew a skirt and 2 metres of blue material is required to sew a pair of trousers. The total amount of white material required is 72 metres and the total amount of blue material required is 100 metres.

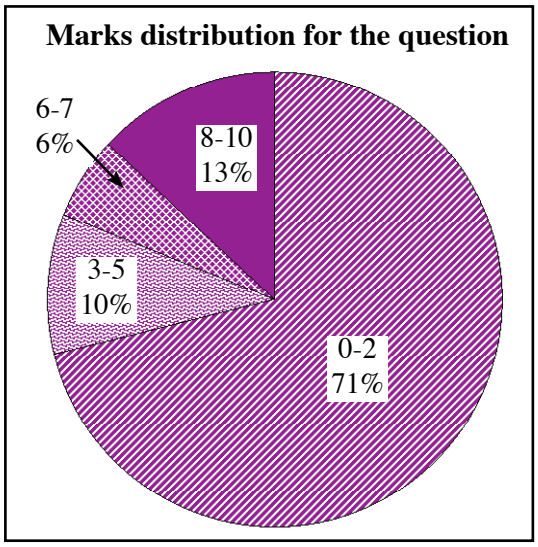
(i) Taking the number of girls as x and the number of boys as y, construct a pair of simultaneous equations in x and y.

(ii) Solve the pair of simultaneous equations and find the number of girls and the number of boys in the hostel.

(iii) The sewing cost for m number of blouses is Rs 750 and the sewing cost for $2m$ number of skirts is Rs 1125. Write down an expression for the sewing cost of a girl's uniform in terms of m and simplify it.

Question Number			Answer	Marks			Other
5.	(i)		$x + 1\frac{1}{2}y = 72$ $1\frac{1}{2}x + 2y = 100$	1 1	(2)		
	(ii)		$2x + 3y = 144$ ——— (1) $3x + 4y = 200$ ——— (2) (1) × 3 – (2) × 3 $6x + 9y - (6x + 8y) = 144 \times 3 - 200 \times 2$ $y = 32$ Substituting $y = 32$ into (1) $2x + 3(32) = 144$ $2x + 96 = 144$ $x = 24$ No. of girls = 24 No. of boys = 32	2 1 1 1 1	(6)		Equating coefficients - 1 mark Eliminating one unknown - 1 mark Finding the value of an unknown - 1 mark
	(iii)		$\frac{750}{m} + \frac{1125}{2m}$ $= \frac{1500 + 1125}{2m}$ $= \frac{2625}{2m}$	1 1	(2)	10	

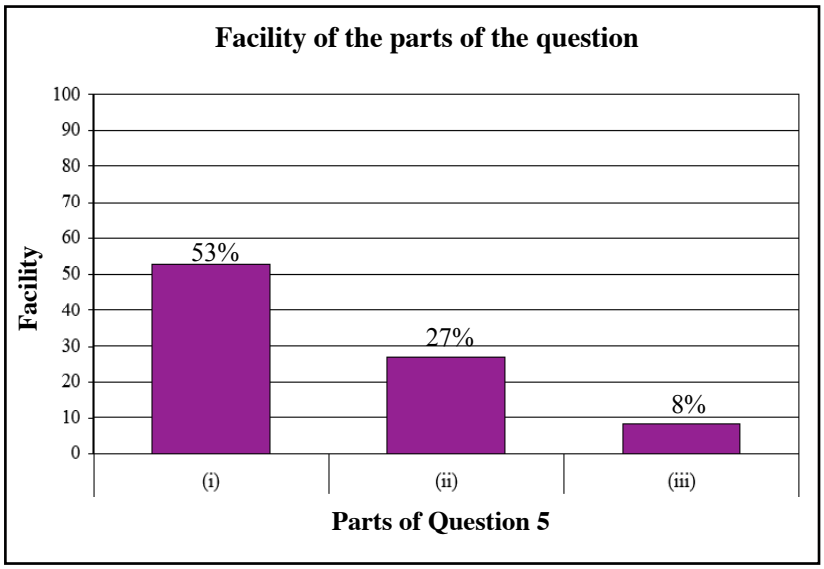
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Algebra' carries 10 marks. 57% of the candidates have selected it. Of these candidates,

about 71% have obtained marks in the interval 0 - 2,
about 10% have obtained marks in the interval 3 - 5,
about 6% have obtained marks in the interval 6 - 7,
and about 13% have obtained marks in the interval 8 - 10.

81% of the candidates have obtained 5 marks or less for this question. Only 13% have obtained 8 marks or more.



This question consists of 3 parts. The easiest part has been part (i) with a facility of 53%. The most difficult part has been part (iii) with a facility of 8%. Overall facility of the question is 29%.

The percentage of candidates who selected and answered this question under the theme 'Algebra' is 57%. Through this question it is expected to measure the ability of the candidate to construct and solve simultaneous equations in two unknown terms with fractional coefficient and the ability to construct an algebraic equation using the given data and simplify it.

Part (i) which measures the ability to construct simultaneous equations in two unknown terms with fractional coefficients has a facility of 53%.

Only 27% of the candidates have correctly answered part (ii) which tests the ability in solving the pair of equations obtained in part (i). It is necessary to provide more practice in constructing equations from questions with complex statements and solving them. The accuracy of the solutions can be checked by substituting them in the equations constructed earlier.

Part (iii) which measures the ability in constructing an expression with algebraic fractions and simplifying it has a very low facility of 8%.

Objectives of Question 6

Competency 10: Gets the maximum out of space by working critically with respect to volume.

Expected Learning Outcomes:

(a) When the radius and the height of a right circular cylindrical container and the height of the liquid in it is given,

(i) finds the volume of the empty space in the container.

(ii) when the volume of water that spills out when a spherical object is completely immersed in the water in the above mentioned container is given, shows that the radius of the spherical object is the given surd.

(b) Finds the value of an expression of the form $\frac{a}{b}$; $a, b \in \mathbb{R}$ and $0 < b < 1$ using the logarithms table.

6. (*a*) A right circular cylindrical container made from a thin material, of height 21 cm and radius 6 cm, is filled with water up to a height of 14 cm.

Take the value of π as $\frac{22}{7}$ in the following calculations.

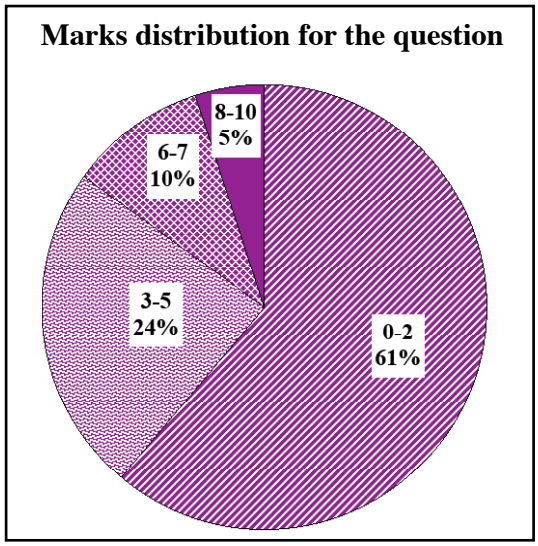
(i) Find the volume of the empty space in the container.

(ii) If 44 cm^3 of water spills over when a solid spherical object is immersed completely in the water of the container, then show that the radius of the spherical object is $\sqrt[3]{199.5}$ centimetres.

(*b*) Using the logarithms table, find the value of $\frac{\sqrt[3]{5}}{0.871}$.

Question Number			Answer	Marks			Other
6.	(a)	(i)	$\pi (6^2) \times 7$ $= \frac{22}{7} \times 36 \times 7$ $= 792 \text{ cm}^2$	1 1	(2)		
		(ii)	$\frac{4}{3} \pi r^3 = 44 + 792$ $\frac{4}{3} \times \frac{22}{7} \times r^3 = 836$ $r^3 = \frac{836 \times 21}{88}$ $r^3 = 199.5$ $r = \sqrt[3]{199.5}$	1 1 1	(3)		
	(b)		$A = \frac{\sqrt[3]{5}}{0.871}$ $\lg A = \frac{1}{3} \lg 5 - \lg(0.871)$ $= \frac{1}{3} (0.6990 - (\overline{1}.9400)$ $= 0.2330 - (\overline{1}.9400)$ $= 0.2930$ $A = \textit{antilog}\ (0.2930)$ $= 1.963$	 1 1 + 1 1 1	(5)	10	

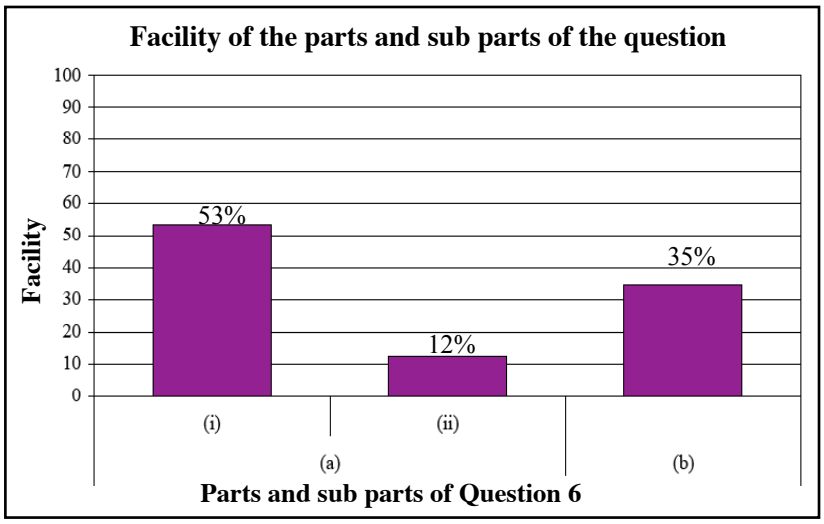
Observations, Conclusions and Suggestions regarding the answers :



This question based on the themes 'Numbers' and 'Measurements' carries 10 marks. 57% of the candidates have selected it. Of these candidates,

about 61% have obtained marks in the interval 0 - 2,
about 24% have obtained marks in the interval 3 - 5,
about 10% have obtained marks in the interval 6 - 7,
and about 5% have obtained marks in the interval 8 - 10.

85% of the candidates have obtained 5 marks or less for this question. Only 5% have obtained 8 marks or more.



This question consists of 3 parts and sub parts. The easiest part has been sub part (a)(i) with a facility of 53%. The most difficult part has been sub part (a)(ii) with a facility of 12%. Overall facility of the question is 32%.

The percentage of candidates who have selected this problem on logarithms and volume under the themes 'Numbers' and 'Measurements' is 69%. The facility of the sub part (a) (i) is 53%. Its facility is low due to their use of data in calculations without understanding the problem. This weakness can be overcome largely by reading the question well and understanding it before answering.

Due to trying to answer without understanding the relationships, sub part (a) (ii), has a very low facility of 12%. Due to trying to obtain the answer by equalizing the spilt volume of water with the volume of the sphere, ignoring the empty space of the cylinder, the facility has dropped.

It is necessary to emphasize that candidates should have a better understanding of what is asked in the question in order to answer the question correctly.

For these questions based on the experience obtained in day to day life, models of the relevant solid objects can be used in practicing to improve effective answering. This may facilitate their ability of visualizing mental pictures related to the question.

Part (b) has a facility of 35% and it is related to logarithms. Candidates had difficulty in finding the cube root of a number using the logarithms table and in writing the characteristic of a number less than 1. Therefore candidates have to be trained to write the logarithms expression correctly and more exercises should be done for better performance and to gain experience in using the correct methods.

Part B

Objectives of Question 7

Competency 2: Makes decisions for future requirements by investigating the various relationships in number patterns.

Expected Learning Outcomes:

When the first term and the common difference are given in an instance where the consecutive terms are in an arithmetic progression,

(i) writes an expression for the nth term and hence finds the value of the given term.

(ii) writes an expression for the sum of 'n' number of terms and simplifies and obtains the given expression.

(iii) shows that the sum of a given number of terms is the given value.

When the condition for the sum of a certain number of terms to be a given value is expressed in terms of an unknown term,

(iv) writes an equation in the unknown term and finds its value by solving the equation.

7. Isuri starts saving money by depositing Rs 5 in her till on the first day. After that, every day, she deposits Rs 2 more than the amount she deposited in the till on the previous day.

(i) Write, in terms of n, an expression for T_n, the amount of money Isuri deposits in the till on the n^{th} day, and thereby find the amount of money she deposits in the till on the 26^{th} day.

(ii) Write, in terms of n, an expression for S_n, the total amount of money in the till at the end of the n^{th} day and by simplifying it, show that $S_n = n(n + 4)$.

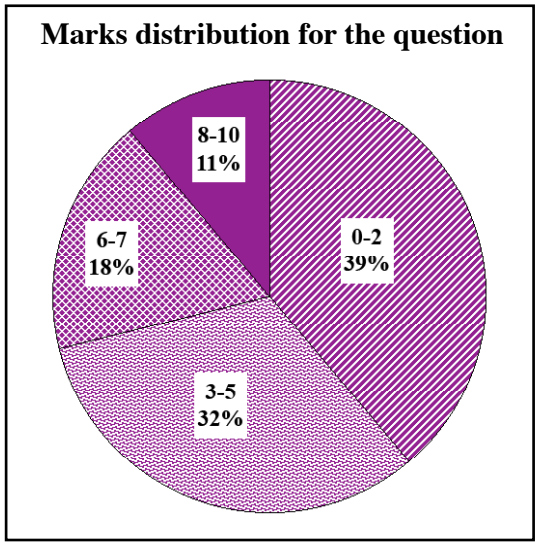
(iii) Show that the amount of money in the till at the end of the 26^{th} day is Rs 780.

In order that the amount of money in the till at the end of the 30^{th} day is Rs 1100, Isuri deposits, from the 27^{th} day, x rupees more than the amount deposited on the previous day.

(iv) Write down an equation in x and find the value of x by solving it.

Question Number			Answer	Marks			Other
7.	(i)		$T_n = 5 + (n-1)\,2$ or $3 + 2n$ $T_{26} = 5 + (26-1)\,2$ $= 55$	1 1 1	(3)		
	(ii)		$S_n = \frac{n}{2}\{2 \times 5 + (n-1)\,2\}$ $= \frac{n}{2}\{10 + 2n - 2\}$ $= \frac{n}{2}\{8 + 2n\}$ $= n\,(4 +)\,1$	1 1 1	(3)		
	(iii)		$S_{26} = 26\,(26 + 4)$ $= 26 \times 30$ $= 780$ $\therefore$ Amount in the till is Rs. 780	1 1	(2)		
	(iv)		$S_n = \frac{n}{2}\{2a + (n-1)\,d\}$ $1100 - 780 = \frac{4}{2}\{2 \times (55 + x) + (4-1)x\}$ $320 = 2\{110 + 5x\}$ $160 - 110 = 5x$ $50 = 5x$ $x = 10$	1 1	(2)	10	$(55 + x) + (55 - 2x) +$ $(55 + 3x) + (55 + 4x)$ $= 1100 - 780$

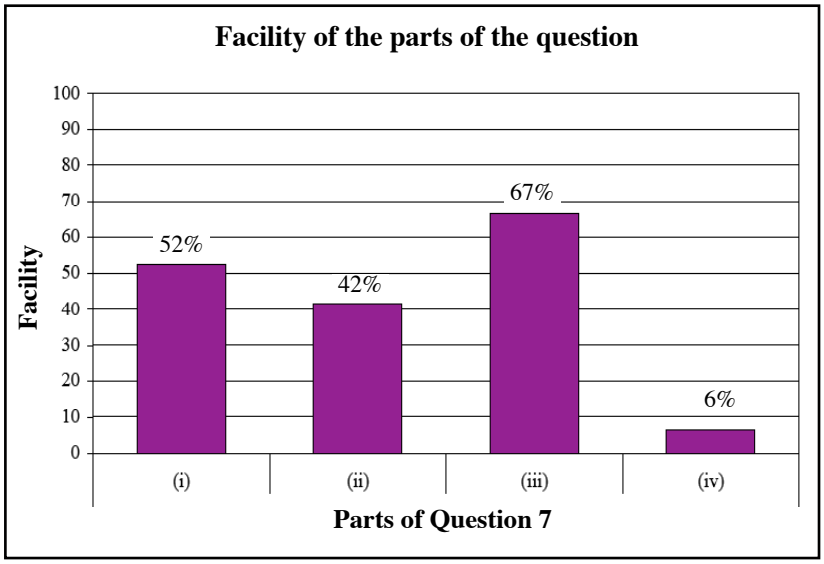
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Numbers' carries 10 marks. 78% of the candidates have selected it. Of these candidates,

about 39% have obtained marks in the interval 0 - 2,
about 32% have obtained marks in the interval 3 - 5,
about 18% have obtained marks in the interval 6 - 7,
and about 11% have obtained marks in the interval 8 - 10.

71% of the candidates have obtained 5 marks or less for this question. Only 11% have obtained 8 marks or more.



This question consists of 4 parts. The easiest part has been part (iii) with a facility of 67%. The most difficult part has been part (iv) with a facility of 6%. Overall facility of the question is 43%.

78% of the candidates have selected this question which tests the knowledge on arithmetic progressions under the theme 'Numbers'.

The facility of part (i) is 52%. It tests the ability in obtaining an expression for the nth term of an arithmetic progression and the ability in finding the value of a term using that expression. It is evident that the candidates have tried to find the relevant term by writing the nth term mechanically.

In part (ii) the data has been substituted correctly into the formula for the sum. But they have failed in obtaining the answer due to incorrect simplification. This has caused the drop in the facility to 42%.

Although the candidates could have obtained the answer for part (iii) easily by using the formula for S_n obtained in part (ii), candidates have attempted to get the solution by using the original formula for the sum. Due to not using this formula correctly and due to simplification errors, the facility of this part is 67%.

It is necessary to practice answering questions related to progression after having understood the question properly. Candidates need to improve their skills in constructing formulae with unknown terms and finding the value of an unknown term using a formula.

Objectives of Question 8

Competency 27 : Analyses according to geometric laws, the nature of the locations in the surroundings.

Expected Learning Outcomes:

Using only a pair of compasses and a straight edge with a cm/ mm scale,

(i) constructs an equilateral triangle when the length of a side is given.

(ii) constructs the bisector of an angle of the triangle that is given, and names the point at which it meets a given side of the triangle.

(iii) constructs a perpendicular from a given point to a given side and marks the foot of the constructed perpendicular.

(iv) constructs a circle which touches a given straight line, by taking a given point as the centre.

(v) constructs a tangent to the circle from a given point and marks the point where the produced tangent intersects a given straight line.

(vi) writes the conditions for the given quadrilateral to be a rhombus.

8. ABC is an equilateral triangle with the length of each side 6 cm.

Use only a straight edge with a cm/mm scale and a pair of compasses for the following constructions. Show your construction lines clearly.

(i) Construct the triangle ABC.

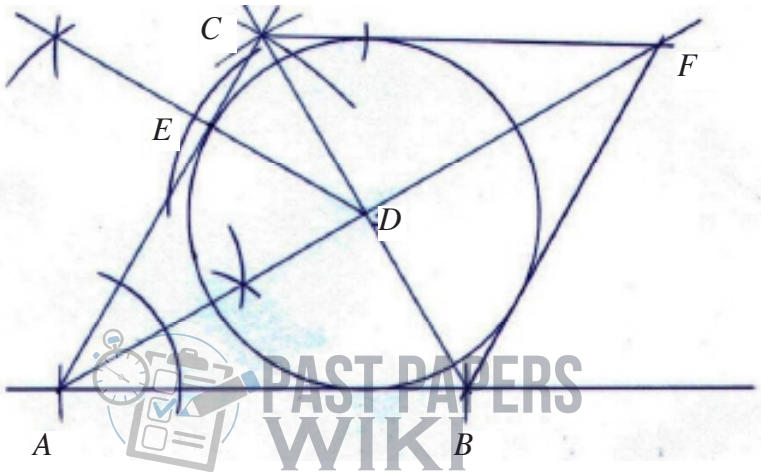
(ii) Construct the angle bisector of $B\hat{A}C$ and mark the point it meets BC as D.

(iii) Construct the perpendicular from D to AC and mark its foot as E.

(iv) Construct the circle with centre D, which touches the line AC.

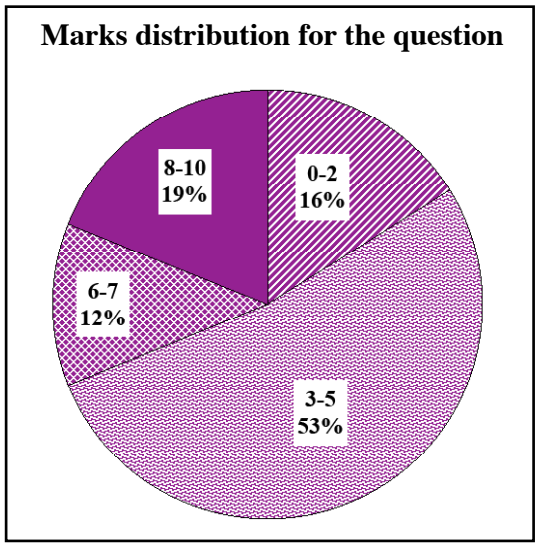
(v) Construct a tangent to this circle from C (other than AC), and mark the point it meets AD produced as F.

(vi) Join B and F, and give reasons why $ABFC$ is a rhombus.



Question Number			Answer	Marks			Other
8.	(i)		Completing the triangle Drawing 6 cm line segment correctly - 1 Constructing 60° or 6 cm arcs - 1	3	(3)		
	(ii)		Constructing the angle bisector of $B\hat{A}C$ and marking D	1	(1)		
	(iii)		Constructing the perpendicular from D and marking E	2	(2)		
	(iv)		Constructing the circle	1	(1)		
	(v)		Constructing the tangent CF	1	(1)		
	(vi)		Showing $ABFC$ is a parallelogram Showing one pair of adjacent sides are equal	1 1	(2)	10	

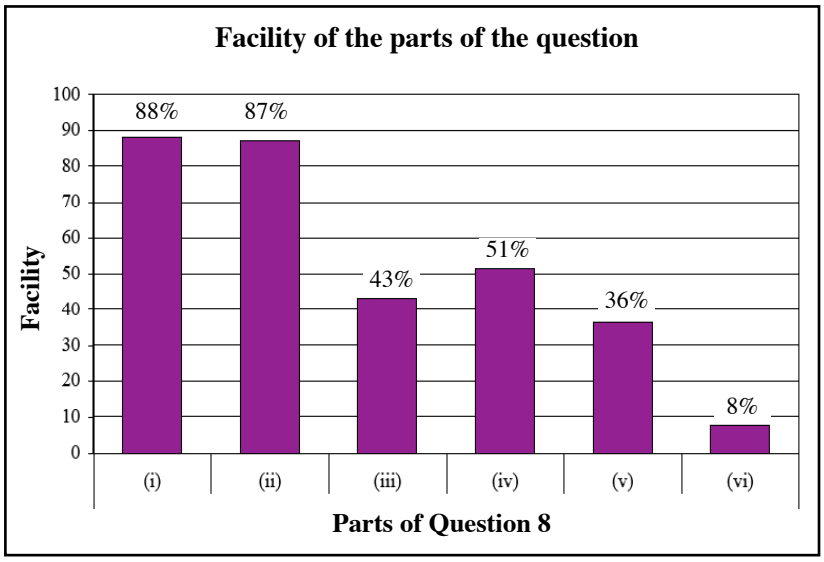
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Geometry' carries 10 marks. 89% of the candidates have selected it. Of these candidates,

about 16% have obtained marks in the interval 0 - 2,
about 53% have obtained marks in the interval 3 - 5,
about 12% have obtained marks in the interval 6 - 7,
and about 19% have obtained marks in the interval 8 - 10.

69% of the candidates have obtained 5 marks or less for this question. Only 19% have obtained 8 marks or more.



This question consists of 6 parts. The easiest part has been part (i) with a facility of 88%. The most difficult part has been part (vi) with a facility of 8%. Overall facility of the question is 58%.

The percentage that has selected this question on construction under the theme 'Geometry' is 89%. To construct accurately one should possess a proper understanding of the basic Loci and Geometry theorems.

The facility of part (i) is 88%. This shows that a majority of the candidates have the ability of constructing a triangle accurately. Part (ii) which tests the ability of naming a diagram accurately and constructing the bisector of an angle has a facility of 87%. Part (iii) which tests the ability of constructing a perpendicular to a straight line from a given exterior point has a lower facility. Candidates should know how to do such constructions using the given data accurately.

The constructions in parts (iv) and (v) test the knowledge on theorems related to tangents, One has to be familiar with the applications of these theorem to do these constructions. Part (vi) which is based on identifying the features of a rhombus has recorded a low facility of 8%. Candidates should be thorough with the specific features of a rhombus which is a significant type of parallelogram, in order to answer correctly.

Objectives of Question 9

Competency 29 : Analyses data by various methods and makes predictions to facilitate daily work.

Expected Learning Outcomes:

When data related to a situation is provided in a frequency distribution,

(i) writes the modal class of the frequency distribution.

(ii) finds the mean of the given data.

(iii) using the mean, finds the expected income for a given situation.

(iv) using the information given, estimates the value related to a described situation.

9. A frequency distribution containing information on the tickets issued to passengers during a morning trip of a bus is shown in the table below.

Price of a ticket (Rs)	8 - 12	12 - 16	16 - 20	20 - 24	24 - 28	28 - 32
Number of tickets	6	7	13	17	13	8

(i) Write down the modal class of the distribution.

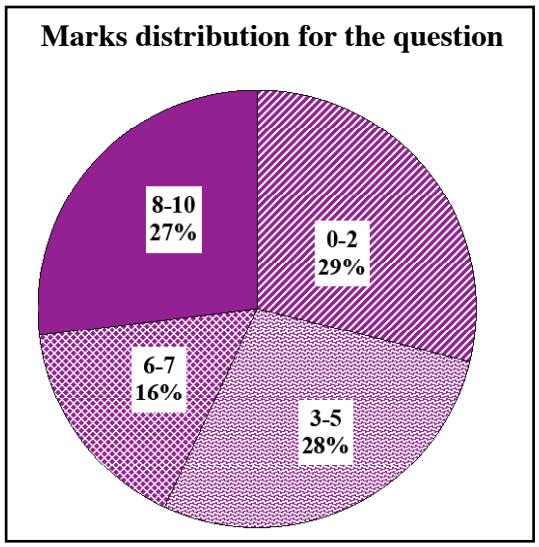
(ii) Find the mean price of the tickets issued.

(iii) Find the expected income from a morning trip in which tickets are issued to 180 passengers.

(iv) Assuming that the total expenditure including fuel is Rs 700 for a morning trip, estimate the minimum number of tickets that should be issued to make a profit from such a trip.

Question Number			Answer	Marks			Other
9.	(i)		20 – 24	1	(1)		
	(ii)		<table><tr><th>Class interval</th><th>Number of tickets</th><th>x</th><th>fx</th></tr><tr><td>8 - 12</td><td>6</td><td>10</td><td>60</td></tr><tr><td>12 - 16</td><td>7</td><td>14</td><td>98</td></tr><tr><td>16 - 20</td><td>13</td><td>18</td><td>234</td></tr><tr><td>20 - 24</td><td>17</td><td>22</td><td>374</td></tr><tr><td>24 - 28</td><td>13</td><td>26</td><td>338</td></tr><tr><td>28 - 32</td><td>8</td><td>30</td><td>240</td></tr><tr><td></td><td>64</td><td></td><td>$\sum fx = 1344$</td></tr></table> x column ---------- 1 fx column ---------- 1 $\sum fx$ ---------- 1 Mean price $= \frac{1344}{40}$ 1 $= $ Rs. 21 1	(5)		Ignore one mistake. If assumed mean is used, give the mark for the fx column for the fd column. Give the mark for $\sum fx$ to $\sum fd$ This mark is given for correctly substituting the obtained values to the formula, when computing the mean price
	(iii)		Income $=$ Rs. 180×2 1 $=$ Rs. 3780 1	(2)			For multiplying by 180
	(iv)		$\frac{700}{21}$ 1 $= 33\frac{1}{3}$ $\therefore$ Minimum number of tickets is 34 1	(2)	10		For dividing by the obtained mean

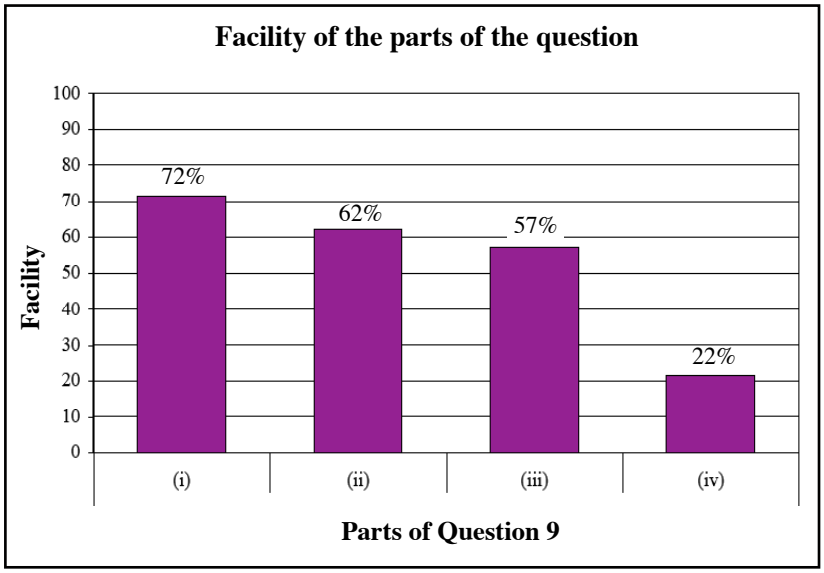
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Statistics' carries 10 marks. 91% of the candidates have selected it. Of these candidates,

about 29% have obtained marks in the interval 0 - 2,
about 28% have obtained marks in the interval 3 - 5,
about 16% have obtained marks in the interval 6 - 7,
and about 27% have obtained marks in the interval 8 - 10.

57% of the candidates have obtained 5 maks or less for this question. Only 27% have obtained 8 marks or more.



This question consists of 4 parts. The easiest part has been part (i) with a facility of 72%. The most difficult part has been part (iv) with a facility of 22%. Overall facility of the question is 54%.

This question on the theme 'Statistics' given to find representative values using a frequency distribution, has a selection of 91%.

Part (i) which asks for the modal class has a facility of 72%. Candidates who studied the data well had found it easy.

Part (ii) which expects the mean to be found using class intervals has a facility of 62%. Here, it is not necessary to use an assumed mean to find the mean. On occasions when it is easy to find the mean directly by multiplying the mid values by the frequencies, it is not necessary to use an assumed mean.

Candidates need to calculate the mean by substituting the sum of the products of the mid values and frequencies in the relevant formula. They should know that an assumed mean should be used only when it is easier to calculate the mean by using it.

Part (iii) expects the income from the passengers to be found using the mean price of a ticket found in part (ii). It has a facility of 57%. Even though the answer can easily be obtained by multiplying the mean by the number of passengers, due to failure in calculating the correct mean and weaknesses in multiplication, it has a low facility.

The facility of part (iv) from which a candidate is expected to estimate the minimum number of tickets that need to be issued to obtain a profit from one bus trip, given the expenditure of the trip, is 22%. The candidates should understand that they need to round off the obtained answer to the higher whole number to find the minimum number of tickets that need to be issued to make a profit.

The inability to understand the meaning of the mean value and the relationship between the question in part (iv) and the mean value has caused the low facility. Candidates should improve the ability to use data to find the appropriate answer rather than to write the answer mechanically.

Objectives of Question 10

Competency 30 : Manipulates the principles related to sets to facilitate day to day activities.

Expected Learning Outcomes:

When the information regarding the universal set, a subset of the universal set and subsets of that subset, which intersect each other are provided,

(i) draws the Venn diagram and marks the given data in it.

(ii) finds the number of elements in a given set.

When an incomplete Venn diagram is given,

(iii) fills the empty regions of the Venn diagram.

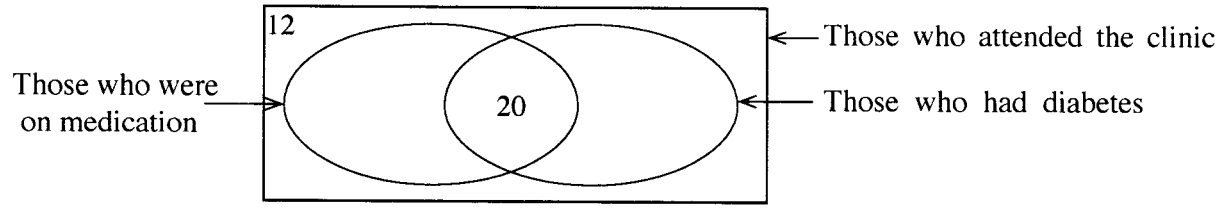
(iv) finds the number of elements in a given set.

10. It was revealed that out of 40 persons who visited a medical clinic, 20 had heart diseases and 25 had diabetes. All those who had heart diseases and all those who had diabetes suffered from stress too. 3 persons suffered from stress only and 4 persons did not suffer from stress.

(i) Draw a Venn diagram to depict this information and write down in it, the number of elements belonging to each region.

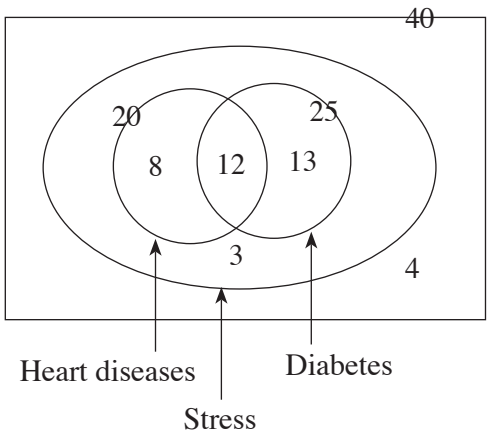
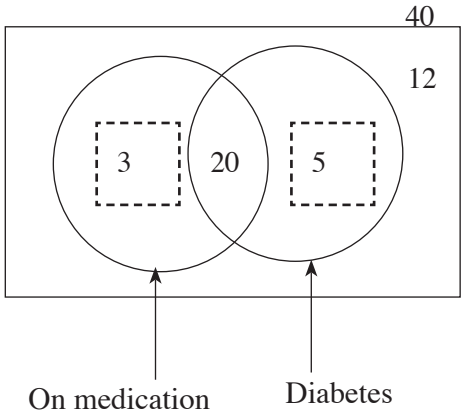
(ii) How many persons had diabetes but did not have heart diseases?

Among the 40 persons who visited the clinic, there were persons who were on medication and those who were not on medication as well. An incomplete Venn diagram drawn using this information too is shown below.

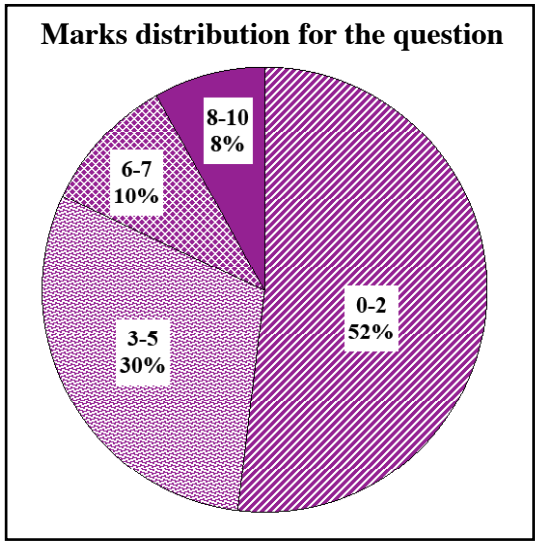


(iii) Copy the Venn diagram given above and write down the values relevant to the two empty regions in it.

(iv) How many persons had diabetes but were not on medication?

Question Number			Answer	Marks			Other
10.	(i)		 Indicating the heart diseases and diabetes sets correctly within the universal set Indicating the stress set such that the heart diseases and diabetes sets are subsets of it. Marking 3 and 4 in correct regions. Marking 8, 12 and 13 in correct regions.	1 1 2 2	(6)		1 Mark for any correct answer
	(ii)		13	1	(1)		
	(iii)			1+1	(2)		
	(iv)		5	1	(1)	10	

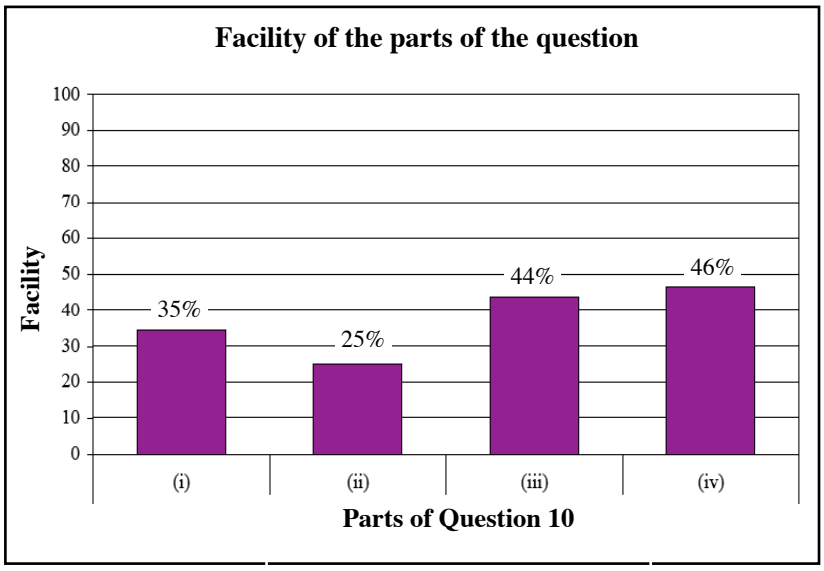
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Sets and Probability' carries10 marks. 82% of the candidates have selected it. Of these candidates,

about 52% have obtained marks in the interval 0 - 2,
about 30% have obtained marks in the interval 3 - 5,
about 10% have obtained marks in the interval 6 - 7,
and about 8% have obtained marks in the interval 8 - 10.

82% of the candidates have obtained 5 marks or less for this question. Only 8% have obtained 8 marks or more.



This question consists of 4 parts. The easiest part has been part (iv) with a facility of 46%. The most difficult part has been part (ii) with a facility of 25%. Overall facility of the question is 37%.

This question based on sets under the theme 'Sets and Probability' has a selection of 82%.

Part (i) that needed drawing a suitable Venn diagram and marking the data accurately has a facility of 35%. In representing the data in a Venn diagram, the relevant subsets should be identified correctly. Lack of this ability has resulted in this low facility. Language skills are essential in understanding how to draw the Venn diagram and to include the given data correctly.

Part (ii) which checks the ability in identifying the regions in a Venn diagram correctly has a facility of 25%. Unfamiliarity in drawing Venn diagrams specially with subsets and weakness in identifying the regions in a Venn diagram have resulted in this low facility level.

The above reasons have affected the answers in the remaining parts of the question too. These weaknesses can be avoided by engaging in exercises to improve communication skills through graphical representation and to improve the ability in identifying the regions in a Venn diagram correctly.

By engaging in different types of challenging questions in order to boost one's analytical thinking one can enhance the ability to answer such questions.

Objectives of Question 11

Competency 23 : Make decisions regarding day to day activities based on geometrical concepts related to rectilinear plane figures.

Expected Learning Outcomes:

When an isosceles triangle with a produced side and an angle bisector are given,

(i) copies the figure and marks the given information.

(ii) shows that the two triangles named are congruent.

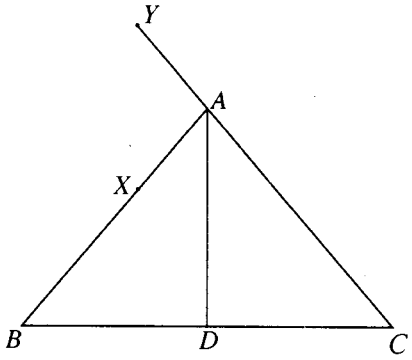
When the point where a line meets a side of the triangle is given,

(iii) shows that the two angles named are equal.

(iv) shows that the value of an angle named is equal to the sum of two other named angles.

(v) shows that two lines are parallel.

11. In the given figure, $A\hat{B}C = A\hat{C}B$, X is a point on AB and Y is a point on CA produced such that $AY = AX$. The angle bisector of $B\hat{A}C$ meets BC at D.



(i) Copy the figure and indicate the information given above in it.

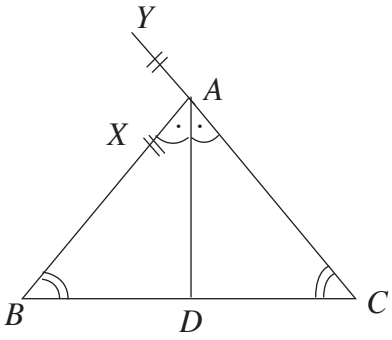
(ii) Show that $\Delta ABD \equiv \Delta ADC$.

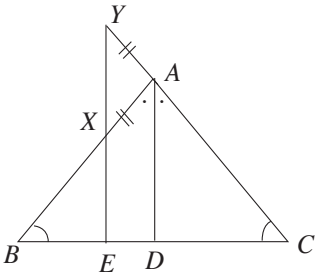
YX produced meets BD at E.

(iii) Show that $X\hat{Y}A = B\hat{X}E$.

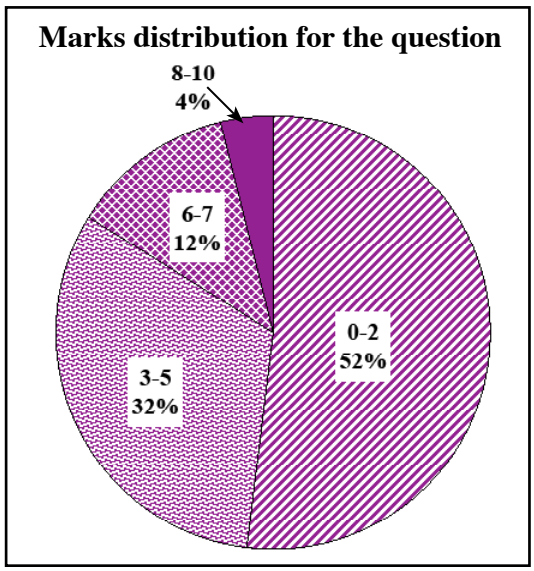
(iv) Show that $B\hat{E}X = B\hat{X}E + E\hat{B}X$.

(v) Show that $XE \,//\, AD$.

Question Number			Answer	Marks			Other
11.	(i)			1	(1)		
	(ii)		$ABD\,\Delta$ and $ADC\,\Delta$				
			$\hat{BAD} = \hat{CAD}$ (since AD is the bisector of $\hat{BAC}$)	1			
			$\hat{ABD} = \hat{ACD}$ (given)	1			
			AD is common				
			$\therefore ABD\,\Delta \equiv ADC\,\Delta$ (A.A.S.)	1	(3)		

Question Number			Answer	Marks			Other
11.	(iii)		$A\hat{Y}X = A\hat{X}Y$ ($\because AY // AX$) but $A\hat{Y}X = B\hat{X}E$ (vertically opposite angles) $\therefore A\hat{Y}X = B\hat{X}E$	1 1	(2)		
	(iv)		$B\hat{E}Y = E\hat{C}Y + C\hat{Y}E$ (applying the exterior angle theorem to the triangle ECY) $B\hat{C}Y = E\hat{B}X$ (given) $C\hat{Y}E = E\hat{X}B$ (proved in iii) $\therefore B\hat{E}X = B\hat{X}E + E\hat{B}X$	1 1	(2)		
	(v)		$A\hat{D}B = A\hat{D}C$ (corresponding angles in congruent triangles) $A\hat{D}B + A\hat{D}C = 180°$ (sum of adjacent angles on a straight line) $\therefore A\hat{D}B = 90°$ $B\hat{E}X = C\hat{E}Y$ (from (iv) and exterior angle theorem) $\therefore$ as above $B\hat{E}X = 90°$ Since corresponding angles are equal, $XE // AD$	1 1	(2)	10	$X\hat{A}D = \frac{B\hat{A}C}{2}$ (AD is the angle bisector) (1) $X\hat{A}C = A\hat{Y}X + Y\hat{X}A$ (applying exterior angle theorem to AYX Δ) $= 2\ A\hat{X}Y$ ($A\hat{Y}X = Y\hat{X}A$) (1) $\therefore X\hat{A}D = \frac{2A\hat{X}Y}{2} = A\hat{X}Y$ (since alternate angles are equal $XE // AD$

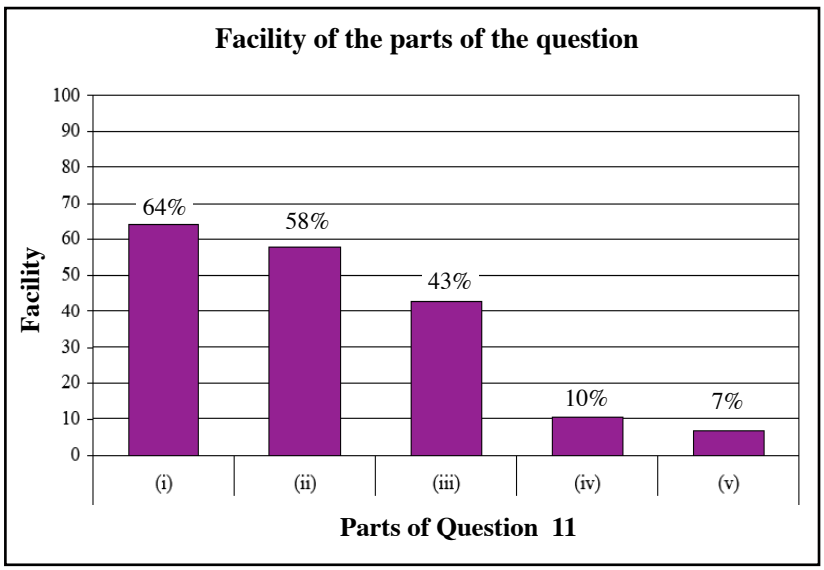
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Geometry' carries 10 marks. 51% of the candidates have selected it. Of these candidates,

about 52% have obtained marks in the interval 0 - 2,
about 32% have obtained marks in the interval 3 - 5,
about 12% have obtained marks in the interval 6 - 7,
and about 4% have obtained marks in the interval 8 - 10.

84% of the candidates have obtained 5 marks or less for this question. Only 4% have obtained 8 marks or more.



This question consists of 5 parts. The easiest part has been part (i), with a facility of 64%. The most difficult part has been part (v), with a facility of 7%. Overall facility of the question is 40%.

This question related to the congruence of triangles and to theorems on triangles under the theme 'Geometry' has a selection of 51%.

Part (i), which is given to check the ability in marking data on a diagram has a facility of 64%. This value is low due to poor knowledge on geometrical facts.

Part (ii) which measures the knowledge on the congruence of triangles has a facility of 58%. To answer this question, students should possess knowledge on the different cases of the congruence of triangles while understanding the similarities and differences in the elements of the triangles. Part (iii) based on the features of isosceles triangles has a facility of 43%. Not having proper understanding of the theorems on triangles, poor application of the theorems and not identifying vertically opposite angles have resulted in a low facility. By enhancing the abilities related to the above, candidates can be guided to answer these questions well.

Parts (iv) and (v) on theorems related to exterior angles and adjacent angles on a straight line have recorded low facilities. Not seeing the connections to these theorems and poor skills in using axioms have greatly contributed to this low facility level.

Enhancing the ability to use axioms and encouraging a proper understanding of the theorems will help in answering these types of questions successfully.

Objectives of Question 12

Competency 24 : Thinks logically when making decisions based on geometrical concepts related to circles.

Expected Learning Outcomes:

When a figure with data marked in it and one angle marked as x is given,

finds with reasons, the angles named in (i), (ii), (iii), (iv), (v) in terms of x. By using the angles obtained in terms of x,

shows that the triangle named in (vi) is an equilateral triangle.

12. In the given figure, AB is a chord of the circle with centre O. The point C is on AB produced such that $OB = BC$. The line BO produced meets the circle again at X. The tangents drawn to the circle at A and B meet at D. DB produced meets OC at E.

If $A\hat{X}O = x°$, giving reasons, find the following angles in terms of x.

(i) $A\hat{O}B$

(ii) $O\hat{B}A$

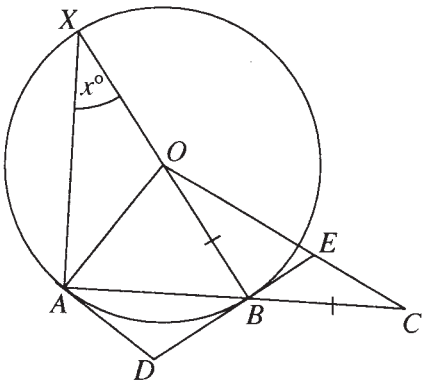
(iii) $B\hat{O}D$

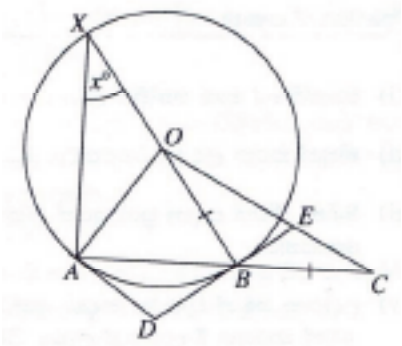
(iv) $B\hat{O}E$

(v) $B\hat{E}O$

By using the angles obtained in the above parts,

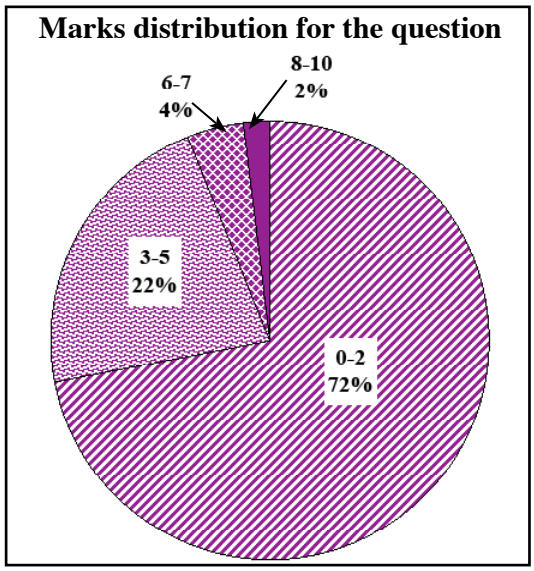
(vi) show that ODE is an isosceles triangle.



Question Number			Answer	Marks			Other
12.	(i)		 $\hat{AOB} = 2x°$ (angle subtended by an arc of a circle at the centre is equal to twice the angle subtended on the circle)	1 + 1	(2)		
	(ii)		$\hat{OBA} = 90° - x°$ (since XB is diameter $\hat{XAB} = 90°$)	1 + 1	(2)		$\hat{OBA} = \frac{180° - 2x°}{2} = 90° - x°$ ($\because OA = OB$) (1)

Question Number			Answer	Marks			Other
12.	(iii)		$\therefore \hat{BOD} = \frac{1}{2} \hat{AOB} = x°$ (tangents drawn from an exterior point to a circle subtend equal angles at the centre.)	1	(1)		
	(iv)		$\hat{BOE} = \frac{1}{2} \hat{OBA} = \frac{90° - x°}{2}$ $(BO = BC)$ or $= 45° - \frac{x°}{2}$	1 + 1	(2)		
	(v)		$\hat{BOE} = 90° - (45° + \frac{x°}{2})$ $(\because DB \perp OB)$ $= 45° + \frac{x°}{2}$	1	(1)		
	(vi)		$\hat{DOE} = 45° + \frac{x°}{2}$ $\therefore OD = DE$ $(\because \hat{DOE} = \hat{OED})$ $\therefore ODE\,\Delta$ is isosceles.	1 1	(2)	10	

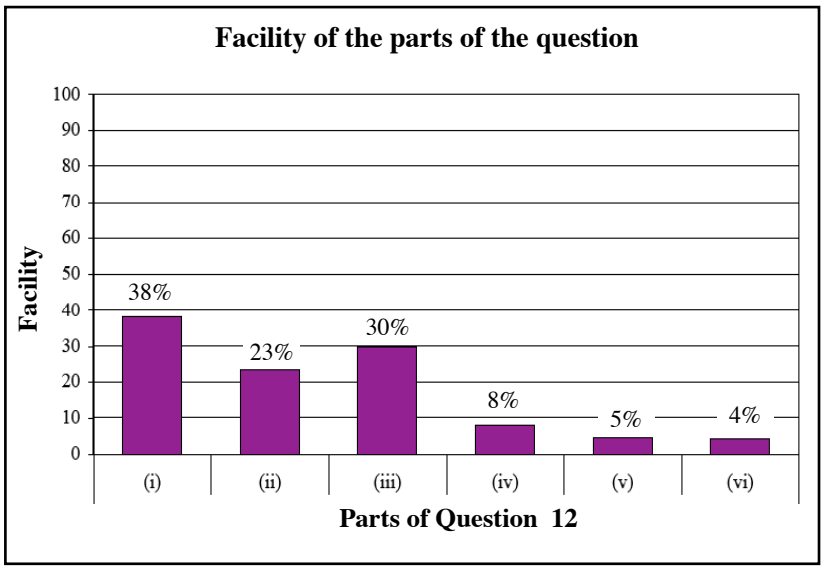
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Geometry' carries 10 marks. 26% of the candidates have selected it. Of these candidates,

about 72% have obtained marks in the interval 0 - 2,
about 22% have obtained marks in the interval 3 - 5,
about 4% have obtained marks in the interval 6 - 7,
and about 2% have obtained marks in the interval 8 - 10.

94% of the candidates have obtained 5 marks or less for this question. Only 2% have obtained 8 marks or more.



This question consists of 6 parts. The easiest part has been part (i) with a facility of 38%. The most difficult part has been part (vi) with a facility of 4%. Overall facility of the question is 20%.

This question has been given to test the knowledge on the theorems on angles related to circles, tangents and plane figures under the theme 'Geometry'. This is the question with the least selection by candidates, It is 26% as a percentage. The easiest part has been part (i) with a facility of 38% and the hardest part has been part (vi) with a facility of 4%.

None of the expected answers were numerical, and along with each answer, the correct reason had to be stated. For this, the candidates have to be familiar with the relevant theorems and in identifying their relationships. This was not evident and was the cause for the lack of success in providing answers.

This weakness can be minimized by enhancing students' knowledge on the geometrical features of plane figures, as well as their skills in applying the theorems related to circle in problems, starting from simple questions and proceeding to more complex ones.

Part III

3. Factors to be considered when answering questions and suggestions:

3.1 Factors to be considered when answering questions.

* The general instructions in the question paper should be read carefully and understood well. That is, students should pay attention to the following: How many questions should be answered from each part? Which questions are compulsory? How much time is available? How many marks are allocated? Students should also read the questions carefully and clearly understand what is expected before selecting the questions.
* The candidate's index number should be written on every page in the space provided for it.
* The answers to the questions in Paper I should be written on the question paper itself.
* When answering the questions in Paper II, each main question should be started on a new page.
* Answers should be written clearly and legibly.
* Numbers related to the question, its parts and sub-parts should be written accurately.
* For problems which require sentences to be written, the relevant steps should be clearly stated.
* In proofs of given results, logical reasons for each steps must be indicated.
* Depending on how the question is asked, facts should be presented in a logical and analytical way.
* It is advisable to do the calculations for each and every question next to the solution itself.
* The initial page of the answer script should be completed accurately.
* Only blue or black pens should be used.

Special Instructions

* When figures have to be drawn, they should be presented very clearly.
* When performing calculations, each step should be written clearly.
* The final answer should be written clearly and according to what has been asked.
* Attention should be paid to write any final solution which is either a fraction or a ratio in its simplest form.
* When required, the correct units should be used. The units relevant to the final answer should be in the standard form.
* Candidates should pay attention to their handwriting and write all numbers and symbols clearly and accurately.
* Candidates should note that, considering the simplification required for a mathematical problem as rough work and not presenting it in the solution, results in the candidate not receiving the marks assigned for the relevant step.
* When answering the problems on geometry, the necessary steps should be written down logically with the appropriate reasons.
* It should be mentioned that for problems on geometry, including the given data and also the derived data in the relevant figure will facilitate the discovery of the steps required to develop the correct answer.
* On occasions when the complete answer cannot be provided for a question, at least the steps that can be presented accurately should be written.
* Since some of the parts that come later in a question may be easier as well as independent of the earlier parts, it is important not to give up on a question if the initial parts are difficult, but to pay attention to all the parts.

3.2 Comments and suggestions regarding the teaching - learning process

* It is important for teachers as well as students to be aware of the resources such as the Syllabus, Teachers' Instructional Manual, Textbooks and other external resources that are available to them and to make use of them.
* Students should be informed of what they will be learning during a lesson.
* More attention needs to be paid to the multiplication tables since students lose a lot of marks due to the mistakes they make in multiplications and divisions as a result of not knowing the multiplication tables.
* Students need to also pay attention and correctly manipulate the mathematical operations with respect to fractions and decimals. It is productive to conduct a programme to develop their skills on manipulating the basic mathematical operations.
* It is also productive to use learning aids and practical activities in the teaching learning process to inculcate the correct mathematical concepts in even the weaker students.
* Subject content such as Geometry which is considered difficult should be first introduced using simple numerical exercises involving figures and gradually developed towards abstract concepts. The teacher should use different techniques and strategies in this effort.
* To overcome the weaknesses with respect to basic algebraic concepts developed during the lower classes, the teacher should pay greater attention to establish these concepts.
* To be successful in problem solving which is one of the special aims of learning mathematics, other skills too should be simultaneously developed and challenging problems which stimulate the mind be gradually introduced.
* Students should be given the confidence that they can do mathematics. For this, the teacher should use various methods. Short methods, games, fun activities, memory games, quizzes are some examples.
* It should be the responsibility of the teacher to inform students that mathematics which is an important and fundamental subject in the curriculum, is necessary for higher education as well as for future jobs and that it has a close relationship with normal day to day life.
* Teachers who continuously work to advance and update their knowledge are skilled and creative people who are a great gift to students.
* A programme should be initiated to minimize the effects of poor literacy skills which affect students' understanding of questions as well as their communication skills.
* It is important in Grade 11 not be just limited to the textbook of that year, but to also revise the knowledge gained in lower grades.
* Students need to be guided to pay more attention to perform reverse operations such as finding the cost price when the selling price is given. In other words, they need to develop not only skills in performing operations towards a solution but in the reverse order as well, when answering a mathematical problem.