EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE
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2025 NSC CHIEF MARKER'S REPORT

SUBJECT	Technical Mathematics		
QUESTION PAPER	1	②	3
DURATION OF QUESTION PAPER	3 hours		
PROVINCE	Eastern Cape		
NAME OF THE INTERNAL MODERATOR	L. V. Cunningham		
NAME OF THE CHIEF MARKER	H. Zeelie		
DATES OF MARKING	28/11/2025 – 11/12/2025		
HEAD OF EXAMINATION:	E. M. Mabona		

SECTION 1:

General overview of Learner Performance in the question paper as a whole

The number of Eastern Cape NSC candidates that wrote the final NSC Technical Mathematics Paper 2 for 2025 was 3264, which is a 383 more than in 2024.

A sample of 100 scripts was collected during the marking process. The selected sample comprises of scripts that were moderated by the Internal Moderator and/or Chief Marker, and/or the Senior Marker and some non-moderated scripts.

The graphical representation in the report will be based on the 100 sampled candidates' responses which were selected as depicted in the next table:

	[0; 44]	[45; 59]	[60; 74]	[75; 89]	[90; 104]	[105; 119]	[120; 150]	TOTAL
Required	15	15	20	20	20	5	5	100
Actual	22	20	20	14	12	8	4	100
Percentage	22%	20%	20%	14%	12%	8%	4%	100%

The 2025 cohort performed better than the cohort of 2024, when looking at the pass percentages. When looking at the 7-point scale, there is also an improvement in the level distributions from 2024 to 2025 and from previous years. There has been a 3,1% increase in the pass rate for Technical Mathematics Paper 2 from 2024 to 2025. There is a total of 37 Level 7's, which is two more than in 2024.

Technical Mathematics Paper 2 is, unfortunately, still failing in its aim as quoted in the CAPS document ("*(d) The National Curriculum Statement Grades R – 12 aims to produce candidates that are able to: • identify and solve problems and make decisions using critical and creative thinking;*"), as the bulk of the candidates still performs at level 1.

The average performance of the sampled 100 candidates of the questions, is depicted in the graph below:

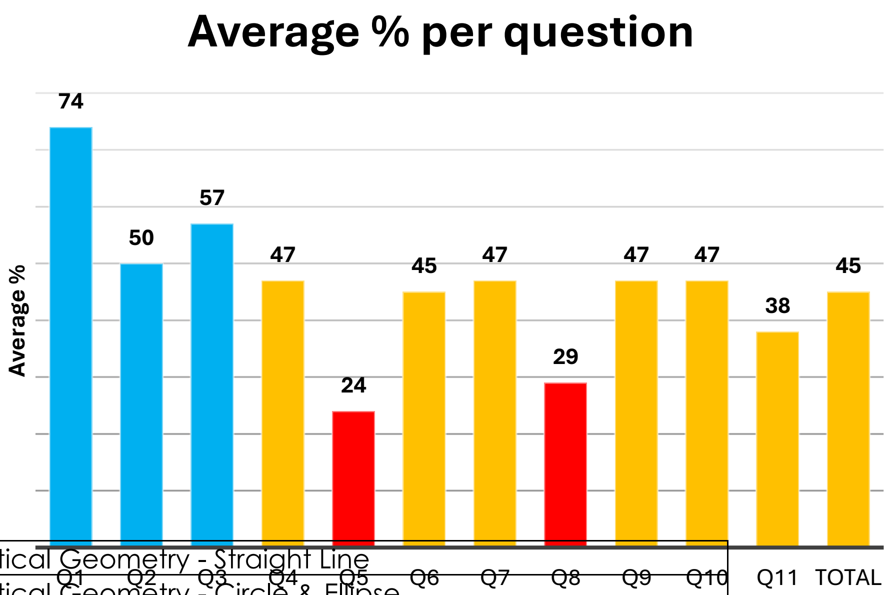
KEY:

Green - > 80%

Blue – < 80%, but > 50%

Orange - < 50%, but > 30%

Red - < 30%



Q1	Analytical Geometry - Straight Line
Q2	Analytical Geometry - Circle & Ellipse
Q3	Trigonometry - Definitions & Equations
Q4	Trigonometry - Reductions & Identities
Q5	Trigonometry - Graph

Q6	Trigonometry - 2D
Q7	Euclidean Geometry
Q8	Euclidean Geometry
Q9	Euclidean Geometry - Proportion
Q10	Circles, Angles & Angular Movement
Q11	Mensuration

Overall the performance of the 100 sampled candidates showed some improvement in certain sections compared to the 2024 cohort, while there was a drastic drop in the performance of other sections. Question 1 (Analytical Geometry) was the best performing question in 2025, with Question 5 (Trigonometry: Graphs) performing very poorly at 24% average for the sampled candidates, as well as Question 8 (Euclidean Geometry) performing at 29%. Overall learners did attempt questions, but in many instances they did not answer the question that was being asked. Many question were still left blank or were very poorly answered. Euclidean Geometry (Question 7, 8 and 9), still presents a problem, as many candidates struggle to answer these questions. The best performing candidate received 142 out 150 and the poorest performance was 0 out of 150.

SECTION 2:

Comment on candidates' performance in individual questions

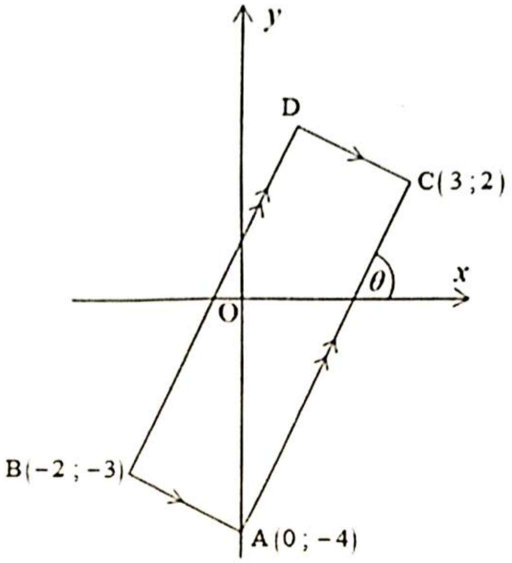
QUESTION 1 [14 Marks]

QUESTION 1

The diagram below shows parallelogram ABDC with vertices $A(0;-4)$, $B(-2;-3)$, D and $C(3;2)$.

AB || CD and AC || BD.

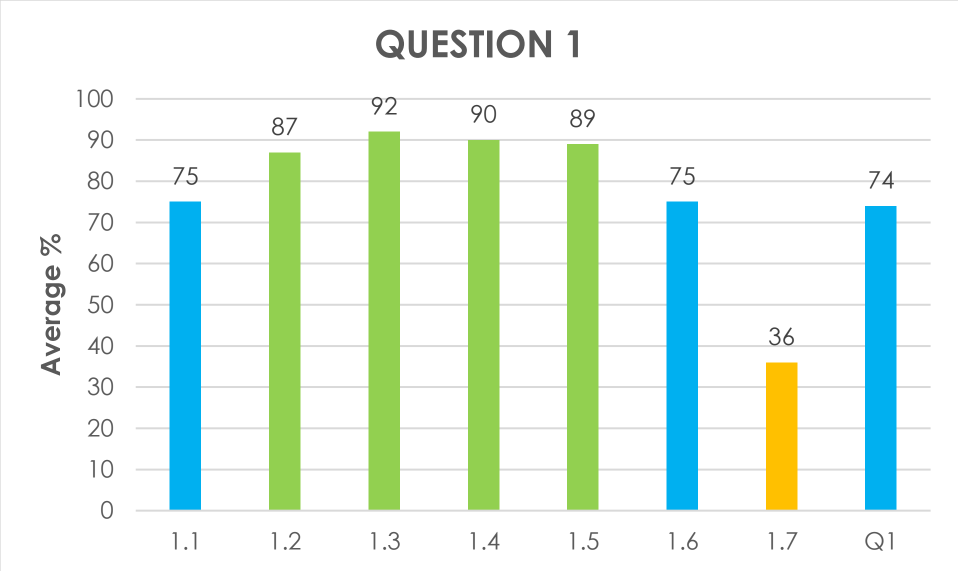
The angle of inclination of AC with the positive x-axis is θ.



1.1	Write down the length of OA.	(1)
1.2	Determine the midpoint of AB.	(2)
1.3	Determine the gradient of AC.	(2)
1.4	Hence, determine the size of angle θ.	(2)
1.5	Complete the following statement: If two lines are parallel, then their gradients are …	(1)
1.6	Hence, determine the equation of BD in the form $y = ...$	(3)
1.7	Determine the gradient of a line that passes through point B and has an inclination of α, where $\cos\alpha = -\frac{\sqrt{2}}{2}$	(3)

[14]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



- Learners performed well overall, with many achieving full marks in sub-questions involving midpoint, gradient, and angle calculation. This question was among the best answered in the paper, due to its procedural nature and learner familiarity with straight-line geometry.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

i.) The most significant error that occurred in Question 1, was in the sub-question 1.6 and 1.7, were candidates were expected to determine the equation of a line parallel to another line and going through a certain point and also finding the gradient of a line using a trig ratio.

ii.) Many candidates were unable to find the final equation of the line, as they simplified incorrectly.

iii.) Candidates also made a mistake when substituting the point to be able to find the final equation of the parallel line, as they substituted the point as positive instead of negative values.

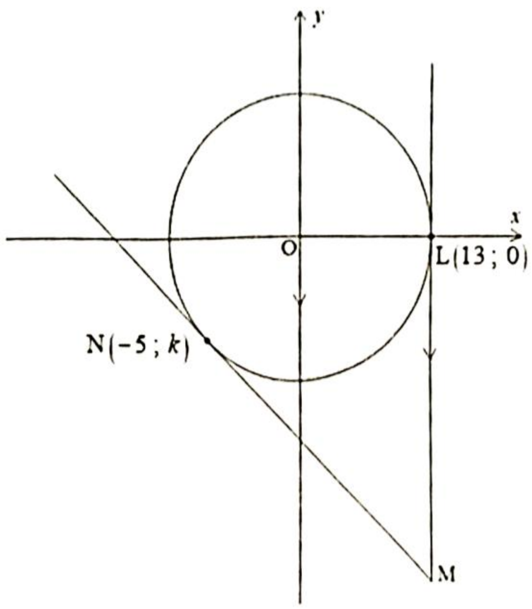
(c) Provide suggestions for improvement in relation to Teaching and Learning. **(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**
Educators should focus on the following during their contact time with candidates: i.) Emphasise basic rules of Analytical Geometry that was taught in Grade 10, but still plays a vital role in answering certain questions in Grade 12. For example, clearly distinguish between when are lines parallel and when they are perpendicular and how do you find the gradients of lines that are parallel or perpendicular. Educators must emphasise the basic rules for gradients: a. When gradients are equal, lines are parallel; b. When the product of two gradients equals -1, the lines are perpendicular and; c. When the gradients on a line are all equal, the points are co-linear. ii.) Educators must remember to do application questions with the candidates, w.r.t straight lines: a. How to find the equation of a line going through a specific coordinate/point; and b. How to find the equation of a line that is either parallel or perpendicular to another line.

QUESTION 2 [12 Marks]

QUESTION 2

2.1 In the diagram below, O is the centre of the circle which passes through points $L(13;0)$ and $N(-5;k)$.

Tangents MN and ML touch the circle at points N and L respectively.
ML || y-axis.



2.1.1 Determine the equation of the circle. (2)

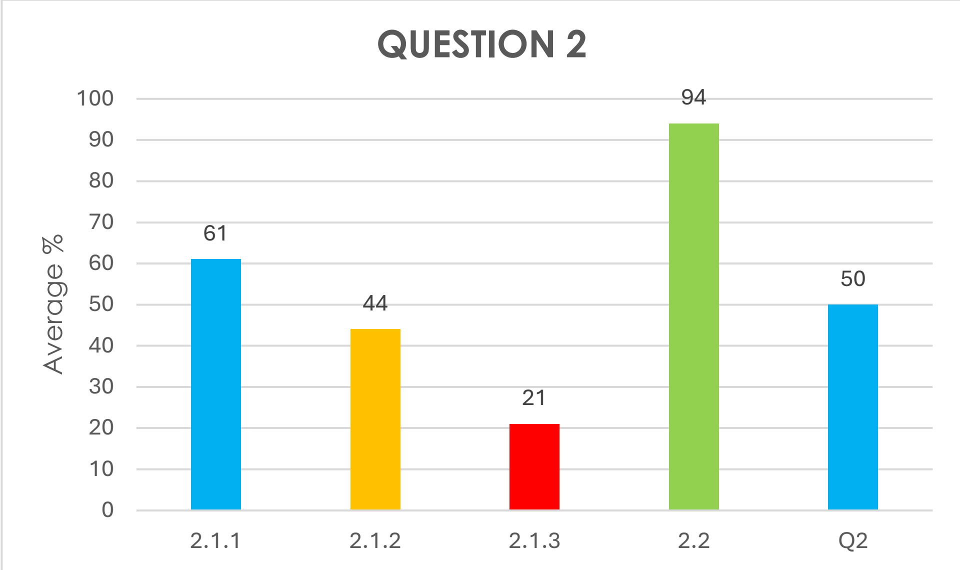
2.1.2 Determine the numerical value of k. (2)

2.1.3 Hence, determine the coordinates of point M, the point of intersection of the two tangents. (5)

2.2 Sketch the graph defined by: $\frac{x^2}{25}+\frac{y^2}{4}=1$ (3)

[12]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



- This question showed moderate performance. While the simpler parts were generally well answered, the multi-step problem involving tangents and determining coordinates of point M proved challenging.
- The ellipse sketching was particularly good.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

i.) Just like the cohort of 2024, candidates once again struggled to give the equation of a circle in its standard form. Candidates, continuously calculated the radius, instead of the equation of the circle.

ii.) Candidates were also unable to find the unknown value of a coordinate on the circle.

iii.) Candidates struggled immensely with finding the coordinate of the point of intersection between the two tangent lines to the circle, even though it was given that the x-value was 13 as the one tangent line was parallel to the y-axis.

(c) Provide suggestions for improvement in relation to Teaching and Learning.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

Educators should focus on the following during their contact time with candidates:

i.) Emphasise to candidates that they must always read the question carefully and make sure of what is being asked of them. Not reading the question completely results in unnecessary marks that are being lost due to them not giving the final answer that is expected in the question.

ii.) Emphasise basic rules of Analytical Geometry that was taught in Grade 10, but still plays a vital role in answering certain questions in Grade 12. For example, clearly distinguish between when are lines parallel and when they are perpendicular and how do you show that lines are parallel or perpendicular.

iii.) Educators must emphasise the basic rules for gradients:

a. When gradients are equal, lines are parallel;
b. When the product of two gradients equals -1, the lines are perpendicular and;
c. When the gradients on a line are all equal, the points are co-linear.
d. Emphasis must be placed on how the standard form of the ellipse must look ($\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$), so that it can aid in the sketching of the graph. If candidates are taught to write the values of a and b in their square form (i.e.: $\frac{x^2}{1}+\frac{y^2}{9}=1 \rightarrow \frac{x^2}{(1)^2}+\frac{y^2}{(3)^2}=1$), it will help to determine the scale that must be used to sketch the ellipse accurately. This will also help to determine whether the ellipse is horizontal or vertical. Encourage learners to label intercepts before sketching ellipses.

QUESTION 3 [13 Marks]

QUESTION 3

3.1 Given: $\hat{A} = 72°$ and $\hat{B} = 30,5°$

Determine the numerical value of $\sqrt{\sin B + \sec A}$ (3)

3.2 Given: $\sin\theta = -\frac{5}{13}$ and $\tan\theta < 0$

Determine, **without the use of a calculator**, the numerical value of the following:

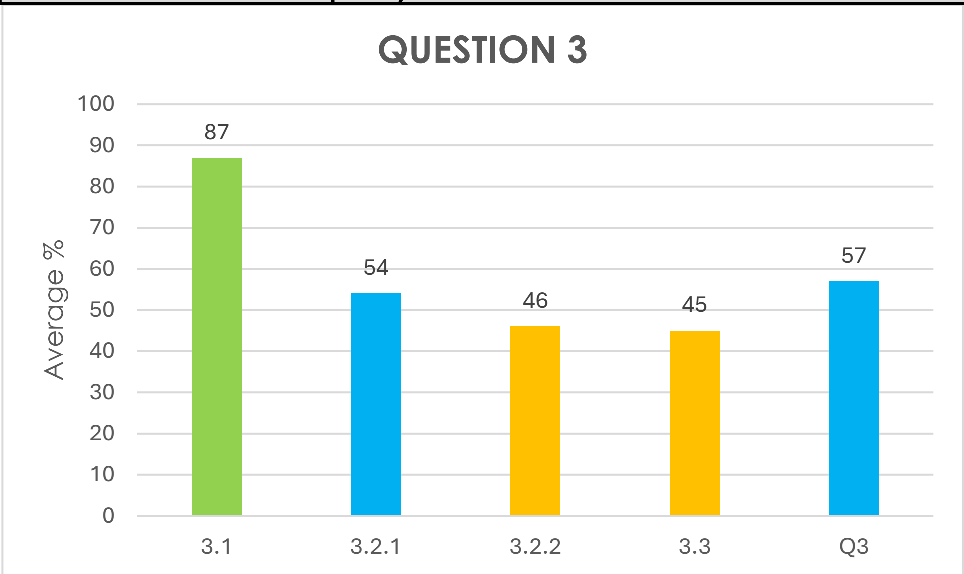
3.2.1 $\cos\theta$ (3)

3.2.2 $\cot\theta - \operatorname{cosec}\theta$ (3)

3.3 Solve for x: $\cot x = -0,587$ for $x \in [0°;360°]$ (4)

[13]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



- Performance was mixed. Calculations using given values were mostly correct, but trig ratios in the Cartesian plane and solving equations were poorly answered. Many learners lacked fluency with reciprocal trig ratios and CAST diagram use.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

i.) In Question 3.1 the most common error that occurred was candidates are mixing the different trigonometric ratios and their reciprocals.

ii.) In Question 3.2, candidates were given a ratio, which they needed to use to find the value of an expression. To do this, candidates needed to apply Pythagoras, which is a concept from Grade 8 and 9. This, however, proved problematic as candidates struggled to apply Pythagoras correctly as they struggle to identify which side is x, y or r (opposite, adjacent or hypotenuse).

iii.) Question 3.3 presented its own problems, whereas candidates were not able to apply the correct trig reciprocal to enable them to find the correct reference angle needed to calculate the size of x.

(c) Provide suggestions for improvement in relation to Teaching and Learning. **(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**

Educators should focus on the following during their contact time with candidates:

i.) Basic Grade 10 trig ratios must be revised and consolidated so that candidates know the ratios as well as their reciprocal ratios.

a. $cosec\theta = \frac{1}{sin\theta}$;

b. $sec\theta = \frac{1}{cos\theta}$ and;

c. $cot\theta = \frac{1}{tan\theta}$;

ii.) When doing questions on completing diagrams, emphasis must be placed on what is required to be done before the question can be answered.

a. If the diagram is given:

1. The triangle must be completed towards the x-axis.
2. All values of the triangle must be calculated. Ratio values cannot be given if all values have not been calculated.

b. If the diagram must be sketched by the candidate:

1. Trig equation given must be simplified so that the trig ratio is clear. i.e.: $3tan\theta - 1 = 0 \Rightarrow tan\theta = \frac{1}{3}$
2. It must be emphasised that diagrams cannot be drawn if it is in reciprocal form, it must be rewritten in original trig ratio form. i.e.: $cotx = -0,587 \Rightarrow tanx = -\frac{1}{0,587}$
3. Diagram should be drawn and completed in the correct quadrant

using the sign (+ or –) of the ratio value.

c. Pythagoras is used to calculate the unknown values in the triangle diagram. This basic Grade 8 concept must be emphasised and consolidated even in Grade 12.

iii.) All forms of questions relating to solving trig equations must be practiced in class and given as homework. Educators cannot just do the basic examples of solving trig equations, more advanced equations must also be included in the classwork. Emphasis must be placed on answering the question. If the reference angle is calculated that does not mean that the question was answered. Classroom practice using and working with their CAST-diagram must be made a priority, to assist in solving trig equations.

2nd Quadrant $\boldsymbol{\theta = 180^\circ - ref.<}$ **SINE POSITIVE** 180°	**1st Quadrant** $\boldsymbol{\theta = ref.<}$ **ALL POSITIVE** 0°
180° **TAN POSITIVE** $\boldsymbol{\theta = 180^\circ + ref.<}$ **3rd Quadrant**	360° **COSINE POSITIVE** $\boldsymbol{\theta = 360^\circ - ref.<}$ **4th Quadrant**

QUESTION 4 [13 Marks]

QUESTION 4

4.1 Given the expression:

$$\frac{\sin(180^\circ + x)\cdot\sin(360^\circ - x) + \cos(2\pi - x)\cdot\cos x}{\sin x} + \frac{1}{\tan(180^\circ + x)}$$

4.1.1 Complete the reduction: $\tan(180^\circ + x) = \ldots$ (1)

4.1.2 Complete the quotient identity in terms of sine and cosine:

$\cot x = \frac{\ldots}{\ldots}$ (1)

4.1.3 Write down any TWO values of x for which the expression is undefined if $x \in [0^\circ;360^\circ]$ (2)

4.1.4 Hence, simplify the given expression fully. (5)

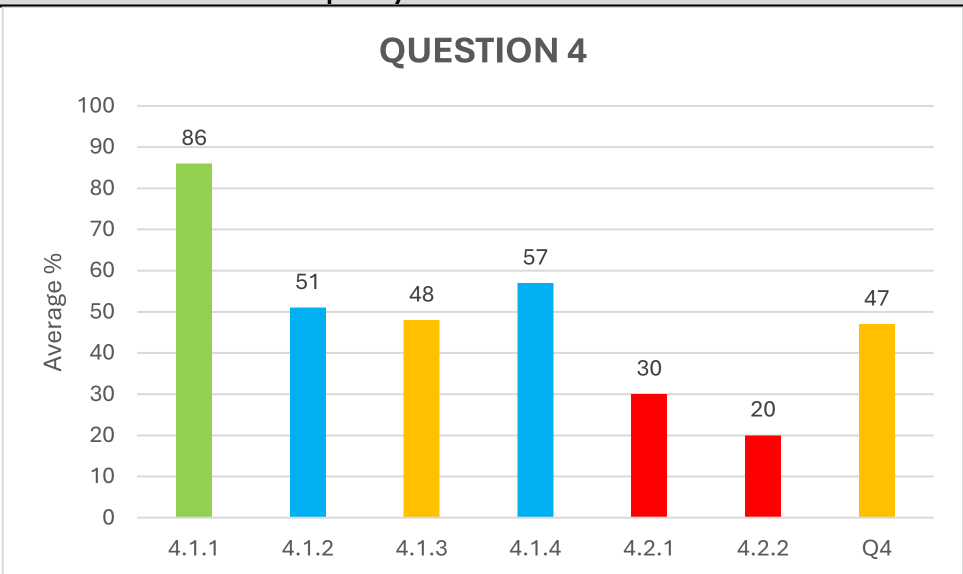
4.2 Given: $\frac{\sin\theta - \cos\theta\cdot\sin\theta}{\cos\theta - (1 - \sin^2\theta)} = \tan\theta$

4.2.1 Factorise the expression: $\sin\theta - \cos\theta\cdot\sin\theta$ (1)

4.2.2 Hence, show that $\frac{\sin\theta - \cos\theta\cdot\sin\theta}{\cos\theta - (1 - \sin^2\theta)} = \tan\theta$ (3)

[13]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



- Performance was slightly better than in 2024, but there are still conceptual gaps.
- Learners struggled with reduction formulae and algebraic manipulation, suggesting weak foundational algebra skills.

(b) Why was the question poorly answered? Also provide specific examples, indicate

common errors committed by learners in this question, and any misconceptions.

i.) Candidates do not know their identities and reduction formulae and how to apply them in a question that is being asked. When working with the reduction formulae, candidates do not know in which quadrants to work to be able to simplify correctly.

ii.) Candidates are struggling to prove identities as they do not do the left and right part separately and they do not apply the identities they are taught correctly to be able to simplify.

iii.) When it comes to the simplification to prove the identities, candidates are struggling with the basic algebra behind the question.

(c) Provide suggestions for improvement in relation to Teaching and Learning.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

Educators should focus on the following during their contact time with candidates:

i.) Candidates must know all the square identities. They must know how to change the subject of these identities to recognise, use and apply them in their calculations.

a. $sin^2\theta + cos^2\theta = 1$ 1. $sin^2\theta = 1 - cos^2\theta$ 2. $cos^2\theta = 1 - sin^2\theta$	b. $tan\theta = \frac{sin\theta}{cos\theta}$ OR $tan^2\theta = \frac{sin^2\theta}{cos^2\theta}$
c. $tan^2\theta + 1 = sec^2\theta$ 1. $tan^2\theta = sec^2\theta - 1$ 2. $1 = sec^2\theta - tan^2\theta$	d. $cot\theta = \frac{cos\theta}{sin\theta}$ OR $cot^2\theta = \frac{cos^2\theta}{sin^2\theta}$
e. $cot^2\theta + 1 = cosec^2\theta$ 1. $cot^2\theta = cosec^2\theta - 1$ 2. $1 = cosec^2\theta - cot^2\theta$	

ii. Candidates must practice enough problems containing reductions on a regular basis, as these are easy marks to score if they are applied correctly. The CAST-diagram can assist in applying the reductions easily.

2nd Quadrant	**1st Quadrant**

$180° - \theta$ **SINE POSITIVE** $180°$	θ $360° + \theta$ **ALL POSITIVE** $0°$
$180°$ **TAN POSITIVE** $180° + \theta$ $\theta - 180°$ **3rd Quadrant**	$360°$ **COSINE POSITIVE** $-\theta$ $360° - \theta$ **4th Quadrant**

ii.) A clear connection must be made between Algebra and Trigonometry. Educators must emphasise that even though the question is on simplifying a Trigonometry Ratio or Proving Identities, in many instances there is Algebra involved in order to simplify to the correct answer.

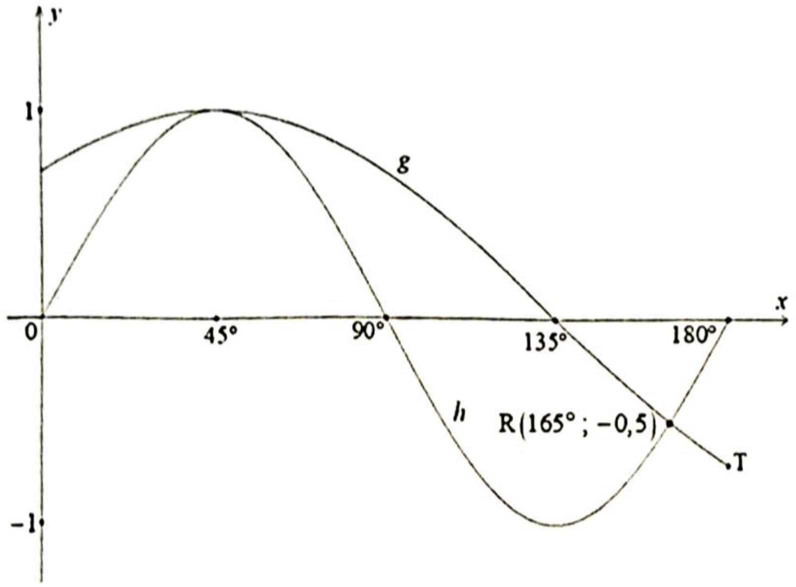
a. When adding or subtracting fractions, one needs to find an LCD
b. When multiplying fractions, the basic rule is to multiply the numerators together and then multiply the denominators together and to then simplify if possible.
c. When dividing fractions, the basic rule is to multiply with the reciprocal.
d. There can be made use of factorisation to simplify expressions
e. Like terms can be added or subtracted

QUESTION 5 [11 Marks]

QUESTION 5

The graph below represents the functions defined by $g(x) = \cos(x - p)$ and $h(x) = \sin mx$ for $0° \leq x \leq 180°$

R(165° ; − 0,5) is a point of intersection of g and h.



5.1 Determine the values of p and m. (2)

5.2 Write down the period of h. (1)

5.3 Write down the maximum value of g. (1)

5.4 Use the graph above to write down the values of x for which:

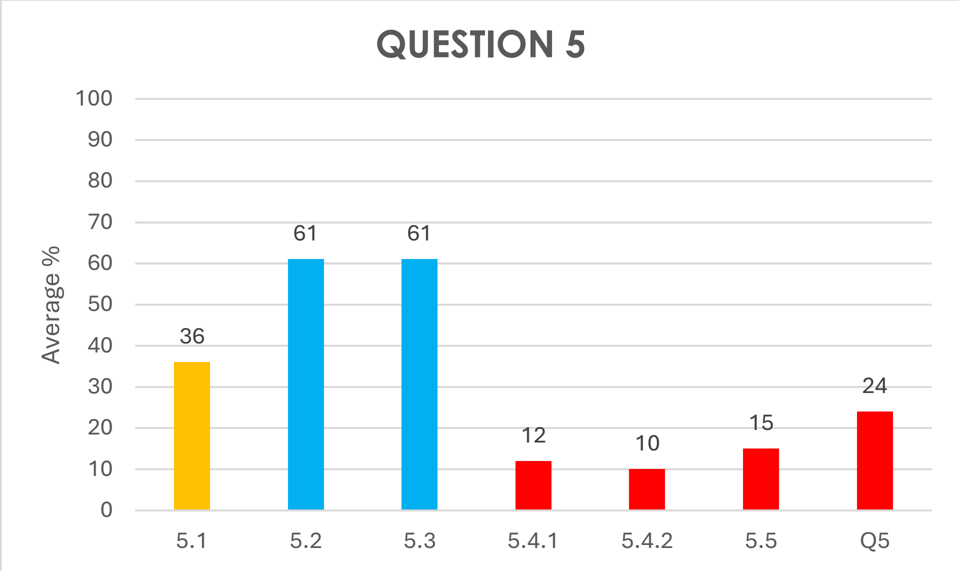
5.4.1 $g(x) < h(x)$ (2)

5.4.2 $g(x) \cdot h(x) \geq 0$ (4)

5.5 If the graph of h is shifted 1 unit downwards, write down the new equation of h. (1)

[11]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



- Question 5 was one of the most poorly answered questions in the question paper.
- Learners are more comfortable sketching graphs than interpreting them.
- Sub-questions requiring interpretation of intervals and phase shift were poorly answered.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

i.) Some candidates who did manage to get the correct value of the period, wrote it as an interval, instead of a single value.

ii.) In sub-question 5.4.1 & 5.4.2 candidates struggled to read the correct values from the graphs, indicating for which values of x, one graph was below the other and also where the product of the two graphs were greater or equal to 0. Hence, candidates are struggling to find values for x, when a specific restriction is given.

iii.) Candidates are struggling to give basic information of graphs if changes have been made to the graphs and they are no longer working with the graphs given or the original graphs.

(c) Provide suggestions for improvement in relation to Teaching and Learning.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

Educators should focus on the following during their contact time with candidates:

i. – iii.) Candidates must be reminded that the period of a graph is a single value in degrees and that the amplitude of a graph is a single positive value. Clearly distinguish the difference between the domain and period of a function and again range and domain as well.

a. Candidates could perhaps be taught to distinguish between the domain and the range they must follow the alphabet, i.e.: $\boldsymbol{D}$ comes before $\boldsymbol{R}$ and $\boldsymbol{x}$ comes before $\boldsymbol{y}$. So therefore the domain and x-values goes together and the range and y-values goes together.

b. Educators must emphasize the fact that changes to the trig graphs can be represented by any letter of the alphabet, as it is only a variable and can represent any value needed. For example:

1. In the CAPS Document the graphs are represented as follows:
   $y = ksinx$ or $y = kcosx$ or $y = \sin(kx)$ or $y = \cos(kx)$
2. In the 2021 Examination Guidelines the graphs are represented as follows:
   $y = asinx$ or $y = acosx$ or $y = \sin(ax)$ or $y = \cos(ax)$

iv. – vi.) Interpretation of graphs must be constantly incorporated in graph revision worksheets and again emphasis must be placed on notation and wording.

- i.e.: $2g(x)$ means to multiply the whole graph by two and this will then influence the amplitude of the graph.
- i.e.: $g(2x)$ means that the period of the graph is being changed, so hence the new period for this graph will be either $\frac{360°}{2}$, if it is a sine- or cosine-graph, or it will be $\frac{180°}{2}$, if it is a tangent graph.
- $g(x) \pm 1$ means that the graph is being shifted up or down and that again the amplitude will be influenced.
- $g(x \pm 30°)$ means that the graph is being shifted left or right.

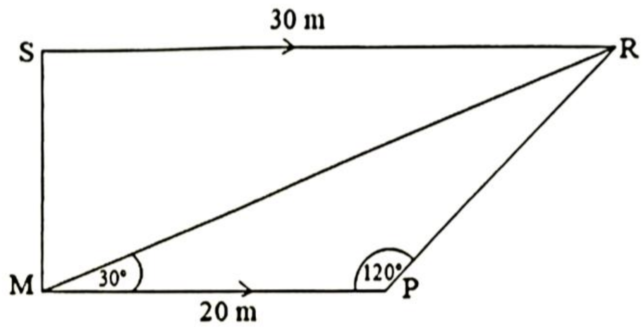
QUESTION 6 [12 Marks]

QUESTION 6

In the diagram below, SRPM is a trapezium with PM = 20 m, SR = 30 m,

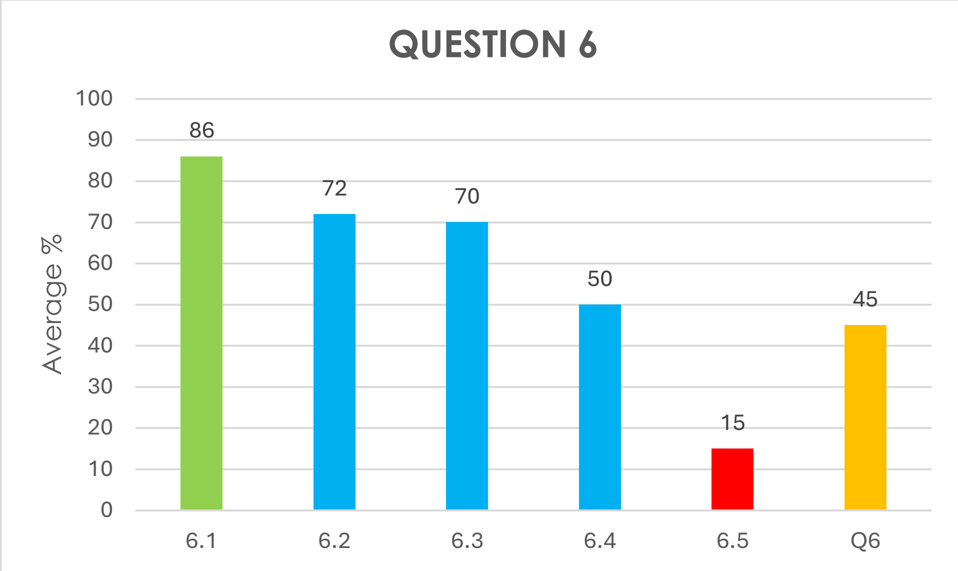
$\hat{P} = 120°$ and $R\hat{M}P = 30°$.

SR || MP



6.1	Write down the size of $M\hat{R}P$.	(1)
6.2	What type of triangle is ΔMRP?	(1)
6.3	Determine the length of MR. (Leave your answer in simplified surd form.)	(3)
6.4	Write down the size of $M\hat{R}S$. Give a reason for your answer.	(2)
6.5	Hence, determine whether ΔMRS is a right-angled triangle.	(5)
		[12]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



- There was a considerable drop in the performance of Question 6. Candidates performed especially bad in sub-question 6.5, this reflects that learners are comfortable applying sine and cosine rules when steps are explicit, but struggle to justify whether a triangle is right-angled or justify geometric relationships using trigonometric reasoning.
- Learners showed moderate performance, but many struggled to choose correct formulae or identify relevant triangles. The question required careful diagram interpretation, which learners lacked.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

i.) Candidates struggled to choose the correct formula. They mixed up the formulae and used cosine-rule when they were supposed to use sine-rule or vice versa or they even tried to use the basic trig ratios.

ii.) Candidates also struggled to choose the correct angles and lengths to substitute into the formula.

iii.) Candidates struggled immensely with sub-question 6.5, where they had to prove that the triangle was a right-angled triangle. Candidates did not understand that they could not assume that the triangle is already right-angled and that they had to prove it.

(c) Provide suggestions for improvement in relation to Teaching and Learning. **(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**
Educators should focus on the following during their contact time with candidates:

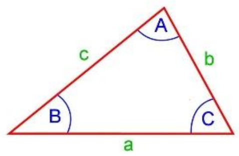
i.) Candidates must be taught how to decide which formula (cosine or sine rule) to select.

a. Conditions for the use of the Sine Rule:
   1. Two sides and a non-inclusive angle
   2. Two angles and one side

b. Conditions for the use of the Cosine Rule:
   1. Two sides and an inclusive angle
   2. Three sides

c. Condition for the use of the Area Rule:
   1. Two sides and an inclusive angle

ii.) Candidates must be taught which angle goes with which side in a specific triangle.



In ΔABC:

$$\frac{\sin\hat{A}}{a} = \frac{\sin\hat{B}}{b} = \frac{\sin\hat{C}}{c}$$

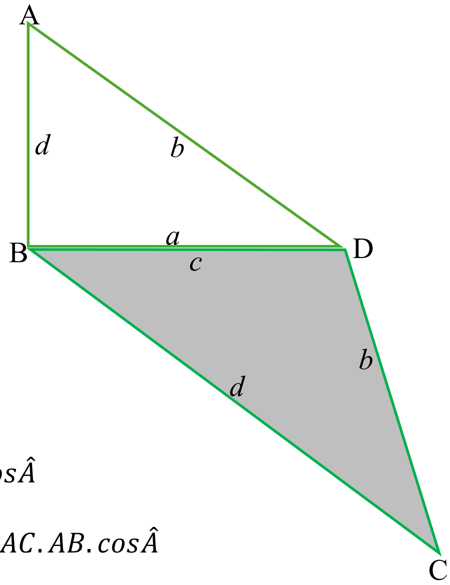
OR

$$\frac{\sin\hat{A}}{BC} = \frac{\sin\hat{B}}{AC} = \frac{\sin\hat{C}}{AB}$$

$$a^2 = b^2 + c^2 - 2bc.\cos\hat{A}$$

OR

$$BC^2 = AC^2 + AB^2 - 2AC.AB.\cos\hat{A}$$



In ΔABD:

$$\frac{\sin\hat{A}}{a} = \frac{\sin\hat{B}}{b} = \frac{\sin\hat{D}}{d}$$

OR

$$\frac{\sin\hat{A}}{BD} = \frac{\sin\hat{B}}{AD} = \frac{\sin\hat{D}}{AB}$$

$$a^2 = b^2 + d^2 - 2bc.\cos\hat{A}$$

OR

$$BD^2 = AB^2 + AD^2 - 2AB.AD.\cos\hat{A}$$

In ΔBCD:

$$\frac{\sin\hat{B}}{b} = \frac{\sin\hat{C}}{c} = \frac{\sin\hat{D}}{d}$$

OR

$$\frac{\sin\hat{B}}{CD} = \frac{\sin\hat{C}}{BD} = \frac{\sin\hat{D}}{BC}$$

$$b^2 = c^2 + d^2 - 2cd.\cos\hat{B}$$

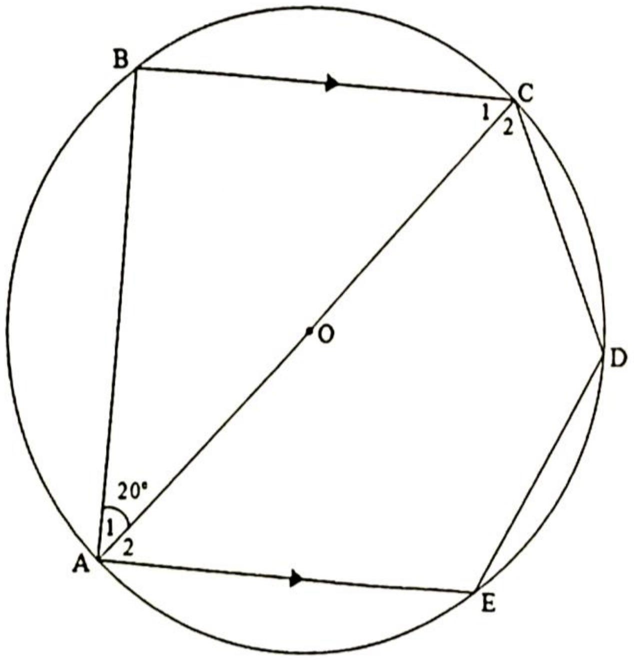
OR

$$DC^2 = BD^2 + BC^2 - 2BD.BC.\cos\hat{B}$$

QUESTION 7 [8 Marks]

QUESTION 7

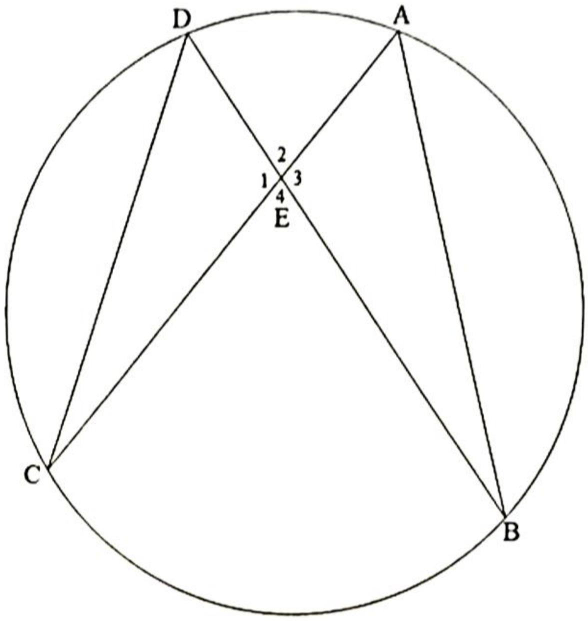
7.1 Below is drawn a circle with centre O.
A, B, C, D and E are on the circle.
CA is a diameter.
AB, CD and DE are drawn.
BC ∥ AE
$\hat{A}_1 = 20°$



7.1.1 Give a reason why $\hat{B} = 90°$. (1)

7.1.2 Determine, with reasons, the size of $\hat{D}$. (3)

7.2 In the diagram below, A, B, C and D are four points on the circumference of the circle.
Chords BD and AC intersect at point E.
Chords DC and AB are drawn.



7.2.1 Complete the statement of the following theorem:

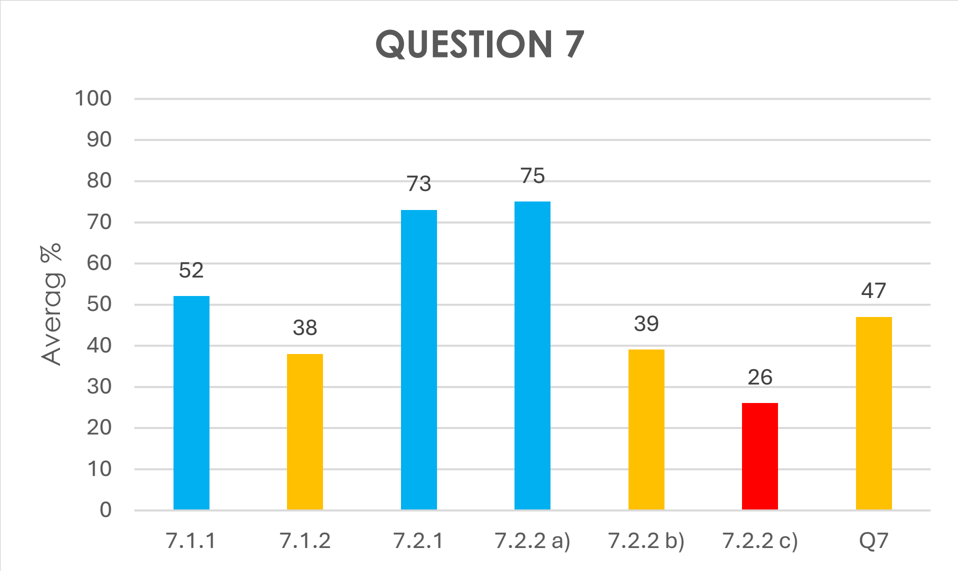
Angles subtended by a chord of a circle, on the same side of the chord, are ... (1)

7.2.2 Write reasons for the statements given below:

STATEMENT	REASON
(a) $C\hat{D}B = C\hat{A}B$	...
(b) $\hat{E}_1 = \hat{E}_3$	...
(c) $\Delta DEC \,|||\, \Delta AEB$	...

(1)
(1)
(1)
[8]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



- Attempts were better than 2024, but reasoning remains weak, indicating severe conceptual gaps.
- These results show persistent weaknesses in recognising circle theorems, providing valid geometric reasons, and interpreting multi-theorem diagrams.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

i.) Candidates struggle to provide reasons for certain calculations or as to why certain calculations can be done, to prove angles or to prove if quadrilaterals are cyclic quadrilaterals.

ii.) Overall, candidates struggle to provide reasons for their geometrical calculations.

iii.) Candidates are struggling to interpret the diagrams given and to properly utilise the answer book and the diagrams there in to help them make conclusions and calculate angles correctly.

(c) Provide suggestions for improvement in relation to Teaching and Learning. **(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**
Educators should focus on the following during their contact time with candidates: i.) Emphasis must be placed on completing a theorem statement – these questions are classified as level 1 questions – use the proper reasons as provided by the Examination Guidelines. Knowing your theorems are the first path to success to Euclidean Geometry and identifying the applicable theorem in a diagram. ii.) When the question requires to determine the size of an angle, it means there must be value attach to the angle. iii.) Assumptions cannot be made if they cannot be substantiated or proved. iv.) Teach candidates to "break-up" the diagram – in other words look for certain identifying diagrams that relate to the individual theorems – this means ample exercises for the eyes to get used to.

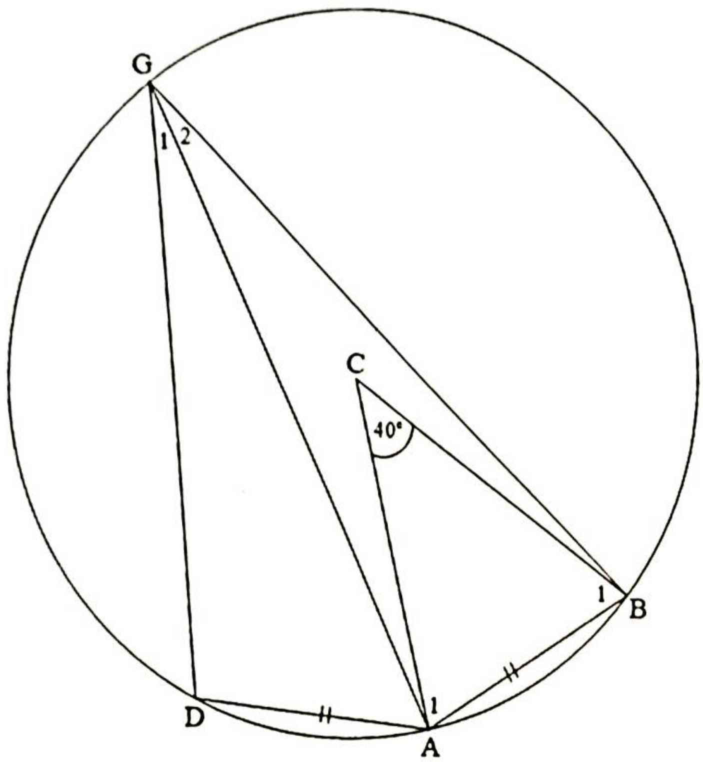
QUESTION 8 [22 Marks]

QUESTION 8

8.1 In the diagram below, G, B, A and D are points on a circle with centre C. GD, GA and GB are drawn.

AB = AD

$A\hat{C}B = 40°$



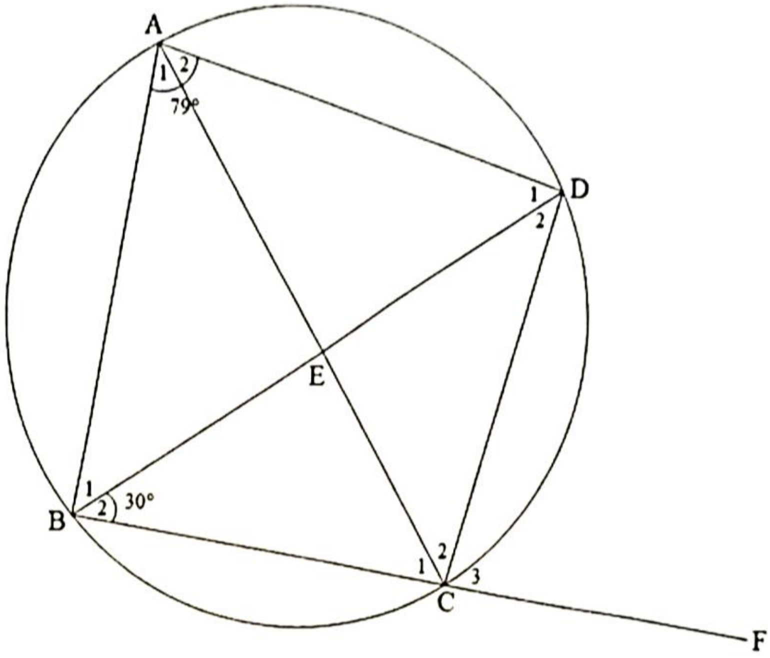
8.1.1	Write down TWO angles that will be equal if AB = AD.	(1)
8.1.2	Determine, with a reason, the size of $\hat{G}_2$.	(2)
8.1.3	Give a reason why $\hat{A}_1 = \hat{B}_1$.	(1)
8.1.4	Determine, with a reason, the size of $\hat{A}_1$.	(2)
8.1.5	Determine, with a reason, the size of $D\hat{A}C$.	(3)

8.2 Complete the statement of the following theorem by filling in the missing information:

The (8.2.1) … angle of a cyclic quadrilateral is equal to the (8.2.2) … opposite angle. **(2)**

8.3 In the diagram below, A, B, C and D lie on the circumference of the circle.
E is the point of intersection of chords BD and AC.
Chord BC is produced to F.

$B\hat{A}D = 79°$ and $\hat{B}_2 = 30°$



8.3.1 Determine, with reasons, the size of the following angles:

(a) $\hat{C}_3$ **(2)**

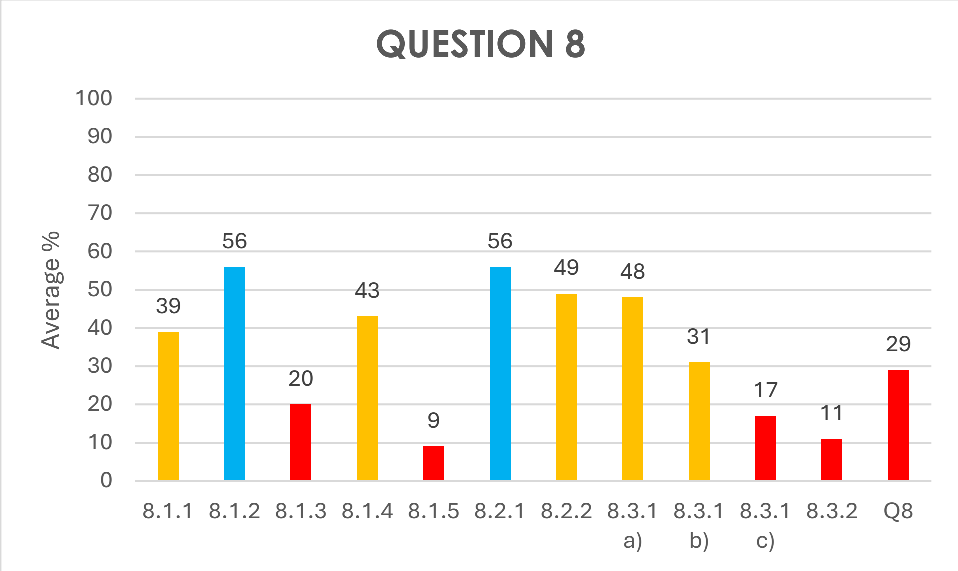
(b) $\hat{D}_2$ **(2)**

(c) $\hat{D}_1$ if it is given that $AB \parallel CD$ **(3)**

8.3.2 Show that $CE = DE$ **(4)**

[22]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



- Performance was very weak. Learners struggled with angle naming, theorem recall, and multi-step reasoning.
- Learners struggled with identifying properties of cyclic quadrilaterals, applying exterior angle theorems, and recognising equal chords/angles relationships.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

i.) Candidates are leaving out reasons for angles calculated or giving incorrect reasons that are not acceptable. This is specific to the Circle Geometry done in Grade 11.

ii.) Candidates are not using correct notation when naming angles. i.e.:

a. When needing to state $\hat{M}_1 = \hat{M}_2$ they simply say $M = M$;

b. Instead of $P\hat{S}T$ or $\hat{S}_1 + \hat{S}_2$ they just refer to it as $\hat{S}$ or;

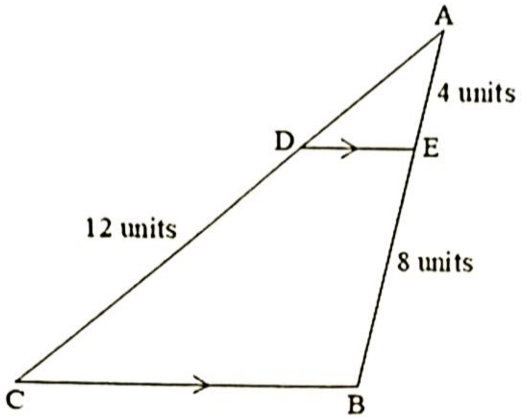
c. They refer to the whole angle when they are giving an answer to part of the angle.

(c) Provide suggestions for improvement in relation to Teaching and Learning. **(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**
Educators should focus on the following during their contact time with candidates: i.) Educators must ensure that candidates only make use of the acceptable reasons as they are stated in the Examination Guidelines for Technical Mathematics of 2021. Perhaps the acceptable reasons can be copied for candidates so that they can paste it in their workbooks and use it while doing classwork, homework or studying for tests/exams. ii.) Candidates must be taught how to name angles in a triangle and they need to be reminded that they need to be specific when it comes to the naming as there might be more than one angle in a triangle that can be linked to a certain letter. iii.) Emphasis must be placed on completing a theorem statement – these questions are classified as level 1 questions – use the proper reasons as provided by the Examination Guidelines. Knowing your theorems are the first path to success to Euclidean Geometry and identifying the applicable theorem in a diagram. iv.) When the question requires to determine the size of an angle, it means there must be value attach to the angle. v.) Assumptions cannot be made if they cannot be substantiated or proved. vi.) Teach candidates to "break-up" the diagram – in other words look for certain identifying diagrams that relate to the individual theorems – this means ample exercises for the eyes to get used to. vii.) Euclidean Geometry can only be mastered if it is practiced continuously. Candidates must be taught how to transfer given information onto the diagram to assist them in answering given questions. viii.) Diagrams should be analysed to assist in finding answers, in other words first try to look which theorems can possibly be used in order to find the answers to the questions being asked.

QUESTION 9 [8 Marks]

QUESTION 9

9.1 ΔABC with $BC \parallel DE$ is drawn below.
AE = 4 units
BE = 8 units
CD = 12 units



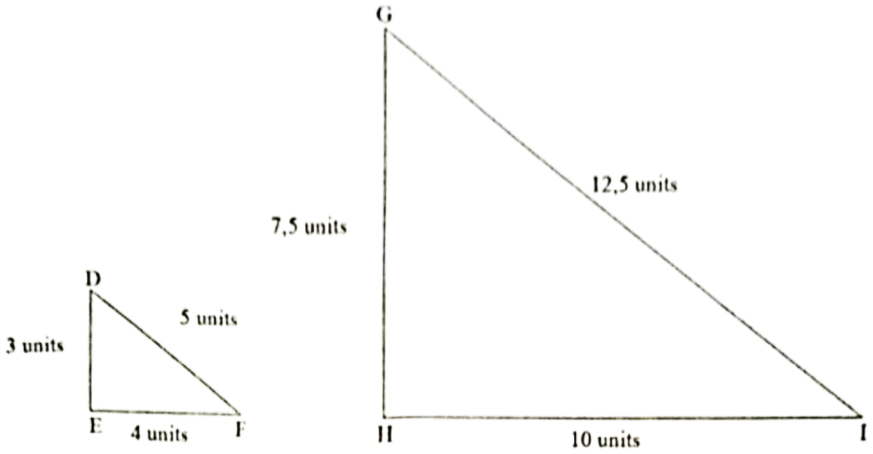
9.1.1 Complete the following statement and reason:

STATEMENT	REASON
$\frac{AD}{CD} = \frac{AE}{...}$	Prop. theorem ; ... ∥ ...

(2)

9.1.2 Hence, or otherwise, determine the length of AD. (2)

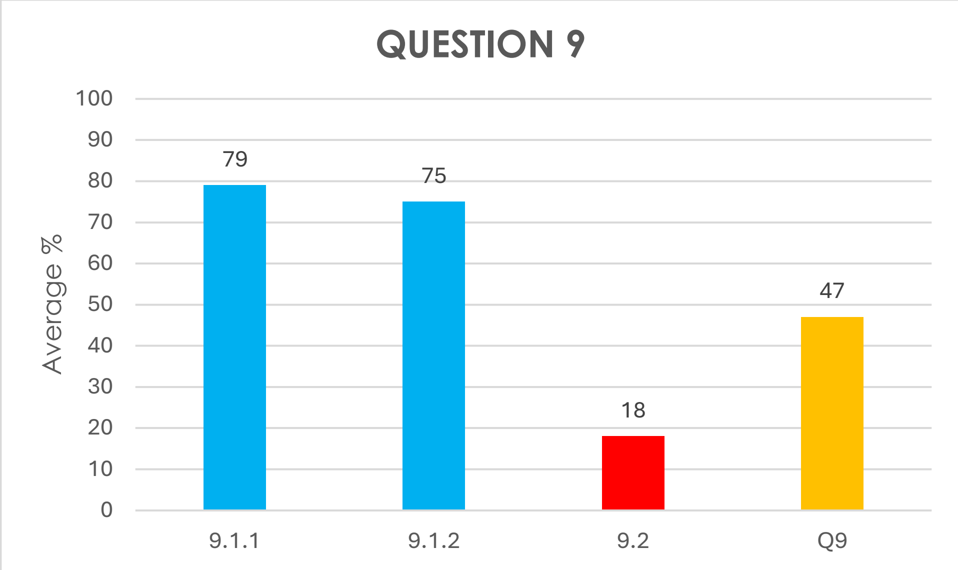
9.2 Given: ΔDEF with EF = 4 units, DE = 3 units and DF = 5 units,
ΔGHI with HI = 10 units, GH = 7,5 units and GI = 12,5 units



Prove that $\Delta DEF \parallel\!\mid \Delta GHI$. (4)

[8]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



- Moderate performance; many learners showed partial understanding.
- Many could not form ratios correctly, thus not proving the similarity, which required multiple step justification, this reveals a long-term deficiency in earlier grades' geometry foundations.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

i.) Candidates struggled to give correct answers for Question 9 and did not quite understand the trend of the question. The candidates who managed to give the correct proportions and get the correct answer lost a mark as they did not give the complete reason.

ii.) Candidates are having a hard time giving the correct ratios when it comes to proportionality and are also not substituting the correct values into the ratio to find the answer to the questions that were asked.

iii.) Candidates are not going back to work done in previous grades when they revise for their Grade 12 examinations, for example something basic like Pythagoras, congruency, similarity, etc.

(c) Provide suggestions for improvement in relation to Teaching and Learning.

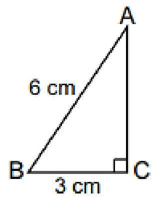
(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

Educators should focus on the following during their contact time with candidates:

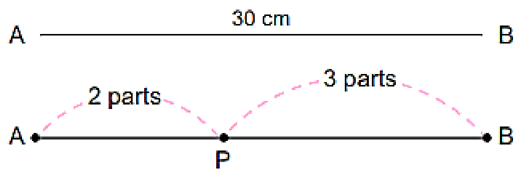
i.) Educators must ensure that candidates only make use of the acceptable reasons as they are stated in the Examination Guidelines for Technical Mathematics of 2021. Perhaps the acceptable reasons can be copied for candidates so that they can paste it in their workbooks and use it while doing classwork, homework or studying for tests/exams.

ii.) Proportionality Theorem:

- The proportionality theorem should be done in as many ways as possible to show candidates all the possible combinations of how sides can be written in proportion (ratios).
- Educators could try to explain the proportionality theorem in the following manner:
  - Start by explaining what a ratio is.
    - Ratios are used to compare two quantities of the same unit (kind).
  - Form basic ratios using shapes.
    - The ratio of $BC : AB = 3 : 6 = 1 : 2$
    - Ratios can also be written as fractions: $\frac{BC}{AB} = \frac{3}{6} = \frac{1}{2}$



  - Then move on to show that a straight line can be divided into ratios.



    - Let $AP = 2k$ and $PB = 3k$, then $AB = 5k$
      $\therefore 5k = 30\ cm$
      $\therefore k = 6\ cm$
    - The length of $AP = 12\ cm$ and $PB = 18\ cm$
    - So therefore the ratio of $AP : PB = 12 : 18 = 2 : 3$
    - NOTE: $\frac{AP}{PB} = \frac{2}{3}$, so therefore $AP = \frac{2}{3}PB$
      BUT $\frac{AP}{AB} = \frac{2}{5}$, so therefore $AP = \frac{2}{5}AB$
  - This can now lead to the proportionality theorem because when two

ratios are equal, e.g.: $\frac{AP}{PB} = \frac{AQ}{QC}$, we can say that AP, PB, AQ and QC are in proportion or that AP and PB are in proportion with AQ and QC.

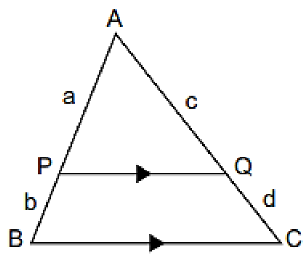
- Hence, the proportionality theorem states that if a line, PQ, is drawn parallel to one side of a triangle, ABC, it divides the other two sides proportionally.
    - So if $PQ \parallel BC$, then $\frac{AP}{PB} = \frac{AQ}{QC}$
    - These proportions can be written in many ways:

$\frac{AP}{PB} = \frac{AQ}{QC} \rightarrow \frac{PB}{AP} = \frac{QC}{AQ}$ OR

$\frac{AP}{AB} = \frac{AQ}{AC} \rightarrow \frac{AB}{AP} = \frac{AC}{AQ}$ OR

$\frac{PB}{AB} = \frac{QC}{AC} \rightarrow \frac{AB}{PB} = \frac{AC}{QC}$ OR

$\frac{AP}{AQ} = \frac{PB}{QC}$ OR $AP.QC = PB.AQ$



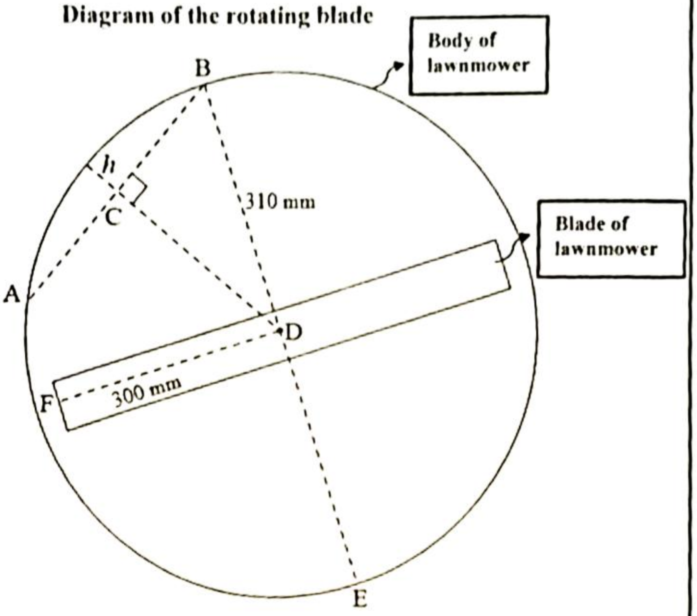
iii.) Emphasis must be placed on completing a theorem statement – these questions are classified as level 1 questions – use the proper reasons as provided by the Examination Guidelines. Knowing your theorems are the first path to success to Euclidean Geometry and identifying the applicable theorem in a diagram.

QUESTION 10 [20 Marks]

QUESTION 10

10.1 The diagram below models the rotating blade of a lawnmower, as shown in the picture alongside it.

- The circular body of the lawnmower has a radius BD = 310 mm.
- The length of the rotating blade from the centre of the circular body, D, to its edge, F, is 300 mm.
- The blade rotates at an angular velocity of 377 radians per second.

Picture of a rotating blade	Diagram of the rotating blade
	

Determine:

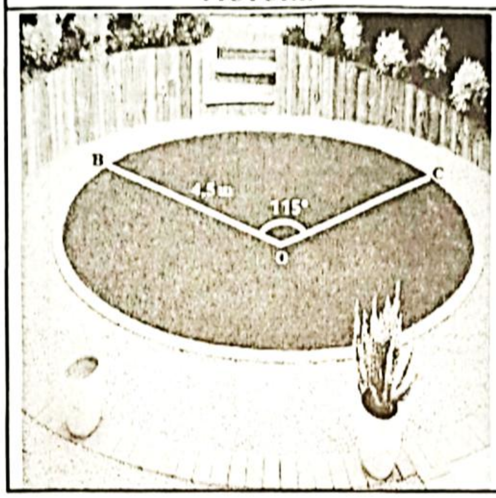
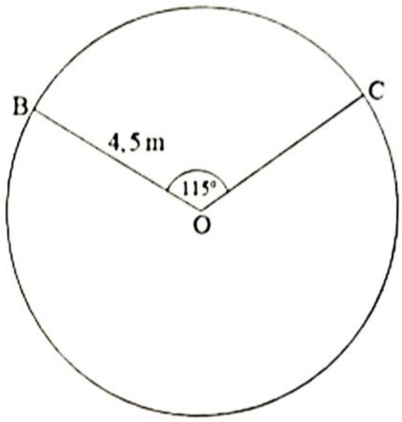
10.1.1 The rotational frequency of the blade, in revolutions per second (3)

10.1.2 The circumferential velocity of the rotating blade in millimetres per second (3)

10.1.3 The height (h) of the minor segment of chord AB if CD $\perp$ AB and AB = 130 mm (5)

10.2 The picture and the diagram below show a sector in a circular garden with a radius of 4,5 m.

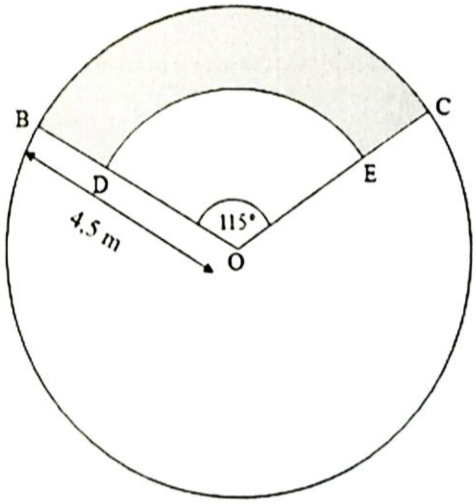
The size of obtuse angle $B\hat{O}C = 115°$

PICTURE	DIAGRAM
	

10.2.1 Convert 115° to radians. **(1)**

10.2.2 Determine the area of minor sector BOC. **(3)**

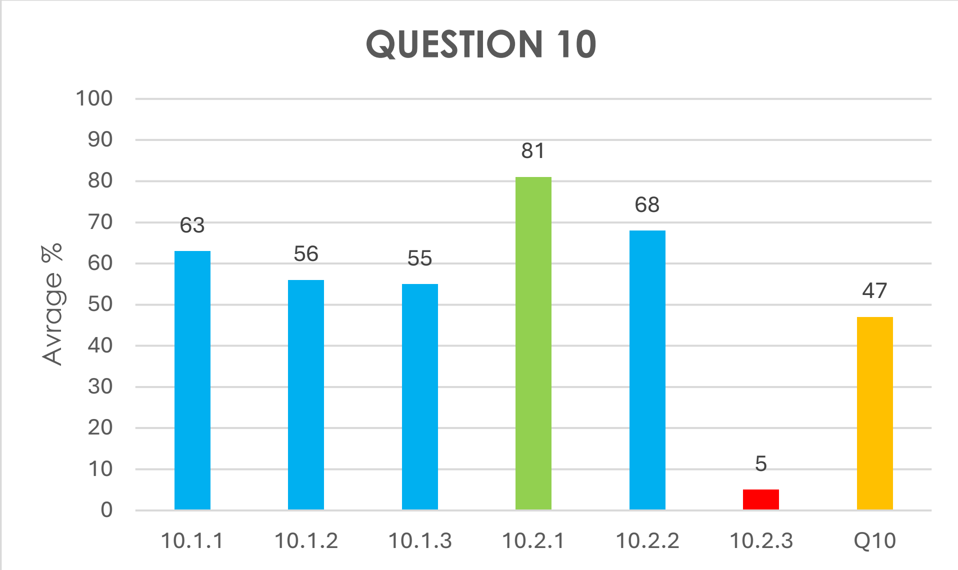
10.2.3 The gardener has to plant flower seedlings in the shaded area BDEC, as shown in the diagram below.
The ratio of BD : DO = 2 : 3.



Determine the number of seedlings needed to be planted in the shaded area if 4 seedlings are planted per square metre. **(5)**

[20]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



- Fair performance overall; learners handled calculations better than geometry.
- Learners struggled with radian measure and sector/segment geometry.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

i.) Many candidates substituted the angle into the formula in degrees instead of radians and then did not convert so that the final answer is in radians/per minute.

ii.) Conversion between units still possess a problem for candidates as they could not do the basic conversions necessary for the questions.

iii.) Formulae were copied incorrectly form the information sheet or if they were copied correctly then they would leave some parameters out as they continue with the question.

iv.) Candidates substituted incorrect values into the formulae, i.e.: instead of substituting the diameter, they substitute the radius into the circumferential velocity formula or height of the segment formula.

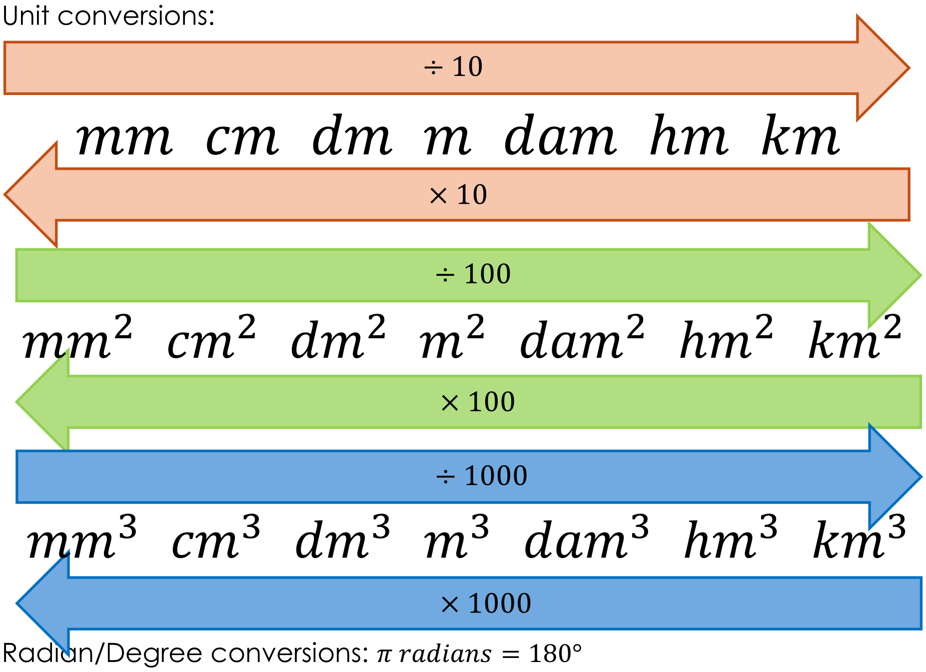
(c) Provide suggestions for improvement in relation to Teaching and Learning.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

Educators should focus on the following during their contact time with candidates:

i.) Basic conversions between different units (mm, cm, m, etc.); from Degrees to Radians or from Radians to Degrees, must be practiced in class to ensure candidates know these level 1 questions. Candidates cannot afford to lose marks because basic conversions cannot be done.

a. Unit conversions:



b. Radian/Degree conversions: $\pi\ radians = 180°$

- To convert, the easiest way to remember the conversion, is to use what you want as the answer (Degrees or Radians), as the numerator in your conversion fraction:

  i. i.e.: To convert from radians to degrees: $radians \times \frac{180°}{\pi}$

  ii. i.e.: To convert from degrees to radians: $degrees \times \frac{\pi}{180°}$

ii.) When using the formulae $s = r\theta$ and $Area = \frac{rs}{2} = \frac{r^2\theta}{2}$,the information sheet clearly states that the angle (θ) must be in RADIANS. Educators should emphasise this to candidates as to many loose a mark as the final answer is then not in the correct unit. All measurements must be in the same units – candidates must select a formula and not to use both.

iii.) Emphasis must be placed on formulae for circumferential and angular velocity. Candidates are using the incorrect formula in questions. Each unknown in the formula must be explained, so that candidates substitute the correct information into the formula to find the correct answer.

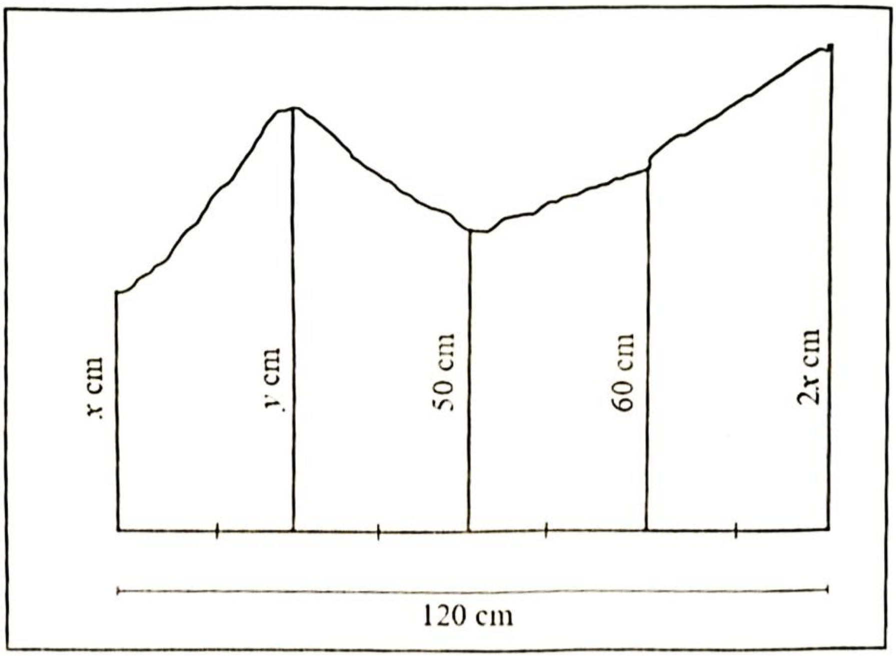
iv.)	Problem solving questions in the context of Circles, Angles and Angular Movement should be done in class as part of the class work and not only focussed on during test or exam times. Incorporating these questions into classwork will help candidates become more comfortable with the questions and more of them will then attempt the questions in exams.

QUESTION 11 [17 Marks]

QUESTION 11

11.1 The diagram below shows an irregular shape with one straight side of length 120 cm, divided into 4 equal parts.

- The ordinates dividing these parts are x cm, y cm, 50 cm, 60 cm and $2x$ cm respectively.



11.1.1 Write down the length of each equal part. (1)

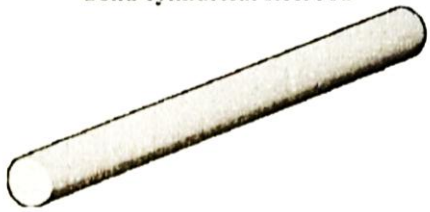
11.1.2 Write down the value of y, the 2nd ordinate, if it is 20 cm longer than the middle ordinate. (1)

11.1.3 Use the mid-ordinate rule to determine the value of x if the area of the irregular shape is 7 200 cm^2. (4)

11.2 A company melts cylindrical steel rods to manufacture solid steel ball bearings, as shown in the picture below. The diagram below each picture gives the dimensions of each shape.

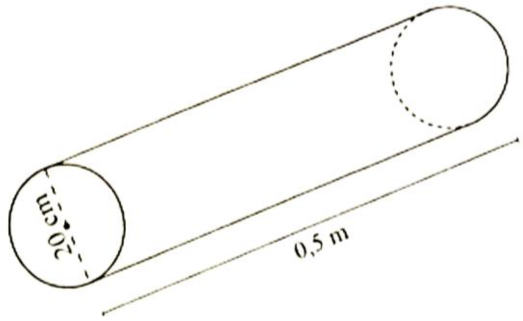
- The cylindrical steel rod has a diameter of 20 cm and a height of 0,5 m.
- The steel ball bearing has a diameter of 40 mm.

Solid cylindrical steel rod

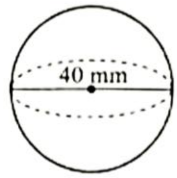


Solid steel ball bearing

Dimensions of solid cylindrical steel rod



Dimensions of steel ball bearing



The following formulae may be used:

Total surface area of cylinder $= 2\pi r^2 + 2\pi rh$ **Volume of cylinder** $= \pi r^2 h$

Total surface area of sphere $= 4\pi r^2$ **Volume of sphere** $= \frac{4}{3}\pi r^3$

11.2.1 Convert 0,5 m to centimetres. **(1)**

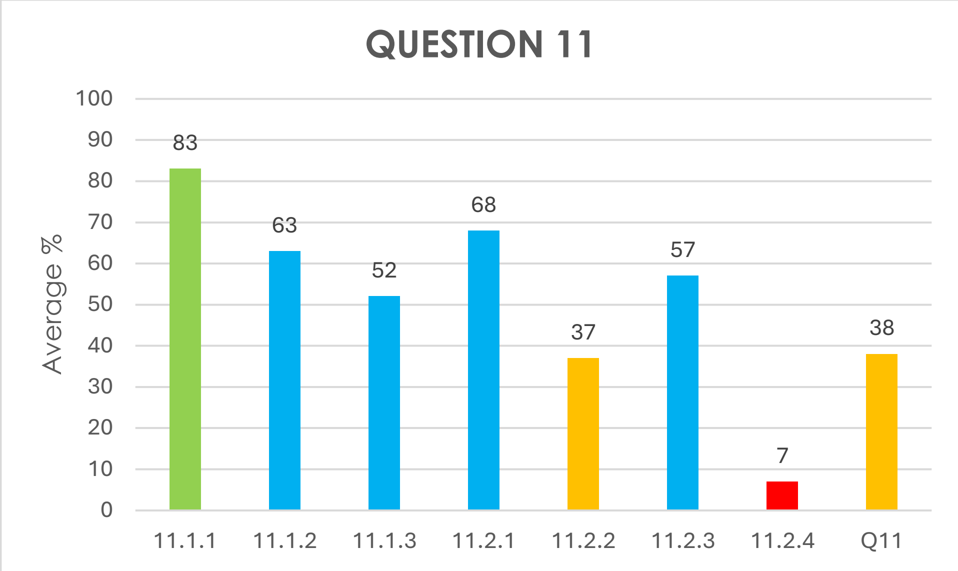
11.2.2 Calculate the length of the radius of the steel ball bearing in centimetres. **(2)**

11.2.3 Determine the total surface area of the cylindrical steel rod in cm^2. **(2)**

11.2.4 Determine whether more than 400 steel ball bearings can be manufactured from one melted cylindrical rod if there is 18% loss of steel during the melting process. **(6)**

[17]

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?



- Moderately poor performance; learners struggled with interpreting the question.
- Applying the mid-ordinate rule proved challenging.
- Weak understanding of numerical approximation methods and unit conversions.
- Question 11.2 showed misunderstanding of volume/surface relationships.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

i.) Candidates are copying formulae incorrectly from the information sheet that is provided or if they were copied correctly then they would leave some parameters out as they continue with the question.

ii.) When substituting the width of the equal parts learners use the number of equal parts instead of the width or they make use of the total length or any other random value.

a. i.e.: 120 or 7200 or 70 is substituted instead of 30.

iii.) Many candidates were not able to answer question 11.2.4. Candidates that did attempt the question, seem to not have understood what was being asked of them.

(c) Provide suggestions for improvement in relation to Teaching and Learning. **(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**
Educators should focus on the following during their contact time with candidates: i.) Educators have to EMPHASISE the importance of copying formulae correctly from the information sheet. Also emphasise that formulae must not be changed unless necessary. ii.) The application of the mid-ordinate rule must be done in all forms so that candidates get used to not only calculating the area itself, but they must be able to calculate any value that is given as an unknown – these are easy marks to get. iii.) Expose candidates to more practical modelling problems, as in sub-question 11.2.4. iv.) Educators must have ample time to revisit this topic in grade 12 not only when learners are about to write the June Exams or Trial Exams.

OVERALL COMMENT
• The overall performance of the 2025 cohort was poorer than the cohort of 2024. Level 6 and 7 learners were still present in the cohort of 2025, but it is less than in 2024. There were however candidates who received ZERO for the question paper. • It is disheartening to see that there are candidates achieving single digit totals in the question paper. • When using formulae, candidates must make sure the units are the same and that they correctly copy the formulae form the information sheet. • In most cases for Technical Mathematics the angles are in radians, especially in the topic Circles, Angles and Angular Movement as provided and mentioned on the information sheet. This must be emphasized so that candidates do not loose marks unnecessarily. • Understanding all the formulae on the formula sheet will be a big advantage to the candidates, so that they are able to identify the correct formulae to use in the questions. 6 Marks in this question paper was dedicated to simply choosing the correct formula from the information sheet, yet candidates could not do this and scored 0, where the minimum mark any candidate should have gotten was 6. • 14 Marks were dedicated to substitution into the correct formulae, yet candidates were not able to substitute the correct values and lost these basic, yet crucial marks. • Educators must focus on practicing level 1 and 2 questions with their candidates as many could not even score marks in these questions. • Grade 11 work must also be thoroughly revised with candidates to ensure all marks asked on Grade 11 work can be scored. The Grade 12 curriculum for Technical Mathematics is structured in such a way that revision of previous grades work is definitely possible. • All questions must always be attempted by candidates as consistent accuracy marking ensures that marks can be given to candidate answers even if previous answers were completely wrong or incorrect. • No adjustments are required for this question paper, as the question paper was fair and on standard according to the CAPS document and Examination Guidelines.