MATHEMATICS

SECTION A – 40 MARKS

*(Attempt **all** questions from this **Section**.)*

Question 1

Choose the correct answers to the questions from the given options.   **[15]**

(Do not copy the questions, write the correct answers only.

(i)   For an Intra-state sale, the CGST paid by a dealer to the Central government is ₹ **120**. If the marked price of the article is ₹ **2000**, the rate of **GST** is:

(a) 6%

(b) 10%

(c) 12%

(d) 16.67%

(ii)   What must be subtracted from the polynomial $x^3 + x^2 - 2x + 1$, so that the result is exactly divisible by $(x - 3)$?

(a) $- 31$

(b) $- 30$

(c) 30

(d) 31

(iii) The roots of the quadratic equation $px^2 - qx + r = 0$ are real and equal if:

(a) $p^2 = 4qr$

(b) $q^2 = 4pr$

(c) $- q^2 = 4pr$

(d) $p^2 > 4qr$

(iv)   If matrix $A = \begin{bmatrix} 2 & 2 \\ 0 & 2 \end{bmatrix}$ and $A^2 = \begin{bmatrix} 4 & x \\ 0 & 4 \end{bmatrix}$, then the value of x is:

(a) 2

(b) 4

(c) 8

(d) 10

1

(v)   The median of the following observations arranged in ascending order is **64**. Find the value of *x*:

$$27, \ 31, \ 46, \ 52, \ \textbf{x}, \ \textbf{x + 4}, \ 71, \ 79, \ 85, \ 90$$

(a)   60

(b)   61

(c)   62

(d)   66

(vi)   Points **A (x, y)**, **B (3, -2)** and **C (4, -5)** are collinear. The value of *y* in terms of *x* is:

(a) $3x - 11$

(b) $11 - 3x$

(c) $3x - 7$

(d) $7 - 3x$

(vii)   The given table shows the distance covered and the time taken by a train moving at a uniform speed along a straight track.

Distance (in m)	60	90	y
Time (in sec)	2	x	5

The values of *x* and *y* are:

(a) $x = 4, y = 150$

(b) $x = 3, y = 100$

(c) $x = 4, y = 100$

(d) $x = 3, y = 150$

(viii) The 7th term of the given Arithmetic Progression (A.P.):

$$\frac{1}{a}, \left(\frac{1}{a} + 1\right), \left(\frac{1}{a} + 2\right) \dots \text{is:}$$

(a) $\left(\frac{1}{a} + 6\right)$

(b) $\left(\frac{1}{a} + 7\right)$

(c) $\left(\frac{1}{a} + 8\right)$

(d) $\left(\frac{1}{a} + 7^7\right)$

(ix)   The sum invested to purchase **15** shares of a company of nominal value **₹75** available at a discount of **20%** is:

        (a)   ₹60

        (b)   ₹ 90

        (c)   ₹1350

        (d)   ₹900

(x)   The circumcentre of a triangle is the point which is:

        (a)   at equal distance from the three sides of the triangle.

        (b)   at equal distance from the three vertices of the triangle.

        (c)   the point of intersection of the three medians.

        (d)   the point of intersection of the three altitudes of the triangle.

(xi)   Statement 1: $\sin^2\theta + \cos^2\theta = 1$

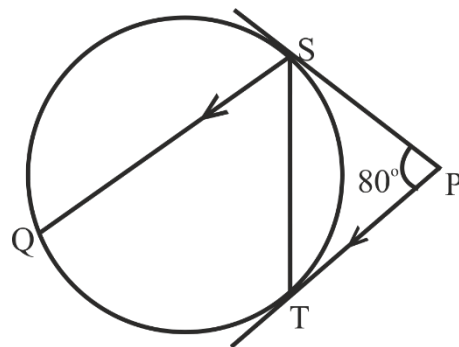   Statement 2: $\operatorname{cosec}^2\theta + \cot^2\theta = 1$

        Which of the following is valid?

        (a)   only 1

        (b)   only 2

        (c)   both 1 and 2

        (d)   neither 1 nor 2

(xii)   In the given diagram, PS and PT are the tangents to the circle. SQ ‖ PT and **∠SPT = 80°**. The value of ∠QST is:

        (a)   140°

        (b)   90°

        (c)   80°

        (d)   50°

(xiii)   **Assertion (A):** A die is thrown once and the probability of getting an even number is $\frac{2}{3}$.

        Reason (R):   The sample space for even numbers on a die is **{2, 4, 6}**

        (a)   A is true, R is false.

        (b)   A is false, R is true.

   (c)   Both A and R are true.

(d)   Both A and R and false.

(xiv)   A rectangular sheet of paper of size 11 cm x 7 cm is first rotated about the side **11 cm** and then about the side **7 cm** to form a cylinder, as shown in the diagram. The ratio of their curved surface areas is:

(a)   1 : 1

(b)   7 : 11

(c)   11 : 7

(d) $\dfrac{11\pi}{7} : \dfrac{7\pi}{11}$
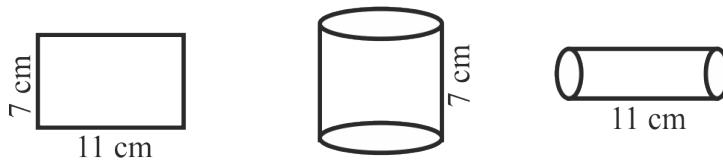
(xv)   In the given diagram, **ΔABC ~ ΔPQR**. If AD and PS are bisectors of ∠**BAC** and ∠**QPR** respectively then:

(a)   ΔABC ~ ΔPQS

(b)   ΔABD ~ ΔPQS

(c)   ΔABD ~ ΔPSR

(d)   ΔABC ~ ΔPSR
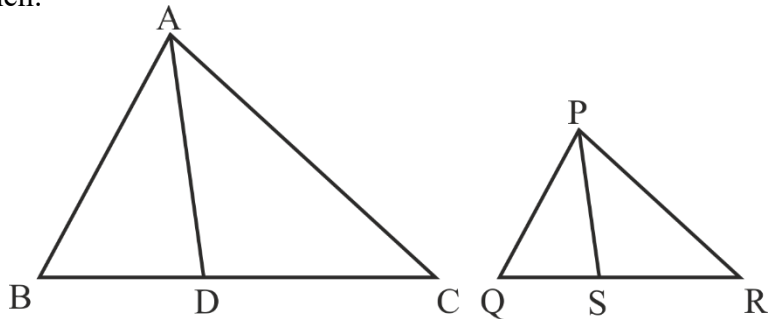
Comments of Examiners

(i)　Most of the candidates' concept of CGST being half of the total GST was not clear, hence selected incorrect option (a). However, to find the rate of GST, some candidates arrived at total GST as ₹120 instead of ₹240.

(ii)　A large number of candidates while reading the question missed out reading 'what must be subtracted'. The remainder obtained on dividing the polynomial by (x – 3) was 31, hence value to be subtracted is 31 and not –31. Hence, an incorrect value was attained as –31.

(iii)　Many candidates made errors in identifying the condition that discriminant of a quadratic equation is b^2 - 4ac = 0 for *real* and *equal* roots, thus opted for option (a). The ones who made errors in squaring a negative integer or transposing, opted for option (c).

(iv)　Almost all the candidates were unable to identify matrix product A^2. Instead of finding the product A^2= AxA, some candidates squared each of the elements of matrix A.

(v)　A number of candidates found the value of *x* correctly. However, some candidates equated x + 4 to 64 and arrived at the value of x as option (a). Due to errors in calculation, other candidates selected incorrect option (b).

(vi)　Many candidates were confused about the concept of collinearity of 3 points and were unable to apply the condition that slopes of AB, BC and AC are equal. Some candidates went wrong in simplifying the equation formed and hence arrived at the answer 'c'.

(vii)　Majority of the candidates answered the question correctly using the property of ratio and proportion. Some candidates without proportionality applied guess work and arrived at an incorrect response. Some candidates opted for option (c) as they applied incorrect logic for proportionality.

Suggestions for teachers

- Provide regular practice with various real-based examples on the way GST is divided equally between the Central Government (CGST) and the State Government (SGST) to avoid errors in future.
- Instruct students to read the question carefully and understand the question to identify the correct option.
- Encourage students that it would be better if the number added to or subtracted from is taken as 'K'(any constant) and then solve for 'K' to minimise the errors.
- Give sufficient practice of nature and condition of roots of a quadratic equation to avoid basic errors.
- Clarify the misconception of square of (- q) is (q^2) and not $(- q^2)$ among students.
- Ensure students' concept of Matrix multiplication is clear by providing regular practice of Matrix product AxB and AxA following the same method of multiplying row x column.
- Train students to find mean, median mode of (a) non-grouped non frequency distribution (b) non-grouped frequency distribution (c) grouped frequency distribution. Encourage students to identify the odd and even number of data in the given distribution.
- Provide repeated practice on different conditions related to slopes, such as collinearity, parallelism, and perpendicularity, to ensure that students do not make conceptual errors.
- Encourage students to do practice of logic-based questions.
- Stress on student's competency in understanding the question and encourage to apply relation that holds in the A.P. that is, the relation between the given terms.
- Make clear concepts of shares at par, premium and discount.
- Teach students to differentiate between circumcentre, incentre, centroid and the orthocentre.

(viii) Candidates made errors for not being able to apply logical thinking in the pattern of the A.P. $\frac{1}{a}, \left(\frac{1}{a} + 1\right), \left(\frac{1}{a} + 2\right) \dots$ as a result mentioned the answer as $\left(\frac{1}{a} + 7\right)$ for the 7th term. Some candidates were confused as they inserted incorrect formula for T_n, thus opted option (c).

(ix) Most candidates arrived at the correct answer to this question. Some candidates gave the answer as option (a) instead of option (d) that was price for only one share and not 15 shares. Due to error in calculation, some candidates selected option (b).

(x) Many candidates were not familiar with the concept of a circumcentre being the point equidistant from the three vertices of a triangle. However, other candidates who opted for the option (a) reflected their misconception between circumcentre and incentre.

(xi) Several candidates answered it correctly. However, some candidates were not familiar with the trigonometric identity $cosec^2\theta - cot^2\theta = 1$ and hence chose the incorrect option (c) as their response.

> ## *Suggestions for teachers*
>
> − Familarise students with actual constructions by creating visual impact.
> − Give practice of standard trigonometric identities with related problems to build conceptual clarity.
> − Regular practice of application-based problems with all properties related to circle, theorems and geometry to be given.
> − Explain the basic concepts and terminology related to probability questions.
> − Guide students to write sample space while solving problems on probability.
> − Provide more practice of Assertion-Reason based questions.
> − Explain the concept of curved surface area of cylinder by means of folding paper lengthwise and breadthwise. With hands on activity, students can apply the formula without memorising. While introducing formulas, they may be taught the two-dimensional representation of a three – dimensional figure.
> − Give sufficient practice of different types of triangles with different given necessary conditions, proportionality of sides and angles of similar triangles.

(xii) Some candidates were not able to use the property that tangents PS and PT drawn from external point P are equal in length, hence failed to identify ΔPST as an isosceles triangle. Hence, the answer was incorrect. Few candidates chose option (b) mistaking QS as the diameter. However, few other candidates selected option (c) due to misconception of $\angle$ QST and $\angle$ SPT being alternate angles.

(xiii) Almost all the candidates opted for the (c) as they were unable to apply concept of sample space in probability. However, some candidates were confused about the total sample space and sample space of even numbers, hence were unable to arrive at the correct option.

(xiv) A large number of candidates were unable to analyse the figures provided in the question. Some candidates were confused with the formula of surface area of cylinder with change in radius and height and few other candidates used incorrect formulas.

(xv) Many candidates selected the incorrect option (a) or (d), as they failed to analyse the [AA axioms] of similarity and to identify similar triangles based on their corresponding equal angles. Some candidates were unable to identify from the given conditions that ΔABD $\sim \Delta$PQS.

		MARKING SCHEME

Question 1

(i)	(c)	12%
(ii)	(d)	31
(iii)	(b)	$q^2 = 4pr$
(iv)	(c)	8
(v)	(c)	62
(vi)	(d)	7 − 3x
(vii)	(d)	x = 3, y = 150
(viii)	(a)	$\left(\dfrac{1}{a} + 6\right)$
(ix)	(d)	₹900
(x)	(b)	at equal distance from the three vertices of the triangle.
(xi)	(a)	only 1
(xii)	(d)	50°
(xiii)	(b)	A is false, R is true.
(xiv)	(a)	1 : 1
(xv)	(b)	ΔABD ~ ΔPQS

Question 2

(i) $A = \begin{bmatrix} x & 0 \\ 1 & 1 \end{bmatrix}, B = \begin{bmatrix} 4 & 0 \\ y & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 4 & 0 \\ x & 1 \end{bmatrix}$ **[4]**

Find the values of **x** and **y**, if **AB = C**.

(ii)   A solid metallic cylinder is cut into two identical halves along its height (as shown in the diagram). The diameter of the cylinder is **7 cm** and the height is **10 cm**. Find: **[4]**

(a)   The total surface area (both the halves).

(b)   The total cost of painting the two halves at the rate of **₹ 30** per cm^2

$$\left(Use\ \pi = \frac{22}{7}\right)$$
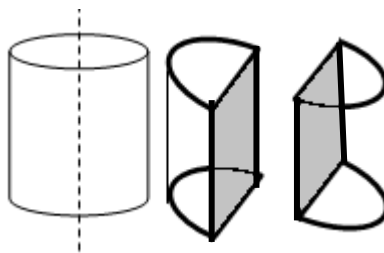
(iii)   15, 30, 60, 120… are in **G.P.** (Geometric Progression).   **[4]**

(a)   Find the **nth** term of this **G.P.** in terms of **n**.

(b)   How many terms of the above **G.P.** will give the sum **945**?

Comments of Examiners

(i) Majority of the candidates made an error in finding the matrix product AB, and hence arrived at the value of *x* and *y*. Thus, the candidates mentioned 4y=1 and the incorrect value of y=1/4 arrived at the end.

(ii) (a) Many candidates failed to identify the formation of two new surfaces on dividing the cylinder into two equal halves. Some candidates found the total surface area of the cylinder using *2πr(r+h)*. Some candidates could not apply higher order thinking and did not include the flat rectangular surfaces in their calculation. Hence, got an incorrect result as 297cm^2. However, some candidates found the total surface area of only one of the halves for the cylinder and many other candidates took the radius of the cylinder as 7.

   (b) As the candidates could not find the total surface area correctly and found the incorrect cost of painting into the two halves.

(iii) (a) Some candidates applied incorrect formula for finding the *nth* term of the given G.P. Many candidates mentioned $15 \times 2^{n-1} = 30^{n-1}$.

   (b) Some candidates used an incorrect summation formula for G.P. and hence arrived at an incorrect answer. Some candidates equated the *nth* term of G.P. to 945 instead of the summation formula. A number of candidates also had confusion of formula for A.P. and G.P. Instead of arriving at 63=2^n-1, the candidates mentioned 63=2^{n-1}.

MARKING SCHEME

Question 2

(i)	AB = C

$$\begin{bmatrix} x & 0 \\ 1 & 1 \end{bmatrix}\begin{bmatrix} 4 & 0 \\ y & 1 \end{bmatrix} = \begin{bmatrix} 4 & 0 \\ x & 1 \end{bmatrix}$$

$$\begin{bmatrix} 4x & 0 \\ 4+y & 1 \end{bmatrix} = \begin{bmatrix} 4 & 0 \\ x & 1 \end{bmatrix}$$

OR

$\therefore 4x = 4$ $\qquad\qquad 4+y = x$

$x = 1$ $\qquad\qquad y = 1-4$

$\qquad\qquad\qquad y = -3$

(ii)

(a) $\quad 2 \times \dfrac{22}{7} \times 3.5 \times 10 + 2 \times \dfrac{22}{7} \times 3.5^2 + 2 \times 7 \times 10$

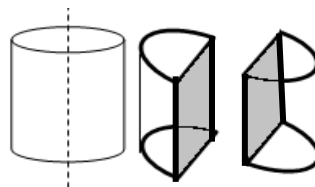$\qquad = 2 \times \dfrac{22}{7} \times 3.5(10 + 3.5) + 140$ $\qquad$ or

$\qquad = 22 \times 13.5 + 140$

$\qquad = 297 + 140$

$\qquad = 437 \ cm^2$

(b) $\qquad$ Cost $= 437 \times 30 = ₹13110$

(iii) $\quad 15, 30, 60, 120\ldots$

(a) $\quad T_n = ar^{n-1} = 15 \times 2^{n-1}$

(b) $\quad S_n = 945$

$\qquad 945 = \dfrac{a(r^n - 1)}{r - 1}$

$\qquad 945 = \dfrac{15(2^n - 1)}{2 - 1}$

$\qquad 63 = 2^n - 1$

$\qquad 64 = 2^n$

$\qquad 2^n = 2^6$

$\qquad n = 6$

Question 3

(i)   Factorize: $sin^3\theta + cos^3\theta$ **[4]**
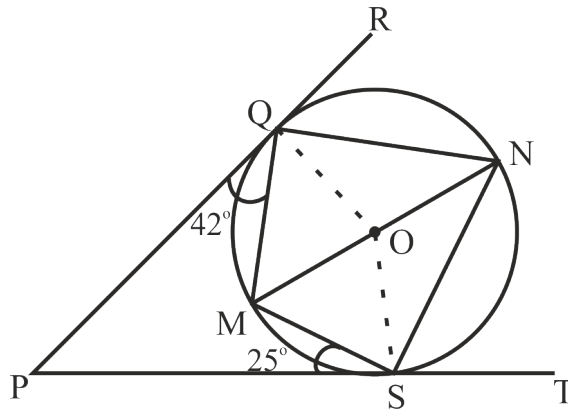
Hence, prove the following identity:

$$\frac{sin^3\theta + \cos^3\theta}{\sin\theta + \cos\theta} + \sin\theta cos\theta = 1$$

(ii) In the given diagram, O is the centre of the circle. PR and PT are two tangents drawn   **[4]**
from the external point P and touching the circle at Q and S respectively. MN is a
diameter of the circle. Given ∠PQM = 42º and ∠PSM = 25º.

Find:

(a)   ∠OQM

(b)   ∠QNS

(c)   ∠QOS

(d)   ∠QMS

(iii) Use graph sheet for this question. Take 2 cm = 1 unit along the axes.   **[5]**

(a)   Plot A(0, 3), B(2, 1) and C(4, -1).

(b)   Reflect point B and C in *y*-**axis** and name their images as B' and C' respectively.
Plot and write coordinates of the points B' and C'.

(c)   Reflect point A in the line BB' and name its images as A'.

(d)   Plot and write coordinates of point A'.

(e)   Join the points ABA'B' and give the geometrical name of the closed figure so
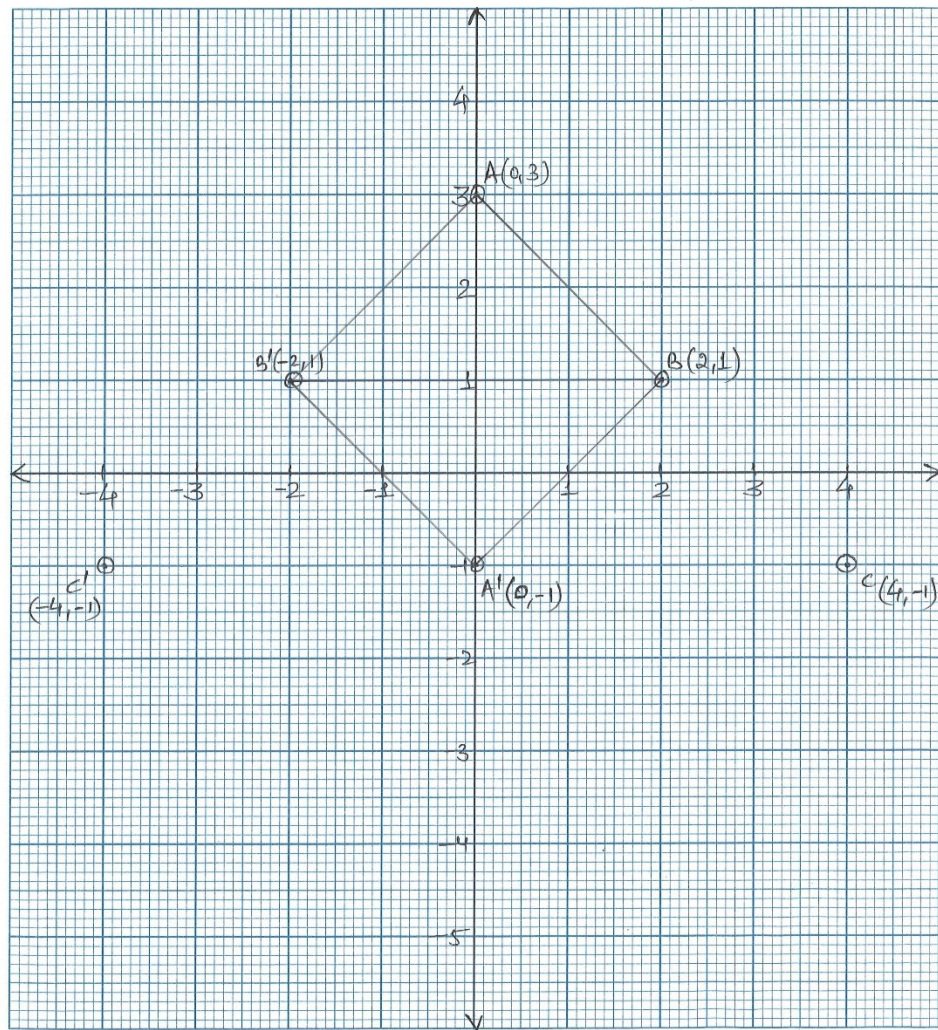formed.

Comments of Examiners

(i)   The question was application based and many candidates failed to apply the algebraic identity $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$ to factorise $sin^3\theta + cos^3\theta$. Some candidates tried to prove the identity by taking $\sin\theta + \cos\theta$ as the LCM but made errors in simplifying the expression.

(ii) (a) Some candidates failed to apply the concept that angle made by a tangent radius equal to 90°, hence arrived at the incorrect value of ∠OQM.

   (b) Many candidates were unable to apply the alternate segment Theorem to find ∠QNM=42°, ∠SNM = 25° and hence value of ∠QNS was incorrect.

   (c) As value of ∠QNS was incorrect, the value of ∠QOS also arrived wrongly which is twice ∠QNS.

   (d) Majority of candidates did not use the property that ∠QMS + ∠QNS = 180° by cyclic property. Some candidates went wrong due to incorrect value of ∠QNS in part (b).

(iii) (a) Some candidates did not read the question carefully and hence chose an incorrect scale and some interchanged the positive and negative axis. Some plotted points A (0, 3), B(2, 1) and C (4, -1) incorrectly. Many candidates did not mention the coordinates of A, B and C on the graph.

   (b) Some candidates plotted the images B' and C' correctly but did not write down the coordinates. There were candidates who reflected B and C on the x-axis instead of y-axis.

   (c) Many candidates reflected A on x-axis instead of BB', hence plotting of A' was incorrect. Hence, a number of candidates arrived at A^1 as (0,-3) instead of A^1 as (0,-1) .

   (d) As candidates reflected A on x-axis instead of BB' found image A' as (0, -3) instead of (0, -1).

   (e) A large number of candidates answered this sub-part of the question incorrectly. Due to incorrect plotting of points, some candidates had incorrect figure ABA'B'. Other candidates named the figure as a Rhombus or a quadrilateral instead of a Square. Since the mirror line was wrong,

the candidates ended up getting the figure as kite. However, other candidates ended up with a square instead of a rhombus.

> ### *Suggestions for teachers*
>
> − More practice to be provided in drawing the correct coordinate axes, plotting the correct co-ordinate points and also reflecting the same.
> − Advise students to name the figure formed according to their special property.

MARKING SCHEME
Question 3

(i)

$$sin^3\theta + cos^3\theta = (sin\theta + cos\theta)(sin^2\theta - sin\theta cos\theta + cos^2\theta)$$

$$= (sin\theta + cos\theta)(1 - sin\theta cos\theta)$$

L.H.S. $sin^2\theta + cos^2\theta = 1$

$$\frac{sin^3\theta + cos^3\theta}{sin\theta + cos\theta} + sin\theta cos\theta$$

$$= \frac{(sin\theta + cos\theta)(1 - sin\theta cos\theta)}{sin\theta + cos\theta} + sin\theta cos\theta$$

$$= 1 - sin\theta cos\theta + sin\theta cos\theta$$

$$= 1 = \text{R.H.S.}$$

(ii)

(a) ∠OQM = 90º – 42º = 48º (∵OQ is ⊥ʳ to QP, tangent)

(b)   ∠QNM = ∠PQM = 42º

         ∠SNM = ∠PSM = 25º

         ∴ ∠QNS = 42º + 25º = 67º

(c)   ∠QOS = 2∠QNS = 2 × 67º = 134º

(d)   ∠QMS = 180º – ∠QNS = 180º – 67º

              = 113º

(iii)

(a)   Plotting A(0, 3), B(2, 1), C(4, –1)

(b)   Reflection of B, C to B′(–2, 1), C′(–4, –1) (*y*-axis)

(c)   Reflection of A(0, 3) on B B′ → A′(0, –1)

(d)   A′(0, –1)

(e)   Square

SECTION B – 40 MARKS

*(Attempt **any four** questions from this Section.)*

Question 4

(i)   Suresh has a recurring deposit account in a bank. He deposits ₹2000 per month and the   **[3]**
bank pays interest at the rate of 8% per annum. If he gets ₹1040 as interest at the time
of maturity, find in years total time for which the account was held.

(ii)   The following table gives the duration of movies in minutes.   **[3]**

Duration (in minutes)	100 – 110	110 – 120	120 – 130	130 – 140	140 – 150	150 – 160
No. of movies	5	10	17	8	6	4

Using step – deviation method, find the mean duration of the movies.

(iii)   If $\dfrac{(a + b)^3}{(a - b)^3} = \dfrac{64}{27}$ **[4]**

(a)   Find $\dfrac{a + b}{a - b}$

(b)   Hence using properties of proportion, find $a : b$.

Comments of Examiners

(i) Majority of the candidates attempted this question incorrectly. Few candidates used incorrect formula to find interest for recurring deposit account. Some candidates made calculation error in forming and solving the quadratic equation $n^2 + n - 156 = 0$, other candidates wrote the final answer as 12 months instead of 1 year as per the question. However, some candidates took ₹1040 as M.V. and calculated using M.V. formula thereby ending up with an incorrect answer.

(ii) A large number of candidates did not apply the step - deviation method as given in the question to calculate the Mean of the distribution. Some candidates did not choose the assumed mean from one of the class - mark, instead took one of the frequency or any other random number. This made calculation complicated. Some candidates took the class interval as 5 instead of 10. Calculations errors were also observed.

(iii) (a) Candidates made error in finding the cube root of $\frac{64}{27}$ and hence, failed to solve the sum. Instead of 4/3, the answer arrived was 8/3. Some candidates were unable to proceed to find $\frac{a+b}{a-b}$. Few candidates used the cross-multiplication method and did not use properties of proportion and forgot to express the answer in ratio form.

(b) Some candidates did not apply componendo and dividendo to find, a: b instead cross – multiplied to find the solution. Other candidates solved the sum correctly but mentioned the final answer in the form $\frac{a}{b} = \frac{7}{1}$ instead of a: b = 7:1, hence lost marks.

MARKING SCHEME

Question 4

(i)	P = ₹ 2000, $r = 8\%$, Interest = ₹1040, time = n months

$$\therefore (1040 =) \frac{2000 \times n(n+1) \times 8}{100 \times 2 \times 12}$$

$$52 \times 3 = n(n+1)$$

$$\therefore n^2 + n - 156 = 0$$

$$(n+13)(n-12) = 0$$

$$\therefore n = 12 \text{ months or } n = 1 \text{ year}$$

(ii)	

Duration (in min)	No. of movies	x	$t = \frac{X-A}{i}$	$f t$
100 – 110	5	105	−3	−15
110 – 120	10	115	−2	−20
120 – 130	17	125	−1	−17
130 – 140	8	135	0	0
140 – 150	6	145	1	6
150 – 160	4	155	2	8
	$\Sigma f = 50$		OR	$\Sigma ft = -38$

$$Mean = A + \frac{\Sigma ft}{\Sigma f} \times i$$

$$= 135 + \frac{-38}{50} \times 10$$

$$= 135 - 7.60$$

$$= 127.40 \text{ mins.}$$

(iii)	

(a) $\dfrac{(a+b)^3}{(a-b)^3} = \dfrac{64}{27}$

$\dfrac{(a+b)^3}{(a-b)^3} = \dfrac{4^3}{3^3}$

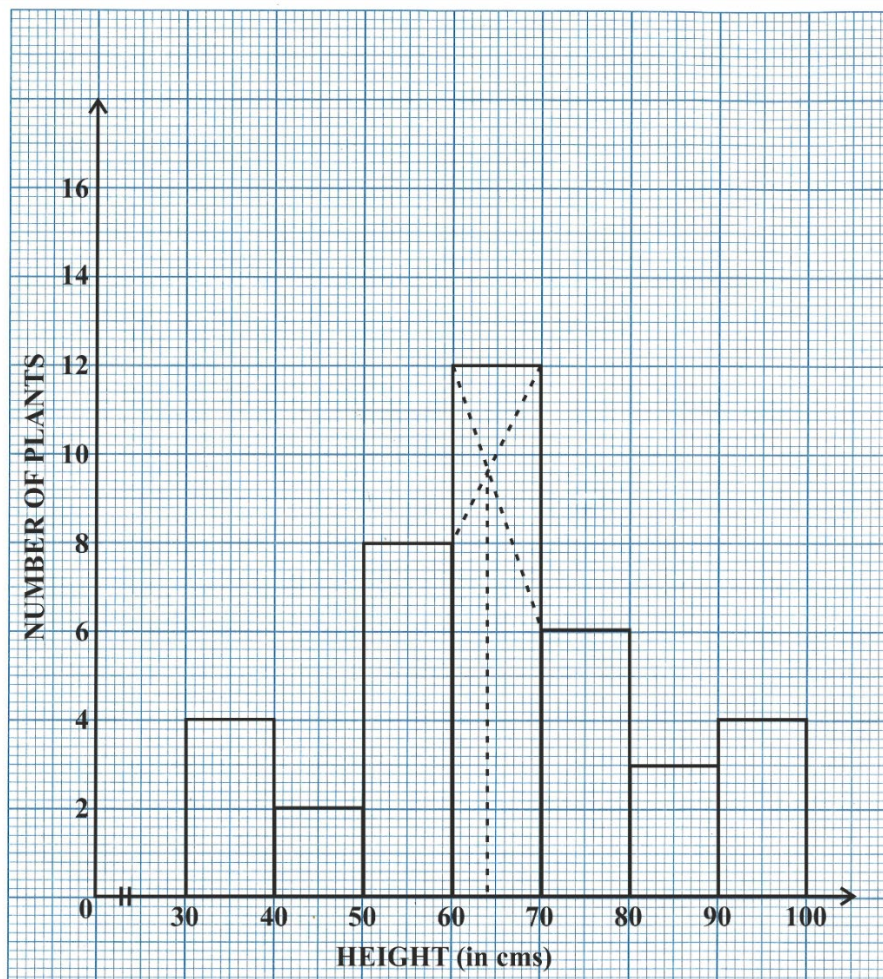$\therefore \dfrac{a+b}{a-b} = \dfrac{4}{3}$

(b) $\dfrac{a+b+a-b}{a+b-a+b} = \dfrac{4+3}{4-3}$

$\therefore \dfrac{2a}{2b} = \dfrac{7}{1}$

$\therefore a : b = 7 : 1$

Question 5

(i)   The given graph with a histogram represents the number of plants of different heights   **[5]**
       grown in a school campus. Study the graph carefully and answer the following
       questions:

(a) Make a frequency table with respect to the class boundaries and their
     corresponding frequencies.

(b) State the modal class.

(c) Identify and note down the mode of the distribution.

(d) Find the number of plants whose height range is between 80 cm to 90 cm.

(ii)   The angle of elevation of the top of a 100 m high tree from two points A and B on the   **[5]**
       opposite side of the tree are 52° and 45° respectively. Find the distance AB, to the
       nearest metre.
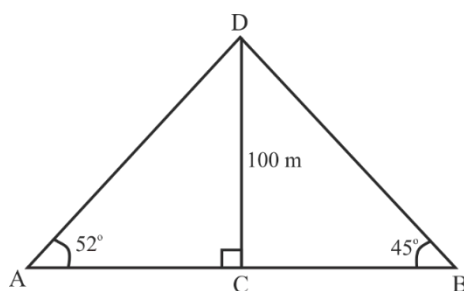
Comments of Examiners

(i) (a) This question was based on analysing graphical representation of Histogram. Many candidates did it correctly. Some candidates were unable to form the frequency table, and some went wrong in listing the frequency and others mentioned the frequency of the class 80 – 90 as 2.5 instead of 3.

(b) Some candidates mentioned the modal class as 64 which is the mode instead of 60 - 70.

(c) Some candidates mentioned the mode as 60 –70 instead of 64. The candidates were confused between mode and modal class. Few candidates wrote the answer as 12 instead of 64, which is the frequency of the modal class.

(d) Most candidates provided the right answer. Some candidates in part 'a' identified the frequency for class interval 80-90 as 2.5 instead of 3, hence provided the answer to this part as 2.5.

(ii) Most of the candidates made the following mistakes in their responses:

- Some candidates used incorrect ratio, for example, $\tan 52° = $ instead of $\frac{100}{AC}$.

- Using mathematical tables to find value of $\tan 52°$. Some candidates rounded off the value of $\tan 52°$ while reading from the table. Many candidates took the value as 1.28 or 1.27.

- Other candidates did not adopt the shorter method of writing, instead substituted $\tan 52°$ as 1.2799 in the denominator which led to long calculation and hence made errors in the process.

- A large number of candidates made a mistake in rounding off the answer to the nearest metre.

MARKING SCHEME

Question 5

(i)   **(a)**

Ht. in cm	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90	90 – 100
Number of plants	4	2	8	12	6	3	4

(b) $60 - 70$

(c)   Mode $= 64$

(d)   3

(ii)   **(a)** $\angle B = 45^0$

$\therefore CD = CB = 100 \, m, \qquad tan45° = 1$

$tan52° = \dfrac{DC}{AC} \; or \; AC = \dfrac{100}{tan52°} = 100 cot52°$

$\therefore AC = 100 \times tan38^o = 100 \times 0.7813 = 78.13/78$

$\therefore AB = 100 + 78.13 = 178.13 = 178 \, m$
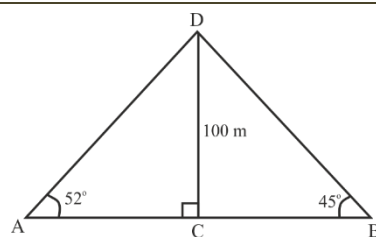
tan52º = 1.2799
tan38º = 0.7813
sin52º = 0.7880
cosec52º = 1.2690
(any one)

Question 6

(i)   Solve the following quadratic equation for x and give your answer correct to three   **[3]**

significant figures: $2x^2 - 10x + 5 = 0$

(Use mathematical tables if necessary)

(ii)   The nth term of an Arithmetic Progression **(A.P.)**   is given by the relation   **[3]**

$T_n = 6(7 - n)$. Find:

(a)   its first term and common difference

(b)   sum of its first **25** terms

(iii)   In the given diagram ΔADB and ΔACB are two right angled triangles with   **[4]**

$\angle ADB = \angle BCA = 90^\circ$. If AB = 10 cm, AD = 6 cm, BC = 2.4 cm and DP = 4.5 cm
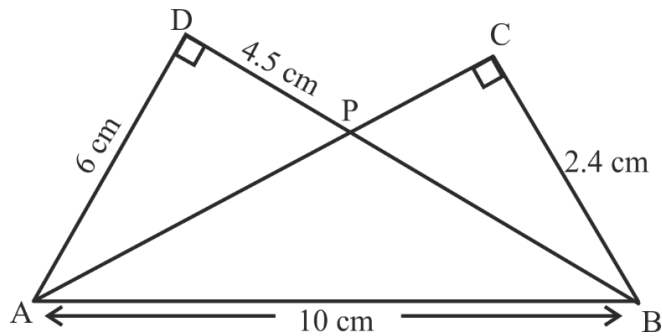
(a)   Prove that $\Delta APD \sim \Delta BPC$

(b)   Find the length of BD and PB

(c)   Hence, find the length of PA

(d)   Find area ΔAPD : area ΔBPC

Comments of Examiners

(i) In solving the quadratic equation $2x^2 - 10x + 5 = 0$, some candidates took $\sqrt{60} = 7.75$ instead of the correct values $\sqrt{60} = 7.746$. However, other candidates used incorrect formula to solve the quadratic equation, some other candidates made sign errors in substitution. A few candidates made calculation errors, and many failed to round off the answers to <u>three significant figures</u>. There were candidates who tried to find the $\sqrt{60}$ or $\sqrt{15}$ by division method instead of using the Mathematical Tables which made working much simpler. There were errors in finding square root by division method. Many candidates made calculation errors while simplifying the expression. A large number of candidates made an error in rounding off the answer to 3 significant figures.

(ii) (a) Many candidates failed to substitute n = 1; n = 2 in the T_n formula. hence, they got wrong values of 'a' and 'd' respectively. They do not have knowledge of finding terms when T_n is given in terms of n for an A.P.

(b) The incorrect summation formula for the A.P. was used. Some candidates used the T_n formula instead of Sn formula for summation of 25 terms of the A.P. Due to incorrect substitution in summation formula of A.P. or error in calculation. Many candidates got $S_{25} = 900$ instead of -900. Some candidates got the summation answer incorrect due to error in value of first term and common difference in part (a).

(iii) (a) Some candidates were unable to prove $\Delta APD \sim \Delta BPC$. Many candidates could prove the triangles similar using AA test. However, some candidates mentioned $\angle P = \angle P$ and gave the reason as common angle instead of vertically opposite angles.

(b) Many candidates failed to identify that ΔADB is a right-angled triangle and length of BD = 8 could have been easily found by using Pythagoras Theorem and PB by subtracting PD from BD i.e. $8 - 4.5 = 3.5$ cm. Several candidates were found making errors in writing the proportional sides and thereby getting wrong value of BD. Simple calculation errors were observed in finding the value of BD & PB.

Suggestions for teachers

- Train students to use mathematical tables to find square root of irrational numbers.
- Give practice of rounding off answers as per the question. Encourage students to do all rounding off right after completely solving the sum.
- Provide more practice of solving quadratic equation using formula to avoid the errors made by the students.
- Make students understand the significance of knowing the nth term of an A.P. which would help them in finding any term of the series by replacing *n* with the term to be found.
- Give repeated practice with sums where general term is given for A.P. or G.P. and certain terms are to be found.
- Provide sufficient practice of sums related to summation of A.P. to avoid errors.
- Give regular practice with emphasis on calculations with due importance on use of brackets and follow BODMAS rules.
- Give more practice to prove triangles with different given data.
- Train students to name angles using all three letters. e.g. $\angle APD = \angle BPC$ and not as $\angle P = \angle P$.
- Encourage students to read while solving a geometry problem of the given data carefully.
- Explain the concept of writing proportional sides in similarity and then use it to find the unknown sides given in the question.
- Give in depth-practice on similarity and getting the proportionality of corresponding sides and angles etc. along with similarity with proper reasoning.

(c) As per the given data length of PA could be found by two different ways. Some candidates managed to apply for them, but some were unable to proceed. Many candidates did not read and comprehend the meaning and importance of the word "Hence " and reached different answers. However, credit to candidates were given whichever way they had proceeded to solve the problem.

(d) Some candidates could not apply that area ΔAPD: area ΔBPC is equal to ratio of the square of the corresponding sides. However, other candidates were unable to get a proper value of (b) and (c) but credit was given for this part.

MARKING SCHEME

Question 6

(i)	$2x^2 - 10x + 5 = 0$ $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \qquad a = 2, \qquad b = -10, \qquad c = 5$ $x = \dfrac{-(-10) \pm \sqrt{(-10)^2 - 4 \times 2 \times 5}}{2 \times 2} = \dfrac{10 \pm \sqrt{100 - 40}}{4}$ $x = \dfrac{10 \pm \sqrt{60}}{4} = \dfrac{10 \pm 7.746}{4} = \dfrac{17.746}{4}, \dfrac{2.254}{4}$ $\boxed{\begin{array}{l}\sqrt{60} = 7.746 \\ \sqrt{15} = 3.873\end{array}}$ $\therefore x = 4.436, \qquad 0.5635$ $x = 4.44, \qquad 0.564$
(ii)	(a) $\quad T_n = 6(7 - n)$ $\qquad \therefore T_1 = 6(7 - 1) = 36$ $\qquad T_2 = 6(7 - 2) = 30$ $\qquad \therefore 1^{st}$ term = 36 and common difference = –6 (b) $S_n = \dfrac{n}{2}[2a + (n - 1)d]$ $\qquad \therefore S_{25} = \dfrac{25}{2}[2 \times 36 + (25 - 1)(-6)]$ $\qquad = 25(72 - 144)$ $\qquad = \dfrac{25}{2} \times (-72) = -900$ $\qquad \therefore S_{25} = -900$
(iii)	(a) $\quad$ In ΔAPD and ΔBPC $\qquad \angle D = \angle C = 90° \ (given)$ $\qquad \angle APD = \angle BPC$ (vertically opposite angles) $\qquad \therefore \Delta APD \sim \Delta BPC \ \{AA)$ (b) $BD = \sqrt{10^2 - 6^2} = \sqrt{64} = 8 \ cm$ OR 7.5 $\qquad \therefore PB = 8 - 4.5 = 3.5 \ cm$ (c) $\dfrac{PA}{PB} = \dfrac{AD}{BC}, \qquad \dfrac{PA}{3.5} = \dfrac{6}{2.4} \ or \ PA = \dfrac{6 \times 3.5}{2.4} = \dfrac{35}{4} = 8.75 \ cm$

(d) $\dfrac{\Delta APD}{\Delta BPC} = \dfrac{6^2}{2.4^2} = \dfrac{\cancel{36} \times \cancel{100}^{25}}{\cancel{24} \times \cancel{24}_4}$
$\therefore \Delta APD : \Delta BPC = 25 : 4$

Question 7

(i)   In the given diagram, an isosceles ΔABC is inscribed in a circle with centre O.   **[3]**
PQ is a tangent to the circle at C. OM is perpendicular to chord AC and ∠COM = 65°.

Find:

(a)   ∠ABC

(b)   ∠BAC

(c)   ∠BCQ
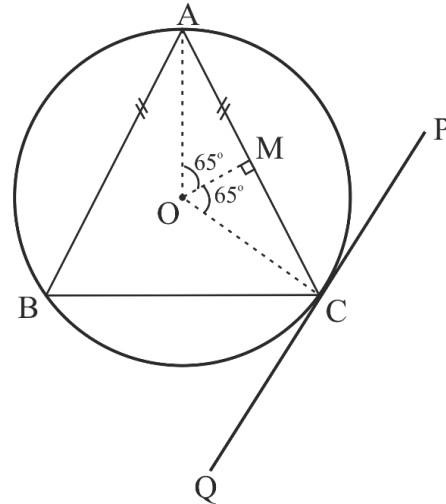
(ii)   Solve the following inequation, write down the solution set and represent it on the   **[3]**
real number line.

$$-3 + x \leq \frac{7x}{2} + 2 < 8 + 2x, x \in I$$

(iii)   In the given diagram, ABC is a triangle, where B(4,– 4) and C(– 4, – 2). D is a point   **[4]**
on AC.

(a) Write down the coordinates of A and D.

(b) Find the coordinates of the centroid of ΔABC.

(c) If D divides AC in the ratio **k : 1**, find the value of **k**.

(d) Find the equation of the line BD.

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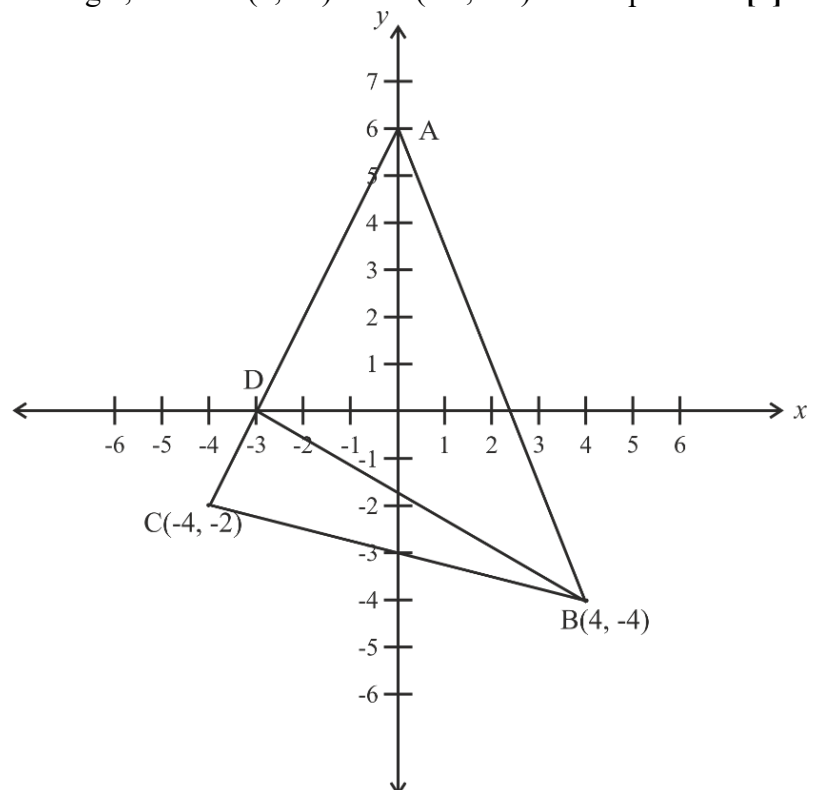
Comments of Examiners

(i) (a) Majority of the candidates made errors due to lack of understanding related to the property of a circle that angle at the centre is twice angle in the remaining circumference i.e., $\angle ABC = \frac{1}{2}\angle COA$. Some candidates arrived at the answer $\angle ABC = 130°$ as they were confused with the angle property and used $\angle ABC = 2 \angle COA$.

(b) Several candidates did not apply that base angles of an isosceles triangle are equal. Hence, did not arrived at the answer $\angle BAC = 50°$. Majority of the candidates were unable to identify that the angle could have been found by using alternate segment theorem.

(c) Many candidates did not give reasons supporting their answer. However, some candidates were unable to apply the alternate segment theorem, hence made mistake in finding $\angle BCQ = \angle BAC = 50°$.

(ii) A number of candidates made errors in solving the two inequalities, especially in transposing x terms on one side and the constants on the other. However, some candidates made errors with signs while transposing like terms in the two inequalities, resulting in $x \leq -2$ instead of the correct $x \geq -2$. Many candidates included 4 in the solution set even though $x < 4$. Some candidates did not write the solution set or wrote incorrect solution set. Many made errors in representing the solution on the number line. When representing the solution on the number line, few candidates overlooked one or more of the following:

- arrows not shown on the number line.
- failed to mark at least one extra integer before –2 and after 4.

(iii) (a) Few candidates wrote the coordinates as A (6, 0), D (0, -3) instead of A (0, 6), D (– 3, 0).

(b) The concept of centroid was not clear to some candidates, hence coordinate of the centroid was incorrect. Some candidates wrote the answer as $\left(\frac{0}{3}, \frac{0}{3}\right)$ instead of $(0, 0)$ and other candidates arrived at the correct answer but instead of writing it in coordinate form, they mentioned x=0 and y=0.

(c) Due to incorrect application of section formula, candidates arrived at the wrong value for k. Some candidates arrived at the value of k as -3 instead of 3 due to calculation error.

Suggestions for teachers

- Give sufficient practice of sums with reasons based on circle while solving the problems.
- Encourage students to identify the properties of circle and other geometrical properties and apply them, wherever necessary with reasons supporting the answers.
- Persuade students to find unknown angles by different methods, using different properties. Give practice for naming the angles.
- Lay stress in the alternate segment theorem while solving sums on circle with supporting reasons.
- Encourage students to find the angles by different methods using different properties.
- Repeatedly remind students about basic concepts related to inequation so that they do not lose marks.
- Teach students to write the solution set for $x \varepsilon I$ or N or W in roster form to avoid errors while representing on the number line.
- Encourage students that only when $x \in R$ solution set is written in the set builder form, representation on the number line for $x \in$ W, N, I must be with dots and for $x \in R$ by shading.
- Make students clear about the concept that a point on the x – axis has the y coordinate as 0 and for a point on the y – axis has the x coordinate as 0.
- Advise students to write the coordinates within the first bracket.
- Give sufficient practice of application of section and mid-point formula would prevent such errors. More practice is necessary in forming equations of a line using the given conditions.
- Instruct students to write the linear equation found without any fractional coefficient.

(d) Many candidates left the equation of BD with coefficients of x and y in fractions form. Some candidates found the slope as $\frac{4}{7}$ instead of $\frac{-4}{7}$, hence got the wrong equation.
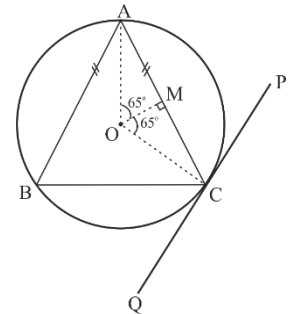
MARKING SCHEME

Question 7

(i)	(a) $\therefore \angle MOC = \angle MOA = 65°$

(a) $\therefore \angle MOC = \angle MOA = 65°$

$$\angle ABC = \frac{1}{2}\angle COA = \frac{1}{2} \times (65° + 65°) = \frac{1}{2} \times 130° = 65°$$

(b) $\angle BAC = 180° - (65° + 65°)$

$= 50°$

(c) $\angle BCQ = \angle BAC = 50°$

(ii) $-3 + x \leq \frac{7x}{2} + 2 < 8 + 2x, \; x \epsilon I$

(at least reason)

$-3 + x \leq \frac{7x}{2} + 2$

$\frac{7x}{2} - x \geq -3 - 2$

$\frac{5x}{2} \geq -5$

$x \geq -2$

7x/2+2<8+2x

7x/2−2x<8−2

3x/2<6

∴x<4

Soln.: $\{-2, -1, 0, 1, 2, 3\}$

(iii)

(a) A(0, 6), D(−3, 0)

(b) Centroid of triangle: A(0, 6), B(4, −4), C(−4, −2)

$$\left(\frac{0 + 4 - 4}{3}, \frac{6 - 4 - 2}{3}\right) = (0, 0)$$
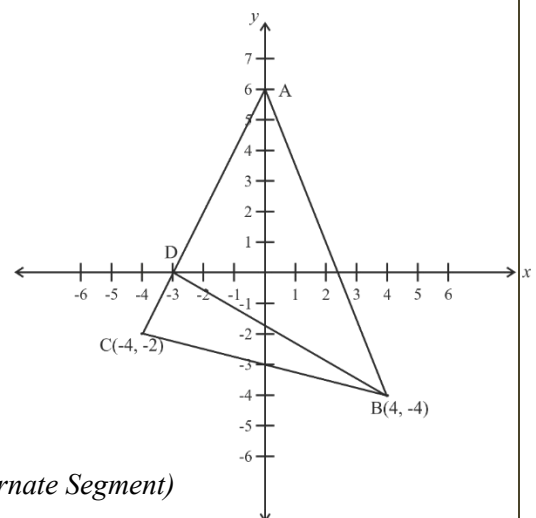
(c) $\frac{-4k + 1 \times 0}{k + 1} = -3 \qquad \therefore -4k = -3k - 3$

$-k = -3 \qquad \therefore k = 3$

(d) *Slope of BD*: $\frac{-4 - 0}{4 + 3} = \frac{-4}{7}$

Eqn.: $y - 0 = \frac{-4}{7}(x + 3)$ *(Alternate Segment)*

$7y = -4x - 12 \; or \; 4x + 7y + 12 = 0$

Question 8

(i)   The polynomial $3x^3 + 8x^2 - 15x + k$ has $(x - 1)$ as a factor. Find the value of k. Hence   **[3]**
factorize the resulting polynomial completely.

(ii) The following letters **A, D, M, N, O, S, U, Y** of the English alphabet are written on   **[3]**
separate cards and put in a box. The cards are well shuffled and one card is drawn at
random. What is the probability that the card drawn is a letter of the word,

   (a)   MONDAY?

   (b)   which does not appear in MONDAY?

   (c)   which appears both in SUNDAY and MONDAY?

(iii) Oil is stored in a spherical vessel occupying **3/4** of its full capacity. Radius of this   **[4]**
spherical vessel is **28 cm**. This oil is then poured into a cylindrical vessel with a
radius of **21 cm**. Find the height of the oil in the cylindrical vessel **(correct to the**
nearest cm).

Take $\pi = \dfrac{22}{7}$
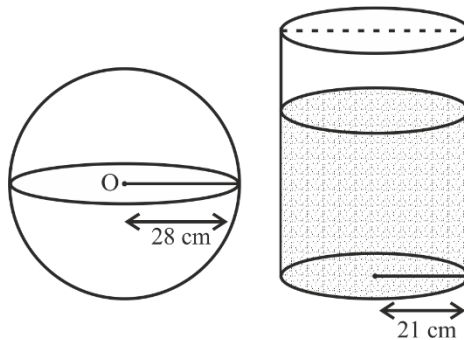
Comments of Examiners

(i) Candidates substituted x = 1 correctly but due to incorrect calculation found K = - 4 instead of 4. Some candidates could not factorise further and skipped the remaining part of the question after finding the value of 'k'. Others made mistake in dividing by

$$3x^3 + 8x^2 - 15x + 4 = 0 \text{ by } x - 1.$$

Some candidates did not write the final answer as the product of the three factors,

$$(x + 4)(3x - 1)(x - 1)$$

(ii) (a) Most candidates attempted this question correctly. Some candidates lost the mark for leaving the answer as 6/8 or directly writing 3/4.

(b) In most cases, answer to finding the probability was correct but some lost the mark for leaving the answer as 2/8 or directly writing 1/4. Some candidates made mistakes in writing the favorable outcomes {S, U}, hence did not arrive at the answer ¼.

(c) Many candidates wrote the probability as,

$$\frac{8}{8} = 1 \text{ instead of } \frac{4}{8} = \frac{1}{2}$$

(iii) A number of candidates applied incorrect formula for volume of sphere and cylinder. Some candidates did not use the given condition volume of oil in cylinder is 3/4 th the volume of cylinder. Another common error made by the candidates was not rounding off the final answer to the nearest cm. Many candidates did not round off 49.7 to 50 to express the answer to the nearest cm.

Suggestions for teachers

- Provide practice of problems based on remainder and factor theorem.
- Advise students to write the final answer as the product of the three factors.
- Give more practice for algebraic division of a polynomial.
- Share the details of the concept of probability with different types of problems, showing all the steps of the working.
- Insist on finding the sample space for each part of the question to avoid any error and express answers in the lowest term with all necessary working details.
- Instruct students to write the probability and simplify the answer, wherever applicable.
- Insist that the students mention the sample space and the favorable outcomes.
- Concept of 'and', 'or' must be drilled.
- Students must be advised to read the question carefully and understand and apply the given conditions.
- Explain to students that the volume of oil remains same even when it is transferred from a spherical container to a cylindrical one. Hence, the volumes are to be equated to solve the sum and not to waste time unnecessarily calculating volumes separately and then dividing them.
- Give consistent practice of Mensuration formula and rounding of answers.
- Ensure that sums involving combinations of solids are solved by taking π and other common terms out, then simplifying to save time and avoid calculation errors.
- Make clear to use only the given value of π for easy and simple calculations.

MARKING SCHEME

Question 8

(i)

$3x^3 + 8x^2 - 15x + k$

$3 \times 1^3 + 8 \times 1^2 - 15 \times 1 + k = 0 \quad or \quad 3 + 8 - 15 + k = 0$

$\therefore k = 4$

$$x - 1 \overline{)3x^3 + 8x^2 - 15x + 4} \quad 3x^2 + 11x - 4$$

$$\underline{(-)3x^3 (+)3x^2}$$

$$11x^2 - 15x$$
$$\underline{(-)11x^2 (+)11x}$$

$$-4x + 4$$
$$\underline{(-)-4x (-)4}$$
$$\mathsf{X}$$

$3x^2 + 11x - 4$

$= 3x^2 + 12x - x - 4$

$= 3x(x + 4) - 1(x + 4)$

$= (x + 4)(3x - 1)$

$3x^3 + 8x^2 - 15x + k = (x + 4)(3x - 1)(x - 1)$

(ii)

Total number of letters are 8.

$(a) \quad \dfrac{6}{8} = \dfrac{3}{4} \qquad \{M, O, N, D, A, Y\}$

$(b) \quad \{S, U\}, \qquad \dfrac{2}{8} = \dfrac{1}{4}$

$(c) \quad \{N, D, A, Y\} \quad \dfrac{4}{8} = \dfrac{1}{2}$

(iii)

Radius of Sphere = 28 cm

$Vol. of\ oil = \dfrac{4}{3} \times \pi \times 28^3$

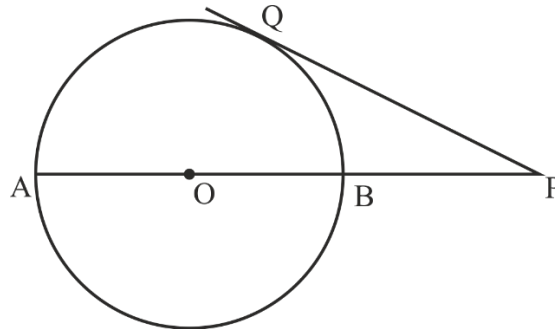$Vol. of\ oil\ in\ cylinder = \dfrac{3}{4}\ volume\ of\ the\ sphere.$

$\therefore \dfrac{22}{7} \times 21^2 \times h = \dfrac{3}{4} \times \dfrac{4}{3} \times \dfrac{22}{7} \times 28^3$

$h = \dfrac{28^3}{21^2} = \dfrac{28 \times 28 \times 28}{21 \times 21} = \dfrac{4 \times 4 \times 28}{3 \times 3} = \dfrac{448}{9} = 49.7 = 50\ cm$
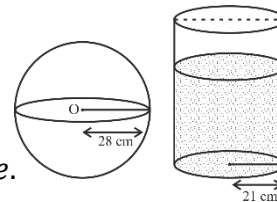
Question 9

(i) The figure shows a circle of radius 9 cm with O as the centre. The diameter AB **[3]** produced meets the tangent PQ at P. If PA = 24 cm, find the length of tangent PQ.

(ii) Mr. Gupta invested ₹33000 in buying ₹100 shares of a company at 10% premium. **[3]** The dividend declared by the company is 12%. Find:

(a) the number of shares purchased by him.

(b) his annual dividend.

(iii) A life insurance agent found the following data for distribution of ages of 100 policy **[4]** holders:

Age in years	Policy Holders (frequency)	Cumulative frequency
20 – 25	2	2
25 – 30	4	6
30 – 35	12	18
35 – 40	20	38
40 – 45	28	66
45 – 50	22	88
50 – 55	8	96
55 – 60	4	100

On a graph sheet draw an ogive using the given data. Take 2 cm = 5 years along one axis and 2 cm = 10 policy holders along the other axis. Use your graph to find:

(a) The median age.

(b) Number of policy holders whose age is above 52 years.

Comments of Examiners

(i) Most of the candidates made errors in this question. The sum could be done by two methods. Either using the tangent secant property $PQ^2 = PA \times PB$ or by applying Pythagoras theorem. Some candidates were not able to identify either of them. Some candidates used $PQ^2 = PO$ x PB or $PQ^2 = AB$ x BP. Few candidates subtracted radius 9 cm from PA=24 cm instead of subtracting the diameter AB=18 cm. Hence, these candidates arrived at the incorrect response.

(ii) (a) Some candidates did not find M.V of the shares which was 10% above the N.V. Hence, received the number of shares as 330 instead of 300. Some candidates were not familiar with the term 'premium.'

(b) Candidates whose number of shares was 330 instead of 300 arrived at the incorrect answer for dividend.

(iii) (a) The candidates made errors related to constructing an ogive:

- Many candidates drew the ogive with respect to lower boundaries or class mark and corresponding cumulative frequency instead of upper-class boundaries.
- The plotted points were joined with ruler instead of making a free hand curve.
- Some candidates did not use kink on the x- axis for demarcation of 0 and the starting interval 20.
- Scale as given in the question was not used.
- Got incorrect value of median due to error in graph.
- Some plotted histograms instead of ogive.
- Did not drop perpendicular lines to get the readings from the graph.

(b) Due to an error in drawing the ogive, the answer for number of policy holders was incorrect. Some candidates did not drop the perpendicular lines to locate the values.

> ### *Suggestions for teachers*
>
> – More practice of sums on circles to be given with reasons provided with supporting the answers.
> – Explain the theorem on tangent property and its application especially how to identify the segments PA and PB.
> – Read questions on shares and dividend carefully to avoid such errors.
> – Give practice of sums involving terms like at premium or discount, or at par, below par, above par need.
> – More practice of sums based on shares and dividend must be provided.
> – Stress must be given on the following points while drawing the ogive and finding values from the graph.
>   - Ogive is plotted with respect to upper class boundaries and corresponding cumulative frequency.
>   - To choose the correct scale and axis as given in the question.
>   - Not to use ruler to join the plotted points. Free hand curve to be drawn.
>   - Use of kink when interval does not start from the origin.
>   - Drop perpendiculars to find median, quartiles etc. from ogive.
> – Make students understand the importance of drawing the indicating lines to read the values from the graph.
> – Supervise while students are initially learning to construct an ogive and recording different values from the graph.

MARKING SCHEME

Question 9

(i)	PQ^2 = PA × PB (secant and tangent meeting externally) PQ^2 = 24 × (24 − 18) = 24 × 6 = 144 ∴ PQ = 12 cm Alt: OP=15cm PQ = $\sqrt{15^2 - 9^2}$ PQ = 12
(ii)	Investment ₹33000, M.V. of each share = 100 + 10 = ₹110 Rate of dividend = 12% (a) 33000 ÷ 110 = 300 shares (b) Dividend = $300 \times 100 \times \frac{12}{100}$ = ₹3600
(iii)	OGIVE: (a) Median = 42 ± 2 (b) Policy holders whose age is above 52 years = 100 – 90 = 9 ± 1
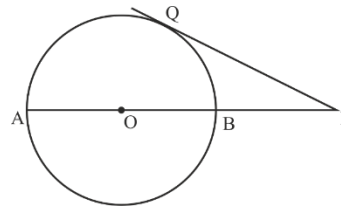
Question 10

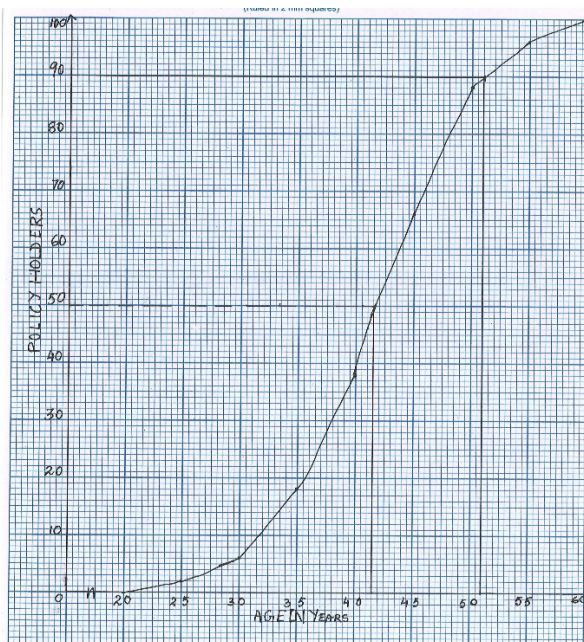(i)   Rohan bought the following eatables for his friends :   **[3]**

Soham Sweet Mart : Bill				
S. No.	Item	Price	Quantity	Rate of GST
1	Laddu	₹500 per kg	2 kg	5%
2	Pastries	₹ 100 per piece	12 pieces	18%

Calculate :

(a)   Total GST paid.

(b)   Total bill amount including GST.

(ii)   (a)   If the lines $kx - y + 4 = 0$ and $2y = 6x + 7$ are perpendicular to each other, find   **[3]**
the value of k.

(b)   Find the equation of a line parallel to $2y = 6x + 7$ and passing through $(-1, 1)$

(iii) Use ruler and compass to answer this question. Construct $\angle ABC = 90^\circ$, where   **[4]**
AB = 6 cm, BC = 8 cm.

(a)   Construct the locus of points equidistant from B and C.

(b)   Construct the locus of points equidistant from A and B.

(c)   Mark the point which satisfies both the conditions (a) and (b) as O. Construct
the locus of points keeping a fixed distance OA from the fixed point O.

(d)   Construct the locus of points which are equidistant from BA and BC.

Comments of Examiners

(i) (a) A large number of candidates answered this question incorrectly. In this, some candidates calculated 5% GST on ₹500 instead of ₹1000, resulting in incorrect GST. Similarly, a few candidates calculated 18% GST on ₹100 instead of ₹1200, resulting in incorrect GST. Hence, the answer of total GST was incorrect. Some calculated individual GST of the two items but not the total GST.

(b) Candidates did not find the total price and the total GST. Hence, the total bill amount including GST was incorrect.

(ii) (a) The slope of the two lines, $kx - y + 4 = 0$ and $2y = 6x + 7$ was incorrect. For perpendicular condition of two slopes instead of using the product equal to -1 took the slopes equal or equated to 1. Found value of k=3 or 1/3 instead of $k = \dfrac{-1}{3}$

(b) Majority of the candidates attempted this question in an incorrect manner. Some candidates calculated the incorrect slope of parallel lines and arrived at the wrong equation. While writing the equation of the parallel line, some candidates provided the answer with fractional coefficient.

(iii)(a) Most candidates constructed the locus of points equidistant from B and C as the perpendicular bisector of BC correctly. Some candidates made mistakes in constructing triangle ABC. Few candidates could not construct $\angle ABC = 90^0$.

(b) Perpendicular bisector of AB mostly constructed correctly.

(c) Many candidates were unable to identify that the locus is a circle having centre O and radius OA.

(d) Some candidates did not bisect $\angle$**ABC** to find the locus of points which are equidistant from BA and BC.

Suggestions for teachers

− Encourage students to read the question carefully before answering it.

− Clearly define the definition of GST and explain the process of finding total GST and total bill.

− Lay stress on accuracy in calculation.

− Carefully follow all the given conditions of the problem.

− Train students to show working for calculating all the parts and giving specific answer for the question asked.

− Teach students to differentiate between the parallel and perpendicular condition between slopes of two lines.

− Share with students to get the given equations to their standard forms, y = mx + c so that it is easy to identify their slopes.

− Guide students to write the equation in the form ax + by + c =0 where a, b and c are integers.

− Give more practice related to the construction of triangles with different given data.

− Provide more practice for constructing 90° using ruler and compass.

− Give more practice to students of Locus constructions with the different given conditions.

− Supervise students for all constructions.

− Clearly show all traces of construction.

MARKING SCHEME

Question 10

(i)	(a) $Total\ GST = 500 \times 2 \times \dfrac{5}{100} + 100 \times 12 \times \dfrac{18}{100}$ $\qquad = 50 + 216 = ₹266$ (b) $Total\ Bill = 500 \times 2 + 100 \times 12 + 266$ $\qquad = 1000 + 1200 + 266$ $\qquad\qquad = ₹2466$
(ii)	$kx - y + 4 \perp^r to\ 2y = 6x + 7$ Slopes are k and 3 $3k = -1 \qquad \therefore k = \dfrac{-1}{3}$ Slope of parallel line $= 3$ $\therefore$ eqn $y - 1 = 3(x + 1)$ $3x - y + 4 = 0$
(iii)	Construction (a) Construction of 90° and perpendicular bisector of BC. (b) Perpendicular bisector of AB (c) Circle with O as centre and OA as radius (d) Bisector of $\angle ABC$