آغا خان یونیورسٹی ایگزامینیشن بورڈ
AGA KHAN UNIVERSITY EXAMINATION BOARD

Notes from E-Marking Centre SSC-II Mathematics Annual Examinations 2024

Introduction

This document has been prepared for the teachers and candidates of Secondary School Certificate (SSC) Part II (Class X) Mathematics. It contains comments on candidates' responses to the 2024 SSC-II Examination indicating the quality of the responses and highlighting their relative strengths and weaknesses.

E-Marking Notes

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

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

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

General Observations

Candidates performed really well in some concepts, such as, H.C.F/L.C.M, Square Root, Linear Equations, Coordinate Geometry and discriminant. However, candidates who did not score well mostly failed to understand the demands of the questions, often misinterpreting the command words and the stimuli.

Mentioned below are few concepts that teachers need to focus so that the candidates may perform better.

- Basic Statistics
- Linear Inequalities
- Simultaneous Equations
- Nature of Roots

Note: Candidates' responses shown in this report have not been corrected for grammar, spelling, form at or information.

DETAILED COMMENTS

Constructed Response Questions (CRQs)

Question No. 1

Question Text

A company has been tracking the daily sales figures for their products over the last month. The figures are as follows: 492, 215, 384, 793, 523, 707, 821, 422, 930, 156, 361, 499, 682, 448, 291

Consider the given figures to complete the following table.

Class Interval	Class Boundary	Frequency	Cumulative Frequency
100 – 299			
300 – 499			
500 – 699			
700 – 899			
900 – 1099			
Total			

SLO No.	14.2.1
SLO Text	Construct a cumulative frequency table.
Max Marks	3
Cognitive Level	A*
Checking Hints	1 mark for class boundary (any three correct) 1 mark for frequency (any three correct) 1 mark for correct cumulative frequency (any three correct)
Overall Performance	The majority of the candidates found this question straight forward, found all the three columns correctly and performed well. Only few candidates faced difficulties with the concept of cumulative frequency.
Description of Better Responses	Better responses demonstrated a solid understanding of class boundary, frequency and cumulative frequency. Candidates correctly added and subtracted 0.5 from class interval for class boundary. They wrote all frequencies and cumulative frequencies correctly. They did not exchange the columns which showed their concepts were marvelous.

Image of Better Response

Class Interval (C.I)	Class Boundary	Frequency	Cumulative Frequency
① 100 – 299	99.5 – 299.5	3	3
② 300 – 499	299.5 – 499.5	6	6*3=9
③ 500 – 699	499.5 – 699.5	2	9+2=11
④ 700 – 899	699.5 – 899.5	3	11+3=14
⑤ 900 – 1099	899.5 – 1099.5	1	14+1=15
Total	—	Ef= 15	ECF= 52

C.I	Tally Marks (for Class Interval)
①	III
②	IIII
③	II
④	III
⑤	I

① 100 – 299 (For C.B)
100-0.5 — 299 +0.5
99.5 – 299.5 (This is how we will get class boundary).

Description of Weaker Responses

Weaker responses revealed misunderstandings of cumulative frequency and frequency. They added frequencies wrongly to get cumulative frequencies. They wrote the squares of frequencies in cumulative frequencies resulting in lost marks. In class boundary column, they wrote midpoints which showed the weakness in the concept.

Image of Weaker Response

Class Interval	Class Boundary	Frequency	Cumulative Frequency
100 – 299	1995	3	9
300 – 499	399.5	5	25
500 – 699	599.5	2	4
700 – 899	799.5	3	9
900 – 1099	999.5	1	1
Total	19188.5	14	48

$\bar{x} = \frac{\Sigma fx}{\Sigma f}$: 492, 215, 384, 293, 523, 707, 921, 425, 930, 156, 361, 499, 682, 488, 291

$\bar{x} = \frac{48}{14}$

$\bar{x} = 3.42857$

Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	Preferred Pedagogy** Used for this SLO	Assessment Strategies
• Identify the expectation of command words (use Command Word Guide) • Ensure the content is taught at the relevant cognitive level • Identify necessary content required (skills + concepts) • Review past paper questions on the concept • Utilise the resource guide for additional materials	• Story Board • Cause and Effect • Fish and Bone • Concept Mapping • Audio Visual Resources • Think, Pair and Share • Knowledge Platform Videos • Questioning Technique (Socratic approach) • Practical Demonstration ** For description of each Pedagogy, refer to Annexure A	• Past paper questions • Discussion on E-Marking Notes • AKU-EB Digital Learning Solution powered by Knowledge Platform https://akueb.knowledgeplatform.com/login

Any Additional Suggestion:

• **Group Work:** Organise group activities where students can discuss their findings and interpretations of the data.

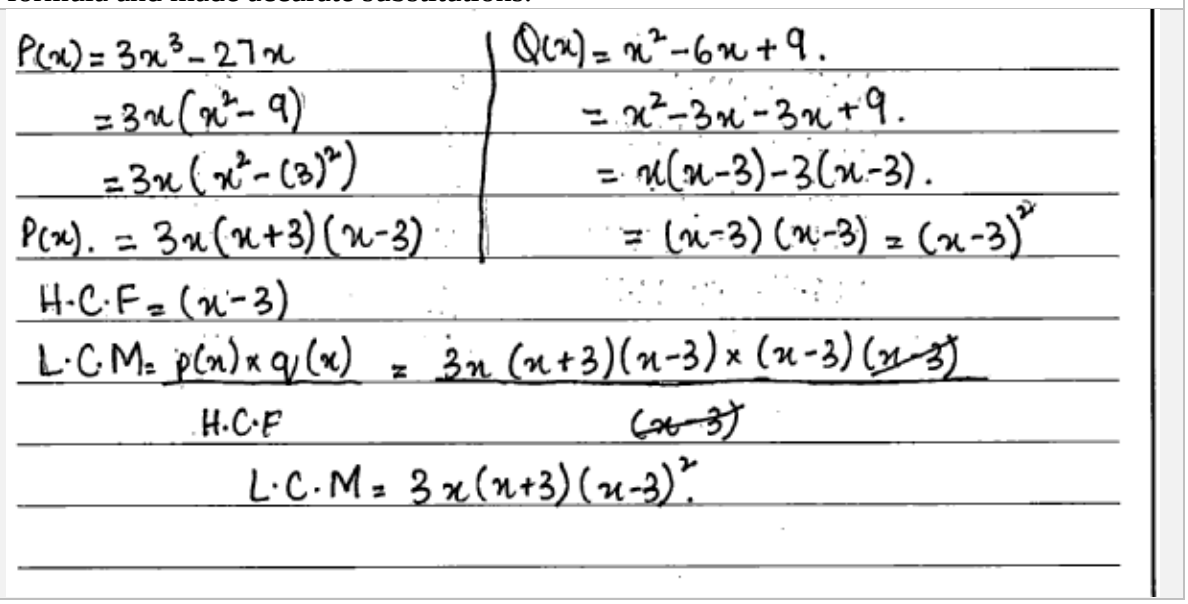
• **Hands-On Activities:** Use manipulatives (like counters or beads) to represent data points and help students visualize how class intervals and frequencies work.

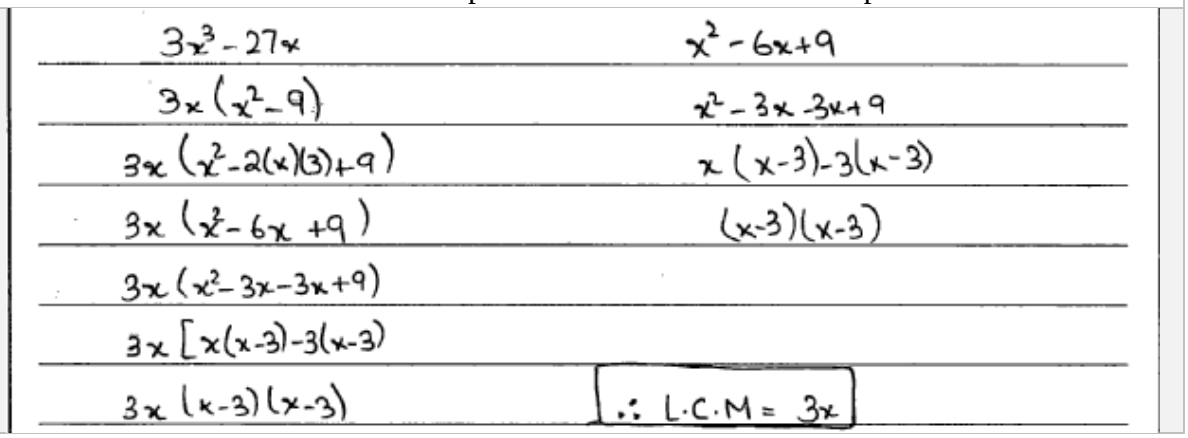
*K = Knowledge U = Understanding A = Application and other higher-order cognitive skills

Question No. 2a

Candidates were given the choice to attempt any ONE out of the two questions: 2a and 2b. Majority of the candidates attempted 2a.

Question Text	Find the least common multiple (L.C.M) of the polynomials $P(x) = 3x^3 - 27x$ and $Q(x) = x^2 - 6x + 9$
SLO No.	15.1.1
SLO Text	Find the highest common factor (H.C.F.) and the least common multiple (L.C.M.) of algebraic expressions using factorisation.
Max Marks	4
Cognitive Level	A
Checking Hints	1 mark for taking $3x$ as common from $P(x) = 3x^3 - 27x$ 1 mark for writing $P(x) = 3x(x-3)(x+3)$ 1 mark for writing $Q(x) = (x-3)^2$ 1 mark for finding the correct L.C.M
Overall Performance	This question was related to H.C.F., L.C.M. and their relationship. Majority of the candidates successfully found the correct L.C.M. However, taking common 'x' in the first step remained challenging step for some of the candidates and they struggled in finding

	out the correct L.C.M.
Description of Better Responses	Better responses showcased a solid understanding of the concepts by effectively finding the L.C.M using both the factorisation method and the formula method. They accurately identified the common factor 'x' and correctly applied the (a^2 - b^2) identity to factorise and determine the H.C.F. Subsequently, they calculated the L.C.M using the appropriate formula and made accurate substitutions.
Image of Better Response	

Description of Weaker Responses	Weaker responses faced difficulties in taking coomon factor *'x'* . Some responses took the common x but they wrote remaining terms in the bracket wrongly and lost their marks. Factorising expressions like $(a+b)^2$ and $a^2 - b^2$ also put them in struggle due to weak understanding of factorisation concepts. Additionally, misconceptions regarding the discrimination of H.C.F and L.C.M process also lead to weaker responses.
Image of Weaker Response	

Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	Preferred Pedagogy Used for this SLO	Assessment Strategies
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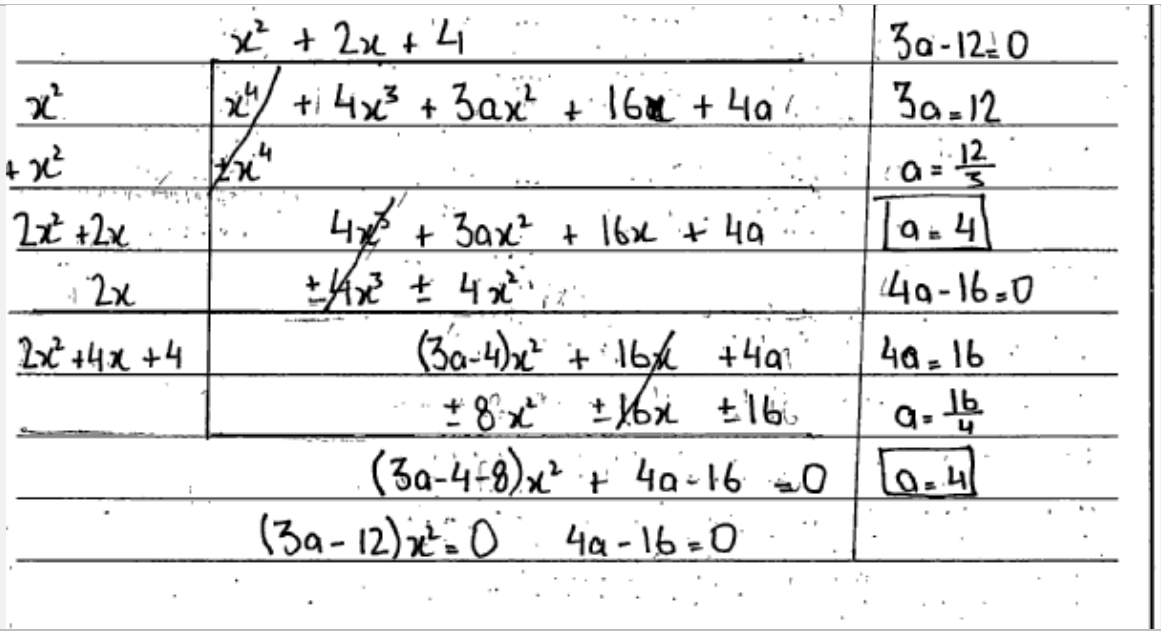
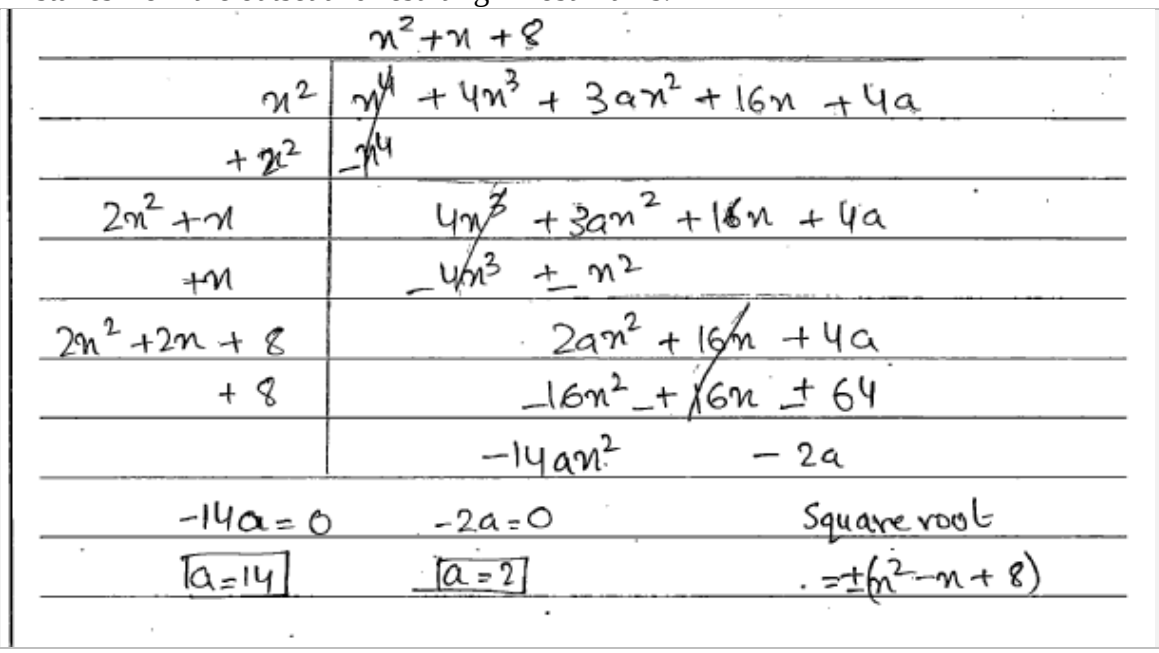
cognitive level • Identify necessary content required (skills + concepts) • Review past paper questions on the concept • Utilise the resource guide for additional materials	Resources • Think, Pair and Share • Knowledge Platform videos • Questioning Technique (Socratic approach) • Practical Demonstration	

Any Additional Suggestion:
Teachers are suggested to use the following strategies to teach the concept:
Start with concrete examples using physical objects like blocks or counters. For L.C.M, use multiple sets of objects and demonstrate finding the L.C.M by grouping them. For H.C.F, use common factors to represent shared quantities.

Question No. 2b	
Question Text	For what value of a, the expression $x^4+4x^3+3ax^2+16x+4a$ will become a perfect square.
SLO No.	15.3.2
SLO Text	Calculate square root of algebraic expressions by division.
Max Marks	4
Cognitive Level	A
Checking Hints	1 mark for cancelling out x^4 and x^3 1 mark for simplifying x^2 and x 1 mark for taking $3ax^2-12x^2=0$, $4a-16=0$ 1 mark for value of a
Overall Performance	Overall, fewer candidates attempted this question compared to Q2(a). Many candidates struggled specifically with determining the value of the variable. However, some of the candidates performed well with correct cancellation of x^4 and x^3 to find the value of a.
Description of Better Responses	In better responses, candidates multiplied x^2 with x^2 and subtracted x^4 with x^4 and $4x^3$ and $4x^3$ successfully. They copied down the remaining term for the second step correctly then, perfectly solved whole long division and found the correct value of a .

Image of Better Response	
Description of Weaker Responses	The question required a deep understanding of square roots. Weaker responses subtracted (3ax^2) from (x^2), indicating a lack of understanding regarding like and unlike terms. This error impacted the entire solution and the value of the variable 'a'. Additionally, some candidates were unsure about which variable to square to obtain (x^4), leading to mistakes from the outset and resulting in lost marks.
Image of Weaker Response	

Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	Preferred Pedagogy Used for this SLO	Assessment Strategies
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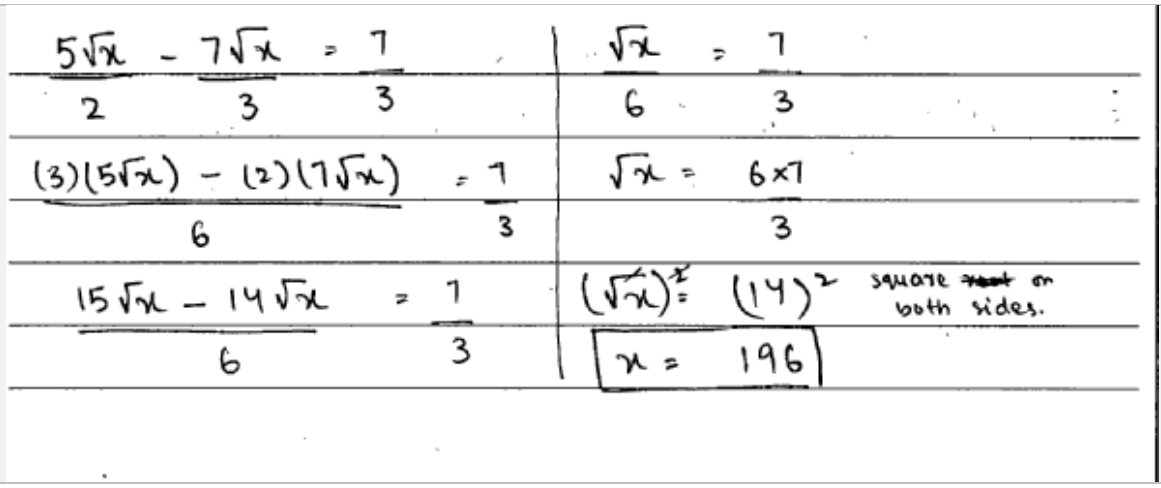
• Identify necessary content required (skills + concepts) • Review past paper questions on the concept • Utilise the resource guide for additional materials	• Think, Pair and Share • Knowledge Platform videos • Questioning Technique (Socratic approach) • Practical Demonstration	

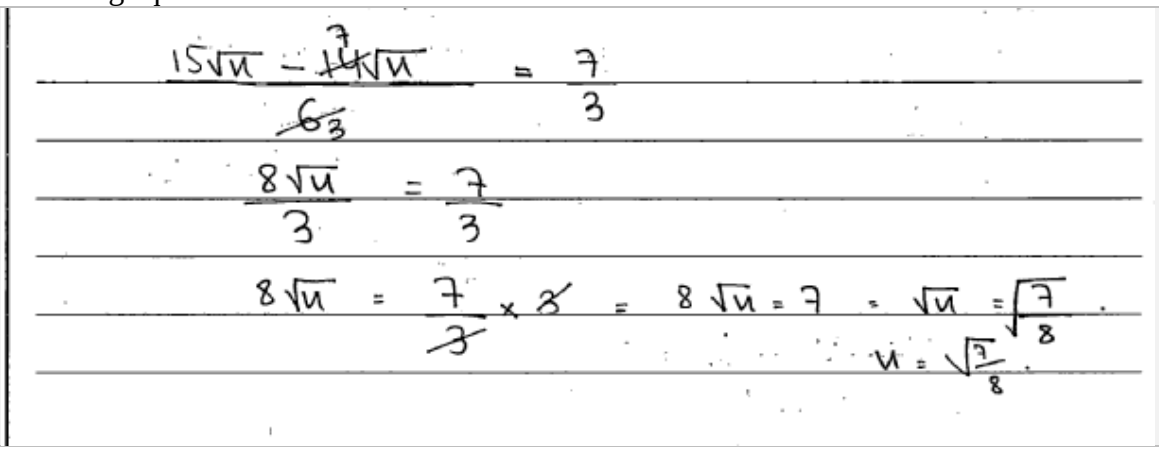
Any Additional Suggestion:

1. Review Long Division for Numbers:
   - **Practice Basic Division:** Ensure you are comfortable with long division for numbers as it lays the groundwork for understanding the process for algebraic expressions.
2. Learn the Process for Algebraic Expressions:
   - **Identify the Expression:** Write down the algebraic expression for which you want to find the square root.
   - **Group Terms:** For long division of algebraic expressions, group the terms in pairs or sets, similar to grouping digits in the long division method for numbers.

Question No. 3a

Candidates were given the choice to attempt any ONE out of the two questions: 3a and 3b. Less number of candidates attempted 3a.

Question Text	Find the value of *x* for the given equation $\frac{5\sqrt{x}}{2}-\frac{7\sqrt{x}}{3}=\frac{7}{3}$ (**Note**: Verification is not required.)
SLO No.	17.1.3
SLO Text	Convert equations, involving radicals, to simple linear form and find their solutions and its verification;
Max Marks	3
Cognitive Level	A
Checking Hints	1 mark for adding as $\frac{15\sqrt{x}-14\sqrt{x}}{6}=\frac{7}{3}$ 1 mark for simplification to get $\frac{\sqrt{x}}{6}=\frac{7}{3}$ 1 mark for finding the value of *x*
Overall Performance	This was a choice-based question and only few candidates attempted this question. Among those who attempted this question, majority of the candidates demonstrated a strong understanding of solving linear equations and correctly identified the value of *x* in their solutions. However, there were few candidates who faced challenge in finding out the value of *x*.
Description of Better Responses	Better responses exhibited correct solutions of linear equations and correct value of *x*. Candidates demonstrated a strong conceptual understanding by taking correct L.C.M $\frac{15\sqrt{x}-14\sqrt{x}}{6}=\frac{7}{3}$. They cross multiplied 6 with 7 correctly and took the square of x to achieved full marks.
Image of Better Response	

Description of Weaker Responses	Weaker responses faced challenges with simplifying irrational expressions and equations. They took the L.C.M like $\frac{5\sqrt{x}-7\sqrt{x}}{6}=\frac{7}{3}$, mean they were lack in concept of L.C.M hence did not multiply 3 with $5\sqrt{x}$ and 2 with $7\sqrt{x}$. They made mistakes in reducing numbers with radicals. Many candidates also struggled with the correct procedures for removing square roots.
Image of Weaker Response	

Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	**Pedagogy Used for that SLO**	**Assessment Strategies**
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Any Additional Suggestion:		

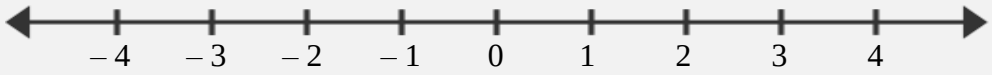
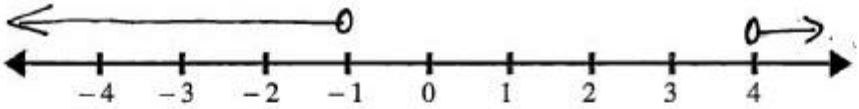
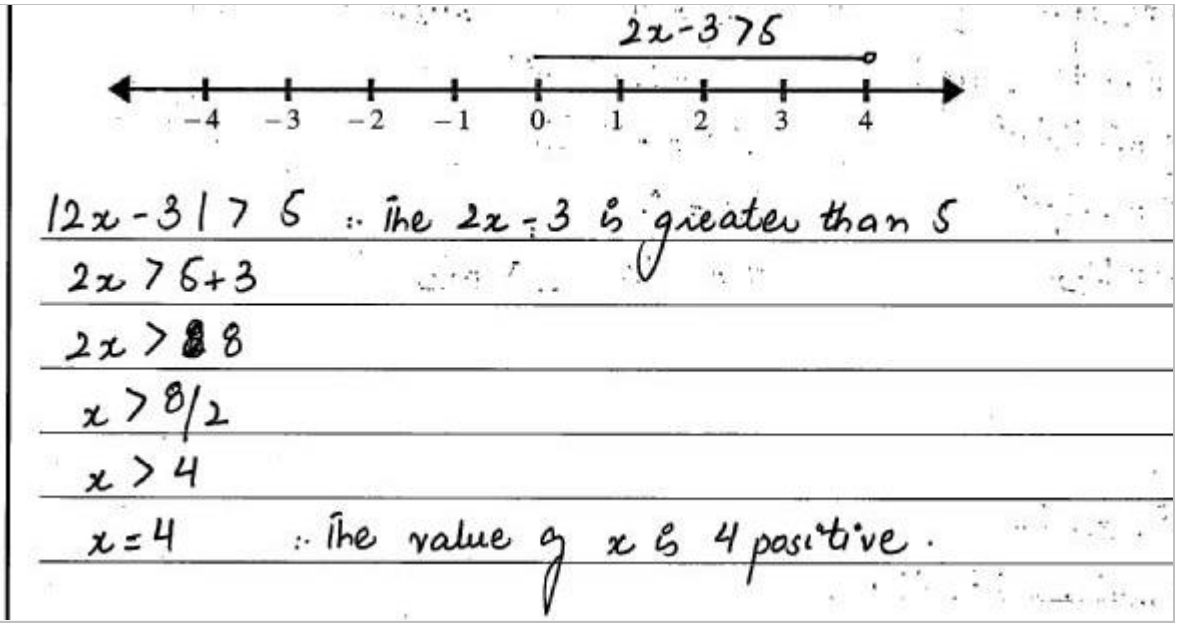
Question No. 3b	
Question Text	Solve the inequality $\lvert 2x-3 \rvert > 5$ and illustrate the solution on the given number line. 
SLO No.	17.4.3(f) and 17.4.4
SLO Text	Solve linear inequalities, involving absolute value, in one variable x, where of the following cases illustrate the solution of the above cases on the number line.
Max Marks	3
Cognitive Level	A
Checking Hints	1 mark for writing in the form of $-5 > 2x-3 > 5$. 1 mark for finding the solution i.e. $x > 4$ and $x < -1$ 1 mark for showing the solution on the number line.
Overall Performance	This question was related to solution of linear inequalities in one variable and the representation of the solution on a number line. Overall, candidates performed relatively weaker in this question. They did not successfully removed the absolute sign.
Description of Better Responses	Better responses not only represented the understanding of solving linear inequality but also displayed the proper representation of solution on a number line. They also wrote the inequality correctly after applying the absolutely sign $-5 > 2x-3 > 5$. Most of the candidates showed the working of all the required steps.
Image of Better Response	 $\lvert 2x-3 \rvert > 5$ $\quad -2x+3 > 5$ $\pm(2x-3) > 5$ $\quad -2x > 5-3$ $2x-3 > 5$ $\quad -2x > 2$ $2x > 5+3$ $\quad x < 2/-2$ $2x > 8$ $\quad x < -1$ $x > 8/2$ $\quad \boxed{x > 4}$ $\quad \{x \mid x \in R \wedge (x < -1) \text{ or } (x > 4)\}$
Description of Weaker Responses	The common mistakes were related to the candidates' misunderstanding about handling absolute values in inequalities. For example, they wrote their first step $-5 > 2x-3 \leq 5$ and particularly with incorrectly breaking down absolute values involving negative signs. Some candidates also attempted to solve inequalities using the concepts of equalities which do not align with the requirements of the question. Additionally, some candidates only addressed one part of the inequality (e.g., with only positive signs), which did not adequately demonstrate the concept of absolute values. Overall, these issues indicated a conceptual lacking among candidates in this question.

Image of Weaker Response	

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Any Additional Suggestion:

Following are some teaching strategies related to misconceptions and common errors which candidates exhibited.

Clear Definitions and Properties: Start by providing a clear and concise explanation of inequalities, including the greater-than (>), less-than (<), greater-than-or-equal-to (≥), and less-than-or-equal-to (≤) symbols.

Interactive Activities: Engage students in interactive activities where they can manipulate number lines and inequality symbols. Online tools and interactive whiteboards can be valuable for this purpose.

Real-Life Scenarios: Present real-life scenarios that involve inequalities, such as age restrictions, budget constraints, or temperature ranges. Encourage students to translate these scenarios into mathematical inequalities.

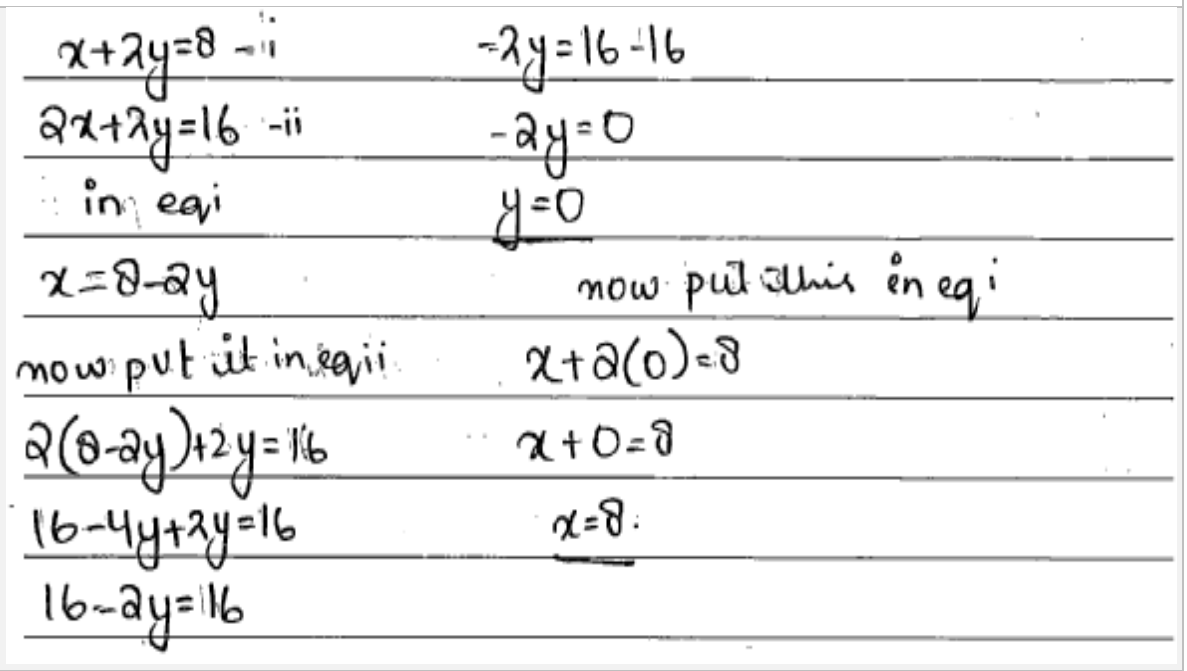
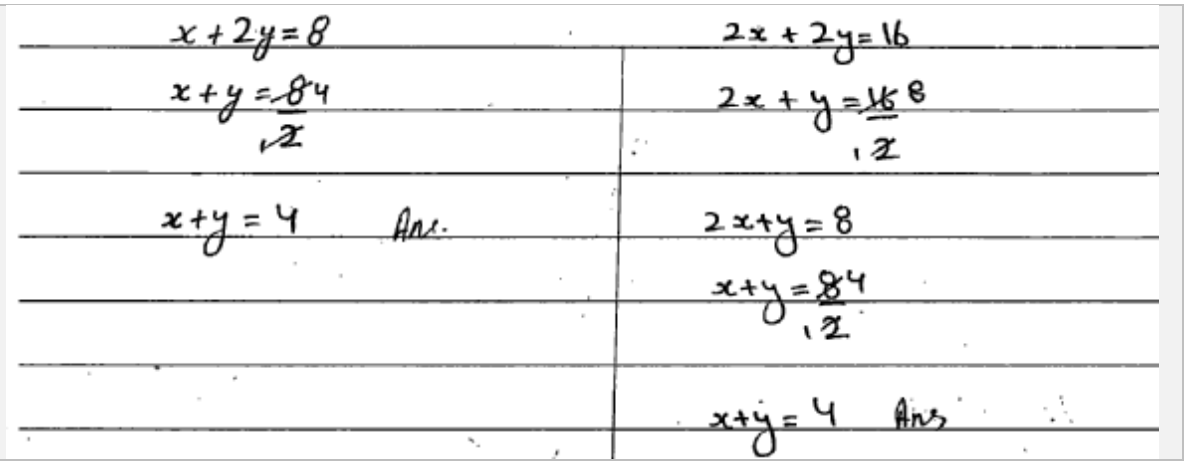
Question No. 4	
Question Text	Use algebraic method to find the values of x and y for the equations $x + 2y = 8$ and $2x + 2y = 16$.
SLO No.	18.3.1
SLO Text	Solve the simultaneous linear equations in two variables using: a. algebraic method
Max Marks	3
Cognitive Level	A
Checking Hints	1 mark for subtracting the two equations 1 mark for finding the value of x 1 mark for finding the value of y
Overall Performance	This question was related to finding the values of x and y from two simultaneous linear equations. Overall, candidates performed relatively weaker in this question. Since candidates were restricted to algebraic method, some of them did not use algebraic method and lost their marks.
Description of Better Responses	Candidates excelled in providing strong responses and demonstrated a solid understanding of simplifying equations. Some candidates introduced a third equation into the first or second equation to find the values of (x) and () using the substitution method. Others employed the elimination method, where they first equalised the coefficients of the variables and then cancelled them out to determine the value of the remaining variable.
Image of Better Response	
Description of Weaker Responses	Some candidates encountered difficulties in solving equations using various methods. Common issues included incorrect concepts related to division and simplification, as well as attempting to solve equations individually through trial and error methods. These approaches lead to deduction of marks.

Image of Weaker Response	

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Any Additional Suggestion:

Follow these steps and write them on the board so that students can follow and make the solution easy for themselves.

Substitution Method

Steps:

1. **Solve one equation for one variable** in terms of the other(s).
2. **Substitute** this expression into the other equation(s).
3. **Solve the resulting equation** for the remaining variable.
4. **Substitute back** to find the other variable.

Elimination Method

Steps:

1. **Multiply** one or both equations to align coefficients of one variable.
2. **Add or subtract** the equations to eliminate one variable.
3. **Solve** the resulting equation for the remaining variable.
4. **Substitute** back into one of the original equations to find the other variable

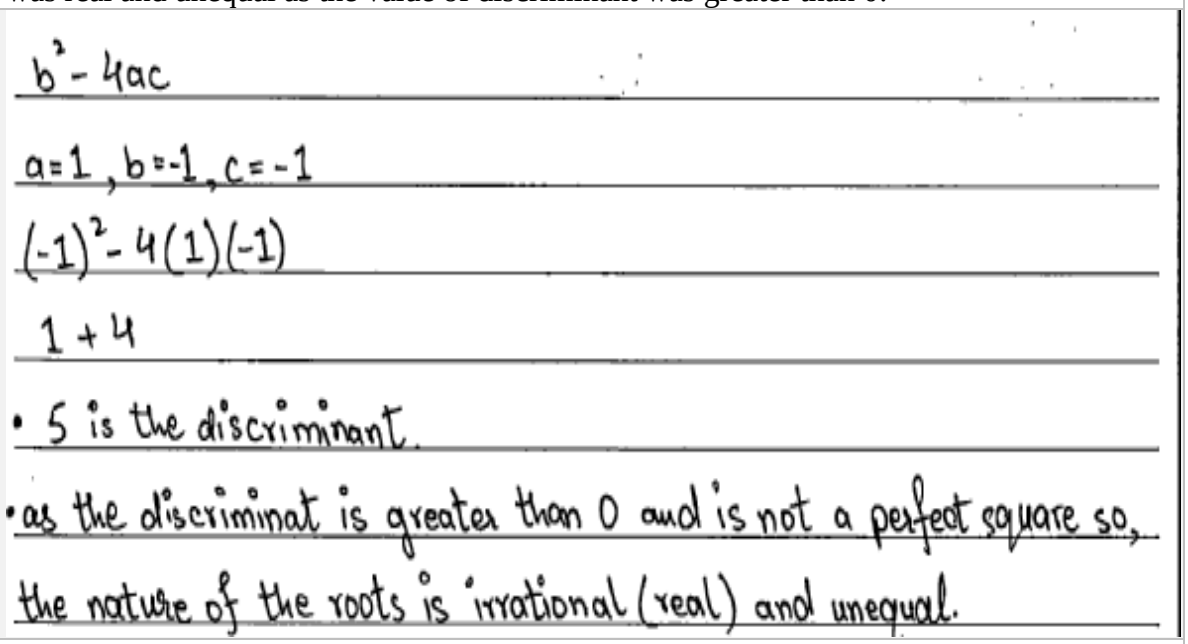
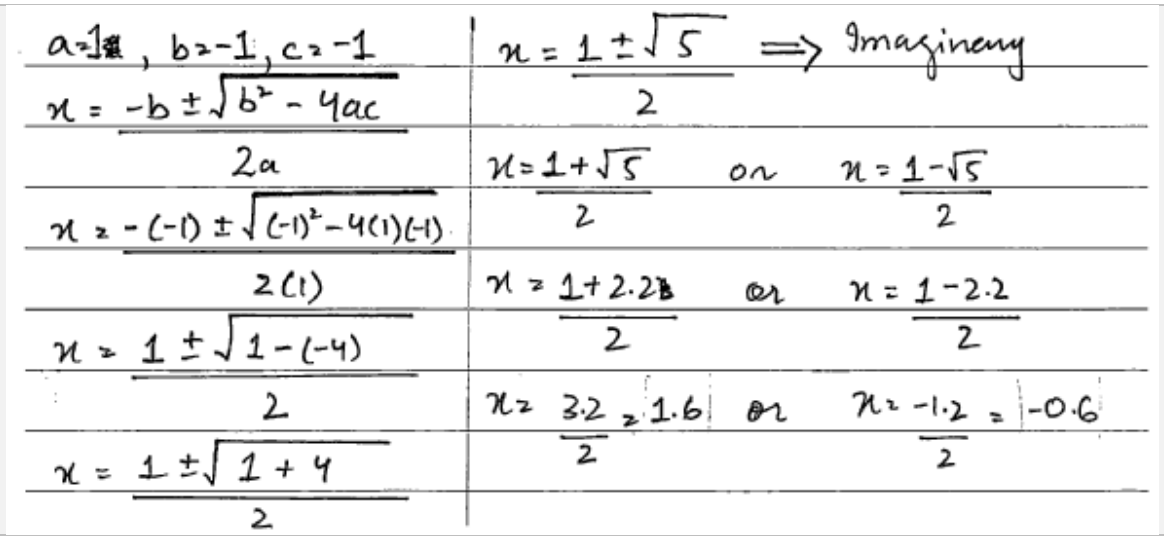
Question No. 5	
Question Text	Find the discriminant of the equation $x^2 - x - 1 = 0$. Using the discriminant, state the nature of the roots.
SLO No.	19.3.3
SLO Text	Determine the nature of the roots of a given quadratic equation through discriminant.
Max Marks	3
Cognitive Level	A
Checking Hints	1 mark for putting the values in the discriminant formula. 1 mark for simplification and finding the value of D. 1 mark for describing the nature of roots on the basis of discriminant.
Overall Performance	Candidates generally did not perform well in this question, many of them struggled with explaining the nature of the roots. However few had a clear understanding of the concept of the discriminant.
Description of Better Responses	Better responses stated the discriminant formula. They identified the correct values of variable (a, b and c) and then substituted those values correctly in the discriminant and solved to find the discriminant which was 5. They stated the correct nature of roots which was real and unequal as the value of discriminant was greater than 0.
Image of Better Response	
Description of Weaker Responses	Weaker responses showed incorrect interpretation of the discriminant by applying the quadratic formula instead of correctly using the discriminant b^2-4ac. Additionally, candidates faced challenges in accurately describing the nature of the roots in their responses. Some of them correctly used discriminant formula but they mistook in picking up the values of variable (a, b and c).

Image of Weaker Response	

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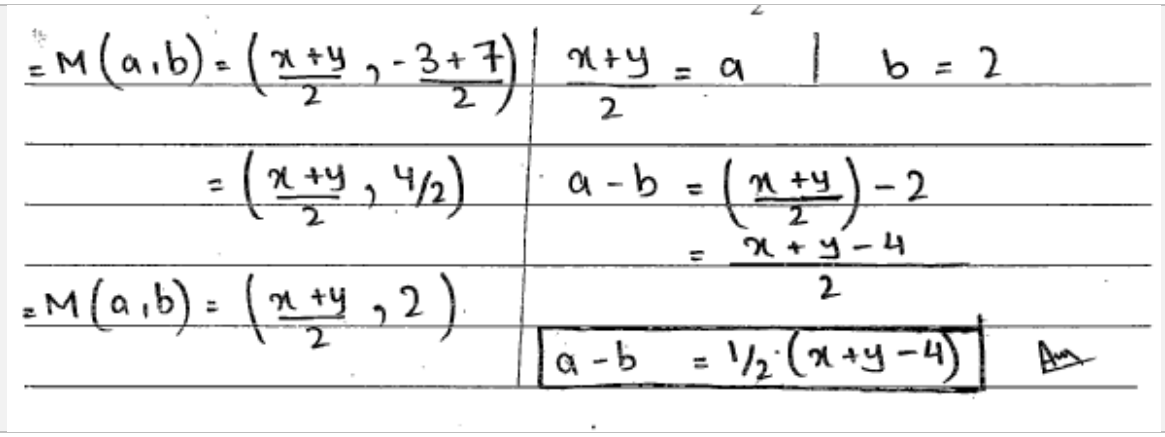
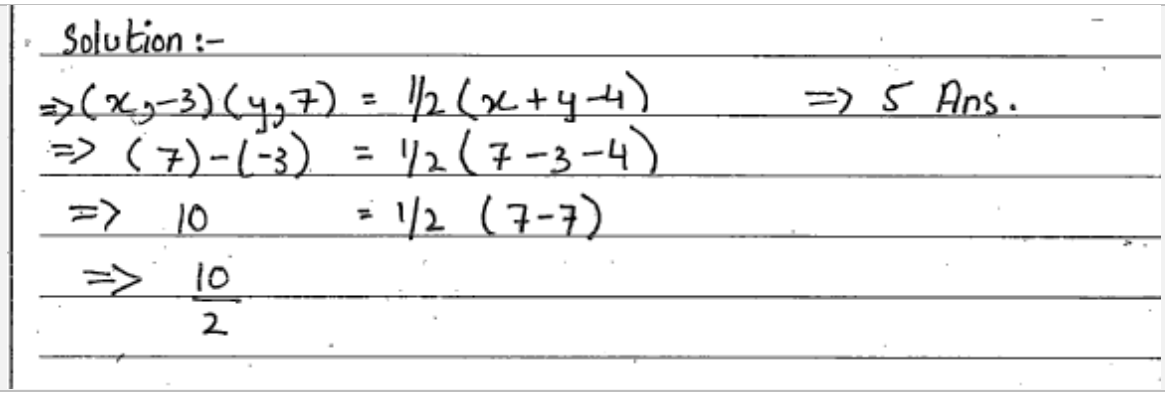
Any Additional Suggestion:

Learn the Types of Roots Based on the Discriminant

1. **Positive Discriminant (Δ>0\Delta > 0Δ>0)**
   - **Nature of Roots:** Two distinct real roots.
   - **Explanation:** The quadratic equation intersects the x-axis at two different points.
2. **Zero Discriminant (Δ=0\Delta = 0Δ=0)**
   - **Nature of Roots:** Exactly one real root (a repeated or double root).
   - **Explanation:** The quadratic equation touches the x-axis at exactly one point.
3. **Negative Discriminant (Δ<0\Delta < 0Δ<0)**
   - **Nature of Roots:** Two complex (non-real) roots.
   - **Explanation:** The quadratic equation does not intersect the x-axis, indicating the roots are complex.

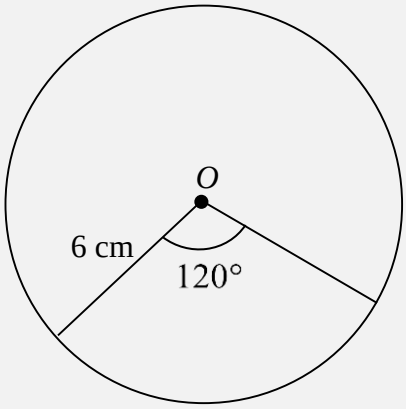
Question No. 6	
Question Text	The midpoint of $P_1(x,-3)$ and $P_2(y,7)$ is (a,b). Show that $a-b=\frac{1}{2}(x+y-4)$.
SLO No.	2.3.2
SLO Text	Solve problems related to midpoint formula
Max Marks	3
Cognitive Level	A
Checking Hints	1 mark for finding the mid-point. 1 mark for writing $(a,b)=\left(\frac{x+y}{2},2\right)$. 1 mark for the required proof.
Overall Performance	Overall responses demonstrated a good understanding of calculating the midpoint, with some candidates completing the task efficiently in just few steps. Few candidates found challenges in substituting the values in the mid-point formula.
Description of Better Responses	Better responses wrote the correct fomula for mid-point $(a,b)=\left(\frac{x+y}{2},2\right)$ and stated the correct substitution of the values in the formula. They identified the correct values of *x-coordinate and y-coordinate*, and verified the given equation as required.
Image of Better Response	
Description of Weaker Responses	Candidates who struggled with this question often did so because of incorrect manipulation of the mid-point formula or difficulties in understanding the question's requirements. Therefore, they used distance formula, hence not verified the required solution. The primary issue lied in accurately interpreting and comprehending what the question asks, leading to potential loss of marks for those who missed this key aspect.
Image of Weaker Response	

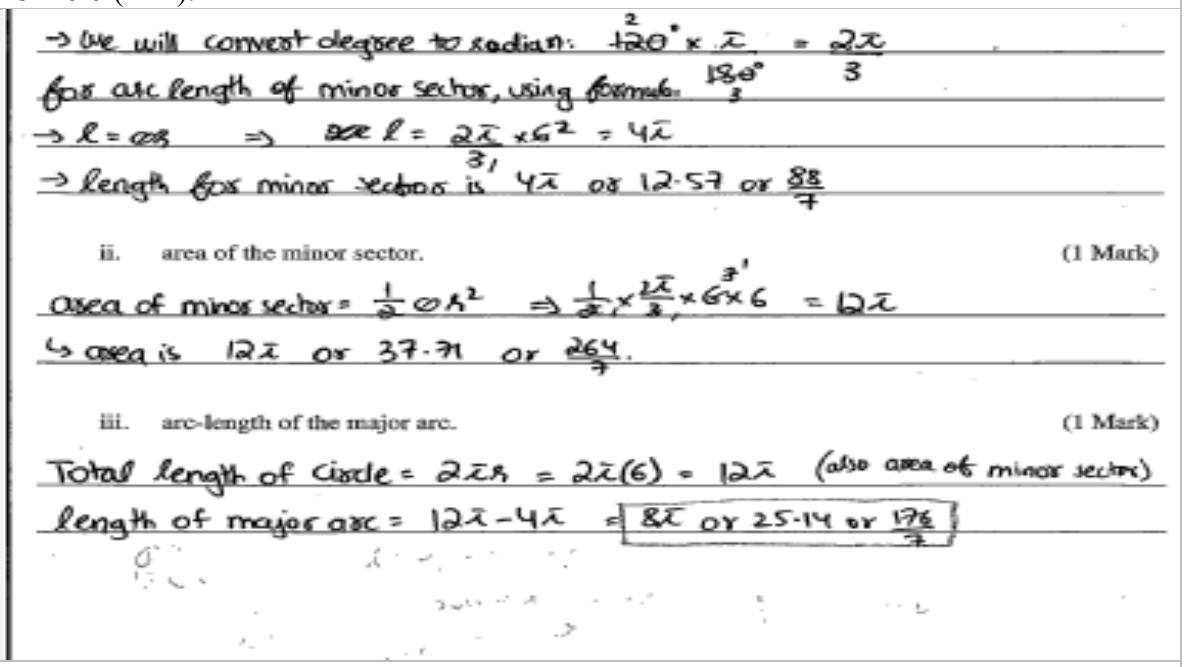
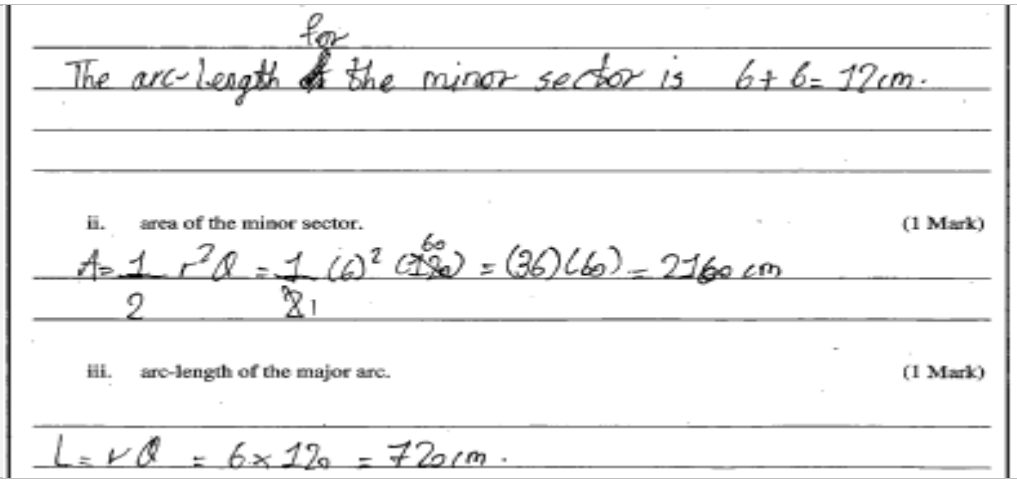
Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	Preferred Pedagogy Used for this SLO	Assessment Strategies
• Identify the expectation of command words (use Command Word Guide) • Ensure the content is taught at the relevant cognitive level • Identify necessary content required (skills + concepts) • Review past paper questions on the concept • Utilise the resource guide for additional materials	• Story Board • Cause and Effect • Fish and Bone • Concept Mapping • Audio Visual Resources • Think, Pair and Share • Knowledge Platform videos • Questioning Technique (Socratic approach) • Practical Demonstration	• Past paper questions • Discussion on E-Marking Notes • AKU-EB Digital Learning Solution powered by Knowledge Platform https://akueb.knowledgeplatform.com/login
Any Additional Suggestion:		

Question No. 7a

Candidates were given the choice to attempt any ONE out of the two questions: 7a and 7b. Majority of the candidates attempted 7a.

Question Text	The given diagram shows a circle having radius 6 cm and centre at O.  **NOT TO SCALE** If the sector subtends a central angle of $120°$, then calculate the i. arc-length for the minor sector. ii. area of the minor sector. iii. arc-length of the major arc.
SLO No.	21.2.4 and 21.2.6
SLO Text	• Apply l=rθ to solve problems. • Apply $A=\frac{1}{2}r^2\theta$ to solve related problems.
Max Marks	4
Cognitive Level	A
Checking	1 mark for converting angle into radians.

Hints	1 mark for calculating the arc-length of the minor arc. 1 mark for calculating the area of the minor sector. 1 mark for calculating arc-length of the major arc. (mark will be granted for correct calculation of the reflex angle)
Overall Performance	Overall, candidates performed relatively stronger in this question. They correctly used the formula for arc-length of the minor arc and area of the minor sector. Some of them struggled in conversion of angles.
Description of Better Responses	Better responses converted angles from degree to radian by multiplying given angle with $\frac{\Pi}{180}$ to solve the question successfully which indicates their critical thinking. They used the correct substitution for the arc-length of the minor sector in the formula (l=rθ) , area of the minor sector in the formula $A=\frac{1}{2}r^2\theta$ and arc-length of the major sector in the formula (l=rθ).
Image of Better Response	
Description of Weaker Responses	Weaker responsees encountered difficulties in converting angles into radians and mistakenly used the given angles (in degree) for calculating both the minor arc length and area. Additionally, some responses showed misconceptions regarding the formulas for calculating area and arc length.
Image of Weaker Response	

Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	Preferred Pedagogy Used for this SLO	Assessment Strategies
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Any Additional Suggestion:

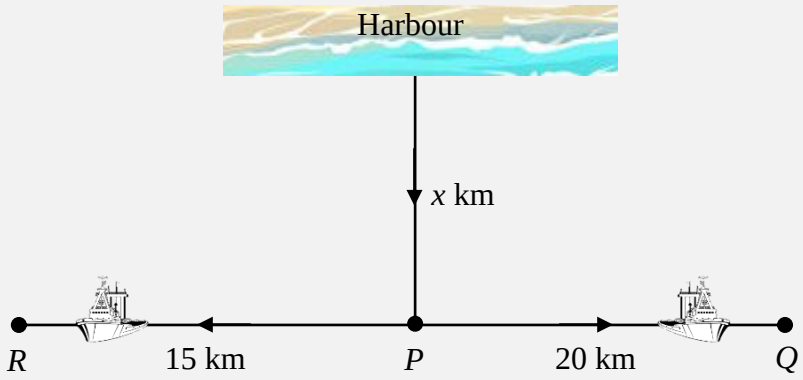
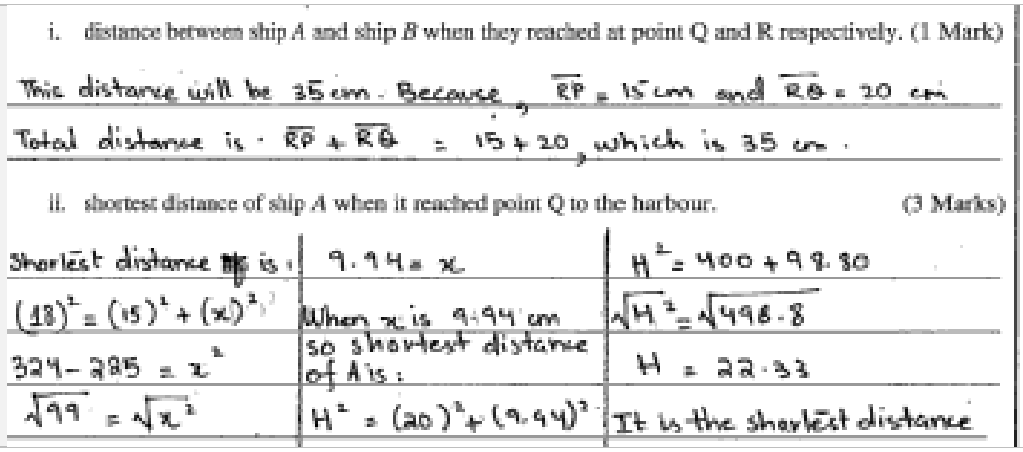
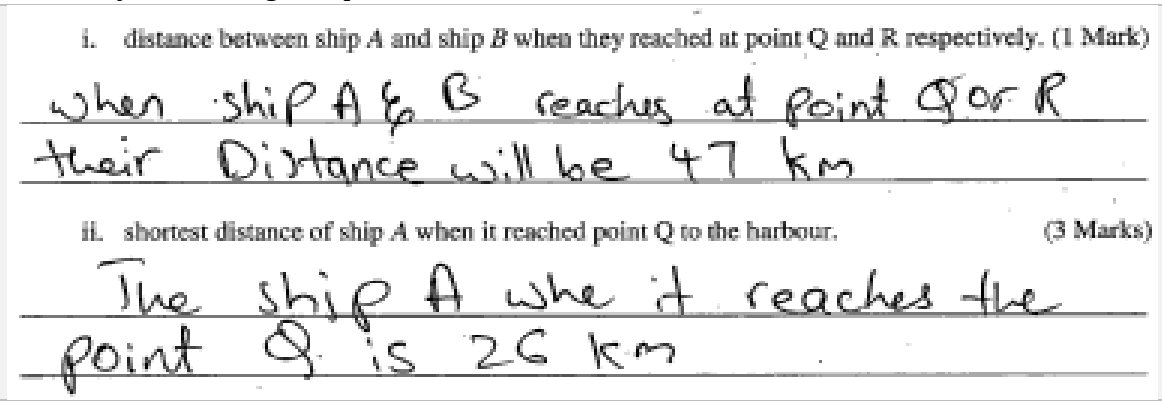
Question No. 7b	
Question Text	Two ships *A* and *B* leave their harbour together and sail to south for *x* km. After reaching at point *P*, • ship *A* turns East and sails for 20 km to reach at point Q. • ship *B* turns West and sails for 15 km to reach at point R. The route is shown in the given diagram. **NOT TO SCALE**  If the shortest distance of ship *B* from point R to the harbour is 18 km, then find the i. distance between ship *A* and ship *B* when they reached at point Q and R respectively. ii. shortest distance of ship *A* when it reached point Q to the harbour.
SLO No.	22.1.1 a
SLO Text	Apply the following theorems to solve related problems: a. in a right-angled triangle, the square of the length to hypotenuse is equal to the sum of the squares of the lengths of the other two sides (Pythagoras' theorem)
Max Marks	4
Cognitive Level	A
Checking Hints	1 mark for correct distance 1 mark for finding *x* 1 mark for correct application of Pythagoras theorem 1 mark for finding *AH* **(Note: ± 0.05 will be accepted)**
Overall Performance	Overall, fewer candidates attempted this question compared to Q7a. Many struggled specifically with determining the shortest distance of ship A and ship B when it reached to point Q to the harbour. But some of them showed a superb understanding of the Pythagorean theorem.
Description of Better Responses	Better responses demonstrated candidates' ability to apply the Pythagorean theorem effectively to solve specific triangles. They took the squares and square roots correctly when solving Pythagorean theorem. They correctly aadded the shortest distance of ship A and ship B when it reached to point Q to the harbour. Their work illustrated all the necessary steps for the question in addition to finding the required lengths which helped them to achieve full marks.

Image of Better Response	 i. distance between ship *A* and ship *B* when they reached at point Q and R respectively. (1 Mark) This distance will be 35 cm. Because, $\overline{RP}$ = 15 cm and $\overline{RB}$ = 20 cm Total distance is: $\overline{RP} + \overline{RB}$ = 15 + 20, which is 35 cm. ii. shortest distance of ship *A* when it reached point Q to the harbour. (3 Marks) Shortest distance is: $(18)^2 = (15)^2 + (x)^2$ $324 - 225 = x^2$ $\sqrt{99} = \sqrt{x^2}$ $9.94 = x$ When x is 9.94 cm so shortest distance of A is: $H^2 = (20)^2 + (9.94)^2$ $H^2 = 400 + 98.80$ $\sqrt{H^2} = \sqrt{498.8}$ $H = 22.33$ It is the shortest distance
Description of Weaker Responses	Weaker responses failed to find the correct distance between Ship A and Ship B because they subtracted 20 and 15 instead of adding them, which indicated a misunderstanding of the question. Candidates struggled with grasping the requirements of the problem and had difficulty in correctly applying and understanding the Pythagoras theorem, which was necessary for solving the question.
Image of Weaker Response	 i. distance between ship *A* and ship *B* when they reached at point Q and R respectively. (1 Mark) when ship A & B reaches at point Q or R their Distance will be 47 km ii. shortest distance of ship *A* when it reached point Q to the harbour. (3 Marks) The ship A whe it reaches the point Q is 26 km

Suggestions for improvement (Highlight all that apply)

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	Demonstration	

Any Additional Suggestion:

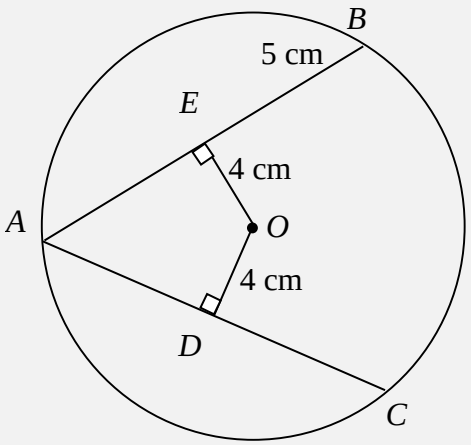
While teaching the concept of Pythagorean theorem, teachers are advised to use the following strategies: Start with real-life examples where the Pythagorean theorem is used. For instance, explain how architects and builders use it to ensure the stability and accuracy of structures. Show how it is applied in navigation, such as calculating distances on maps or GPS systems.

Use interactive demonstrations with props like wooden blocks to physically show the concept of the theorem. Create right-angled triangles with sides of known lengths and ask students to verify the theorem by measuring the sides and calculating the square of the hypotenuse.

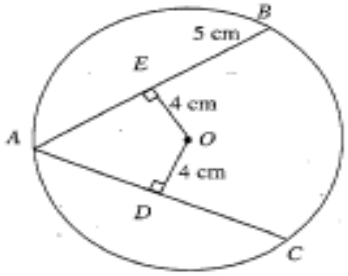
Conduct hands-on activities where students construct right-angled triangles using materials like string, rulers, and protractors. Have them measure the sides and calculate the hypotenuse to reinforce the theorem.

Question No. 8a

Candidates were given the choice to attempt any ONE out of the two questions: 8a and 8b. Both the choices attempted almost equally.

Question Text	In the given circle with centre O, $\overline{BE} = 5$ cm and $\overline{OE} = \overline{OD} = 4$ cm.  **NOT TO SCALE** i. Find the length of $\overline{DC}$ and write a statement to justify your answer. ii. Find the length of $\overline{AB}$ and write a statement to justify your answer.
SLO No.	23.1.1c
SLO Text	Apply the following theorems to solve related problems: perpendicular from the centre of a circle on a chord bisects it.
Max Marks	4
Cognitive Level	U
Checking Hints	i. 1 mark for finding $\overline{DC}$ 1 mark for writing its reason ii. 1 mark for finding $\overline{AB}$ 1 mark for writing its reason

Overall Performance	This question was well attempted by majority of the candidates. Candidates found the length of $\overline{DC}$ and the length of $\overline{AB}$ with justifications of each. Some of them struggled in mentioning the reason of the values of $\overline{DC}$ and $\overline{AB}$.
Description of Better Responses	Better responses stated the correct values and correct reasons for part (i) and (ii). There one of the reasons were 'A line is drawn from the centre of the circle bisect the chord into two equal parts and line and chord are perpendicular to each other'.
Image of Better Response	i. Find the length of $\overline{DC}$ and write a statement to justify your answer. (2 Marks) Length of $\overline{DC}$ is 5cm. As $\overline{AB}$ and $\overline{AC}$ are at equal distance from the centre, so $\overline{AB} = AC$, and $\overline{EB} = \overline{DC}$. The line drawn from the centre bisects the chord into equal parts. $BE = 5cm$ so $\overline{DC} = 5cm$. equal chords are at equal distance from the centre. ii. Find the length of $\overline{AB}$ and write a statement to justify your answer. (2 Marks) The length of $\overline{AB}$ is 10cm as $\overline{AE} = \overline{BE}$. A line drawn from the centre of the circle bisects the chord into two equal parts and it is a perpendicular bisector. so by adding $AE + BE = 5 + 5 = 10$, $\overline{AB} = 10cm$
Description of Weaker Responses	Candidates struggled to accurately state the lengths and explain the reasons of the theorem that justified their answers. **Incorrect Lengths**: 1. Students wrote $\overline{DC} = 8cm$. They added $\overline{OE}$ and $\overline{OD}$ which was wrong. 2. Students wrote $\overline{AB} = 5 + 4$, $\overline{AB} = 9cm$ which was wrong. **Incorrect Reasons** 1. Because of same radii of a circle. 2. Becausse it is perpendicular so the angle is 90 degrees.

Image of Weaker Response	a. In the given circle with centre O, $BE = 5$ cm and $OE = OD = 4$ cm.  NOT TO SCALE i. Find the length of $\overline{DC}$ and write a statement to justify your answer. (2 Marks) $\overline{EB} = \overline{DC}$ (Because of same radii of a circle) $DC = 5cm$ ii. Find the length of $\overline{AB}$ and write a statement to justify your answer. (2 Marks) $OE + EB = AB$ (Sum of all sides) $AB = 5 + 9$ $AB = 9$ cm

Suggestions for improvement (Highlight all that apply)

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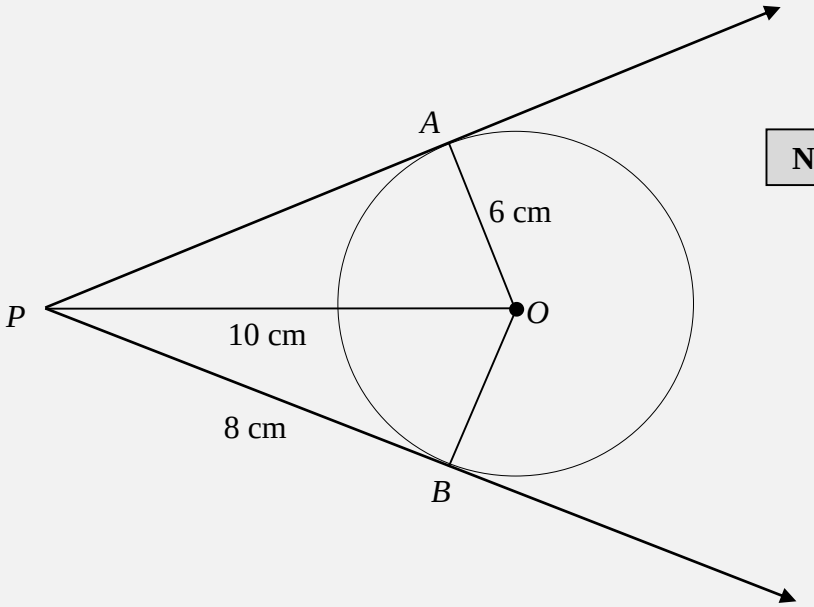
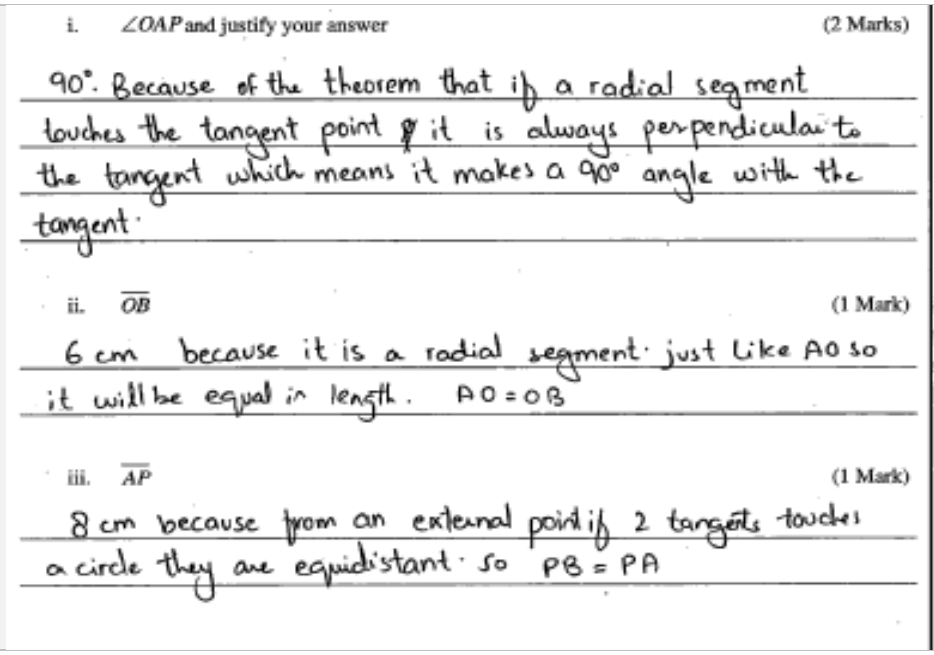
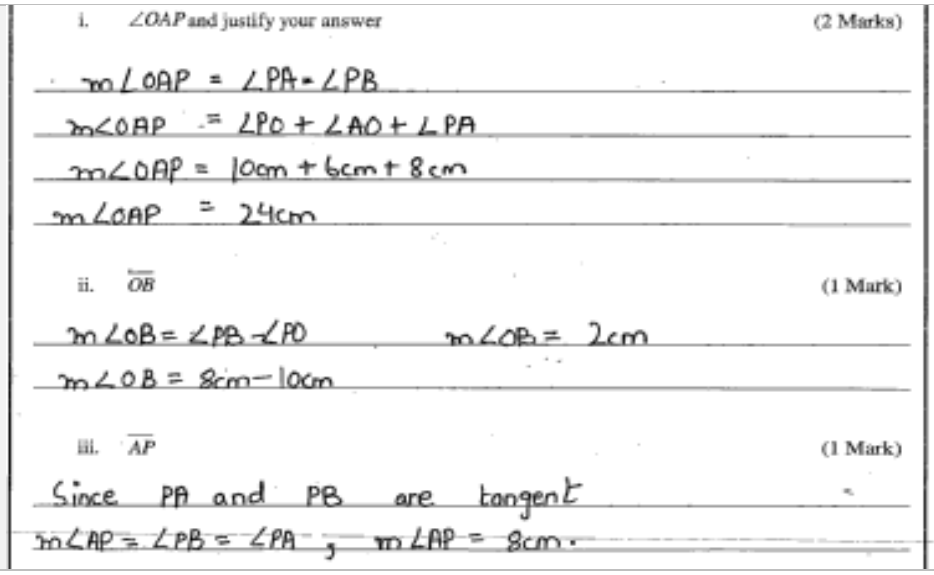
Any Additional Suggestion:		

Question No. 8b	
Question Text	In the given diagram, a circle with centre *O* is shown. *PA* and *PB* are tangents to the circle at point *A* and *B* respectively.  **NOT TO SCALE** State the value of i. $\angle OAP$ and justify your answer ii. $\overline{OB}$ iii. $\overline{AP}$
SLO No.	24.1.1
SLO Text	Apply the following theorems to solve related problems: a. if a line is drawn perpendicular to a radial segment of a circle at its outer end point, it is tangent to the circle at that point. b. the tangent to a circle and the radial segment joining the point of contact and the centre are perpendicular to each other. c. the two tangents drawn to a circle from a point outside it are equal in length.
Max Marks	4
Cognitive Level	U
Checking Hints	1 mark for $\angle OAP = 90^{o}$ 1 mark for its justification 1 mark for finding *OB* 1 mark for finding *AP*
Overall Performance	This question was well attempted by most of the candidates. Some of them struggled in mentioning the reason of the value of $\angle OAP$.
Description of Better Responses	Better responses showed that the candidates accurately applied the theorem and supported their answers effectively with sound reasoning. **Reasons candidates mentioned:** Radial segment touches the tangent point is always perpendicular to tangent and makes 90 degrees angle. AND If a radial segment (or radius) touches a tangent at a point of tangency, it is always

	perpendicular to the tangent line at that point.
Image of Better Response	 i. $\angle OAP$ and justify your answer (2 Marks) 90°. Because of the theorem that if a radial segment touches the tangent point it is always perpendicular to the tangent which means it makes a 90° angle with the tangent. ii. $\overline{OB}$ (1 Mark) 6 cm because it is a radial segment just like AO so it will be equal in length. AO = OB iii. $\overline{AP}$ (1 Mark) 8 cm because from an external point if 2 tangents touches a circle they are equidistant so PB = PA
Description of Weaker Responses	Weaker responses lacked conceptual understanding of the tangent, as they did not support the correct interpretation of the statements with their answers and they did not write the correct values as well. They used the formula of sum of angles of a triangle is equals to 180 degrees which was absolutely not required here.
Image of Weaker Response	 i. $\angle OAP$ and justify your answer (2 Marks) $m\angle OAP = \angle PA = \angle PB$ $m\angle OAP = \angle PO + \angle AO + \angle PA$ $m\angle OAP = 10cm + 6cm + 8cm$ $m\angle OAP = 24cm$ ii. $\overline{OB}$ (1 Mark) $m\angle OB = \angle PB - \angle PO$ $m\angle OB = 2cm$ $m\angle OB = 8cm - 10cm$ iii. $\overline{AP}$ (1 Mark) Since PA and PB are tangent $m\angle AP = \angle PB = \angle PA$; $m\angle AP = 8cm$.

Suggestions for improvement (Highlight all that apply)

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Any Additional Suggestion:		

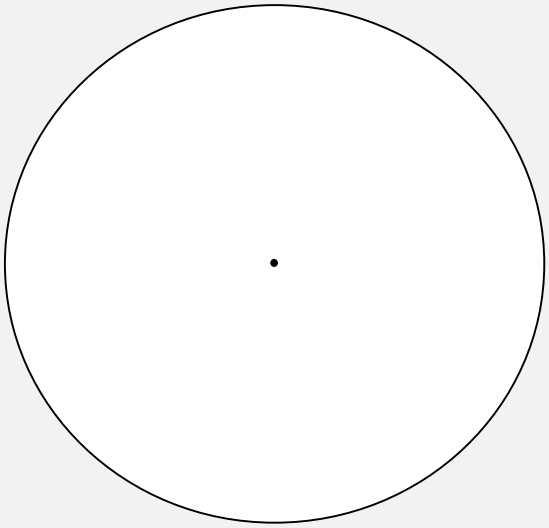
Question No. 9	
Question Text	Draw an inscribed square about the given circle. 
SLO No.	27.2.7
SLO Text	Draw an inscribed square about a given circle.
Max Marks	3
Cognitive Level	A
Checking Hints	1 mark for drawing diameter of the given circle 1 mark for drawing perpendicular bisectors to the diameter 1 mark for construction of required square
Overall Performance	This question was related to construction of inscribed square for the given circle with the help of compass. This question was well attempted by majority of the candidates. Some of the candidates struggled in construction of required square.
Description of Better Responses	Better responses exhibited the accurate illustration of the inscribed square of a given circle. Candidates were able to construct the square with proper arcs by using compass. Candidates successfully constructed the required inscribed square, including all necessary steps such as bisecting and using the diametre effectively.

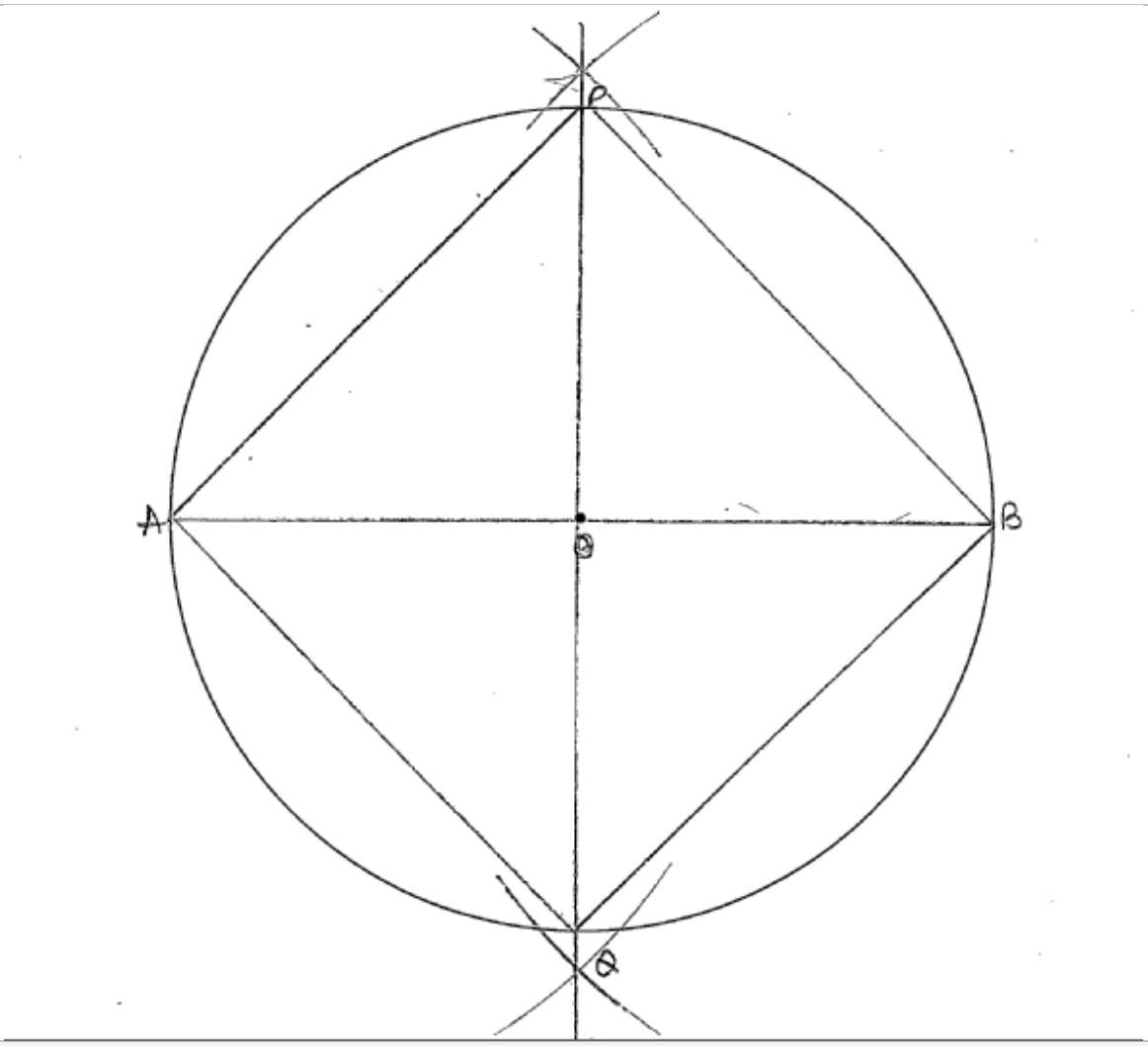
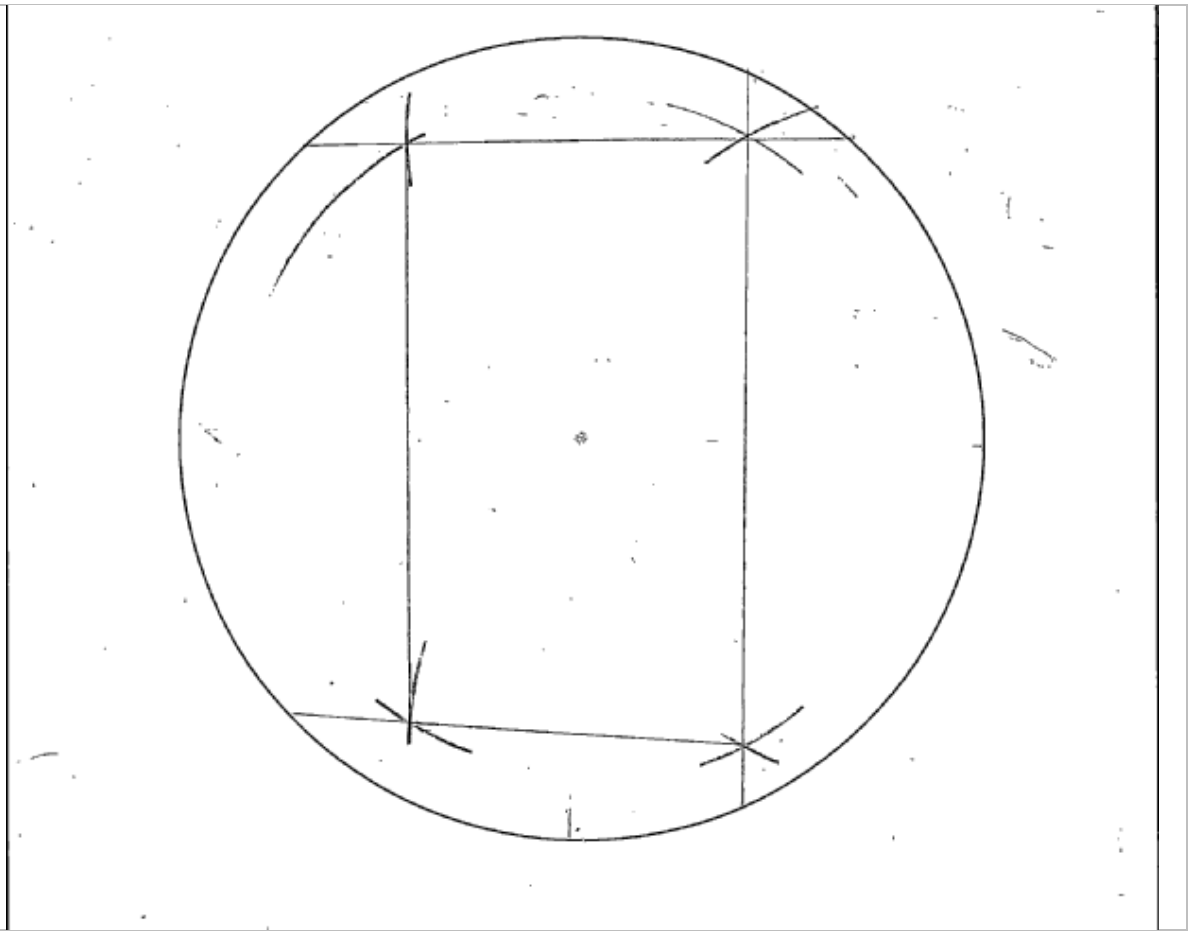
Image of Better Response	
Description of Weaker Responses	Weaker rresponses faced difficulties in drawing the inscribed circle correctly. They did not draw the right bisector properly, their arcs were not at the right place to make the desired figure. Additionally, few candidates drew altitudes which was not required, further impacting their performance on the question.

Image of Weaker Response	

Suggestions for improvement (Highlight all that apply)

Maximising SLO Achievement	Preferred Pedagogy Used for this SLO	Assessment Strategies
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Any Additional Suggestion:		

Annexure A: Pedagogies Used for Teaching the SLOs

Pedagogy: Storyboard
Description: A visual pedagogy that uses a series of illustrated panels to present a narrative, encouraging creativity and critical thinking. It helps learners organise ideas, sequence events, and comprehend complex concepts through storytelling.
Example: In a Literature class, students are tasked with creating storyboards to visually retell a novel. They draw key scenes, write captions, and present their stories to the class, enhancing their reading comprehension and fostering their imagination.

Pedagogy: Cause and Effect
Description: This pedagogy explores the relationships between actions and consequences. By analysing cause-and-effect relationships, learners develop a deeper understanding of how events are interconnected and how one action can lead to various outcomes.
Example: In a History class, students study the causes and effects of the Industrial Revolution. They research and discuss how technological advancements in manufacturing led to significant societal changes, such as urbanisation and labour reform movements.

Pedagogy: Fish and Bone
Description: A method that breaks down complex topics into main ideas (the fish) and supporting details (the bones). This visual approach enhances comprehension by highlighting essential concepts and their relevant explanations.
Example: During a Biology class on human anatomy, the teacher uses the fish and bone technique to teach about the human skeletal system. Teacher presents the main components of the human skeleton (fish) and elaborates on each bone's structure and function (bones).

Pedagogy: Concept Mapping
Description: An effective way to visually represent relationships between ideas. Learners create diagrams connecting key concepts, aiding in understanding the overall structure of a subject and fostering retention.
Example: In a Psychology assignment, students use concept mapping to explore the various theories of personality. They interlink different theories, such as Freud's psychoanalysis, Jung's analytical psychology, and Bandura's social-cognitive theory, to see how they relate to each other.

Pedagogy: Audio Visual Resources
Description: Incorporating multimedia elements like videos, images, and audio into lessons. This approach caters to different learning styles, making educational content more engaging and memorable.
Example: In a General Science class, the teacher uses a documentary-style video to teach about the solar system. The video includes stunning visual animations of the planets, interviews with astronomers, and background music, enhancing students' interest and understanding of space.

Pedagogy: Think, Pair, and Share

Description: A collaborative learning technique where students ponder a question or problem individually, then discuss their thoughts in pairs or small groups before sharing with the entire class. It fosters active participation, communication skills, and diverse perspectives.
Example: In a Literature in English class, the teacher poses a thought-provoking question about a novel's moral dilemma. Students first reflect individually, then pair up to exchange their opinions, and finally participate in a lively class discussion to explore different viewpoints.

Pedagogy: Questioning Technique (Socratic Approach)
Description: Based on Socratic dialogue, this method stimulates critical thinking by posing thought-provoking questions. It encourages learners to explore ideas, justify their reasoning, and discover knowledge through a process of inquiry.
Example: In an Ethics class, the instructor uses the Socratic approach to lead a discussion on the meaning of justice. By asking a series of probing questions, the students engage in a deeper exploration of ethical principles and societal values.

Pedagogy: Practical Demonstration
Description: A hands-on approach where learners observe real-life applications of theories or skills. Practical demonstrations enhance comprehension, skill acquisition, and problem-solving abilities by bridging theoretical concepts with real-world scenarios.
Example: In a Food and Nutrition class, the instructor demonstrates the proper technique for filleting a fish. Students observe and then practice the skill themselves, learning the practical application of knife skills and culinary precision.

(**Note:** The examples provided in this annexure serve as illustrations of various pedagogies. It is important to understand that these pedagogies are versatile and can be applied across subjects in numerous ways. Feel free to adapt and explore these techniques creatively to enhance learning outcomes in your specific context.)

Acknowledgements

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We particularly thank to Ms Uroosa Manzar, Senior Marker, Bai Virbaijee Soparivala (BVS) Parsi High School, Karachi, for evaluating each question's performances, delineating strengths and weaknesses in candidates' responses, and highlighting instructional approaches along with recommendations for better performance.

Additionally, we express our gratitude to the esteemed team of reviewers for their constructive feedback on overall performance, better and weaker responses, and validating teaching pedagogies along with suggestions for improvement.

These contributors include:

- Mahrukh Amin Jiwa, Specialist, MSP, AKU-EB
- Zain Muluk, Manager, Examination Development, AKU-EB
- Raabia Hirani, Manager, Curriculum Development, AKU-EB
- Ali Aslam Bijani, Manager, Teacher Support, AKU-EB
- Dr Naveed Yousuf, CEO, AKU-EB