



THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA



CANDIDATES' ITEM RESPONSE ANALYSIS
REPORT ON THE CERTIFICATE OF
SECONDARY EDUCATION EXAMINATION
(CSEE) 2025

BASIC MATHEMATICS



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041 BASIC MATHEMATICS

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FOREWORD

This report presents the Candidates' Item Response Analysis (CIRA) on the 2025 Certificate of Secondary Education Examination (CSEE) in Basic Mathematics. The report is intended to provide feedback to education stakeholders on candidates' performance and the challenges faced by the candidates in answering the questions.

The analysis of candidates' responses identifies areas of strength and weakness and classifies examination questions into three performance levels; namely, *Good*, *Average*, and *Weak*. Selected samples of candidates' responses are used to illustrate observed competences and misconceptions.

The findings indicate that 26.45 percent of the candidates passed. The overall performance was weak, mainly caused by inability to use correct mathematical formulae, weak problem-solving skills in word-based questions, inadequate computational proficiency, challenges in translating information from words and figures into mathematical expressions, and difficulty in applying mathematical concepts to real-life situations.

The Council acknowledges the contribution of all individuals involved in the preparation of this report and anticipates that its findings will contribute to the improvement of teaching, learning, and assessment practices in Basic Mathematics.



Prof. Said Ally Mohamed
EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report presents an analysis of candidates' performance in Basic Mathematics in the Certificate of Secondary Education Examination (CSEE) conducted in 2025. The report integrates both statistical and descriptive analyses of candidates' performance, with the aim of identifying factors that contributed to observed levels of performance, including areas of success and challenges encountered by the candidates.

The Basic Mathematics examination paper consisted of two sections, A and B. Section A comprised ten questions, each carrying six (06) marks, while Section B comprised four questions, each carrying ten (10) marks. Candidates were required to answer all questions in both sections.

The analysis indicates that, a total of 555,405 candidates sat for the Basic Mathematics examination in CSEE 2025, of whom 146,622 candidates, equivalent to 26.45 percent, passed. Comparatively, in CSEE 2024, a total of 517,245 candidates sat for the examination, and among them 134,094 candidates, representing 25.35 percent, passed. This reflects an increase of 1.10 percent in candidates' performance. Despite this improvement in performance, the findings demonstrate that candidates continue to experience challenges in mastering mathematical concepts. These challenges include; inability to recall and apply appropriate formulae, rules, and theorems; difficulties in formulating, simplifying, and solving mathematical expressions and equations; and limited skills in interpreting word problems, figures and diagrams. In addition, the majority of candidates had insufficient procedural knowledge and inadequate computational skills.

The candidates' performance on each question is categorized as *Good* (65–100%) denoted by green colour, *Average* (30–64%) yellow, or *Weak* (0–29%) denoted by red, based on the percentage of candidates who passed. The report provides a detailed analysis of candidates' responses to each question, highlighting strengths and weaknesses, and proposing recommendations aimed at improving performance in Basic Mathematics in future examinations.

2.0 ANALYSIS OF CANDIDATES' PERFORMANCE ON EACH QUESTION

This section presents a detailed analysis of candidates' performance in the Basic Mathematics examination on a question-by-question basis. The analysis focuses on the specific demands of each question, candidates' responses, and the factors that contributed to their success or failure.

Candidates' performance is classified into three levels; namely, *Good*, *Average*, and *Weak* performance based on the scoring ranges established in each section. In Section A, scores ranging from 4.0 to 6.0 marks indicate a good performance, 2.0 to 3.5 marks reflect an average performance, while scores from 0.0 to 1.5 marks represent a weak performance. In Section B, a good performance is represented by scores ranging from 6.5 to 10.0 marks, an average performance is illustrated by scores from 3.0 to 6.0 marks, and a weak performance is indicated by scores ranging from 0.0 to 2.5 marks.

Graphical representations are included to illustrate trends in candidates' performance on each question. The analysis further examines the competences that candidates were expected to demonstrate when responding to each question. Emphasis is placed on identifying weaknesses and areas of strength. To support the analysis, extracts from both correct and incorrect candidates' responses are provided to highlight typical strengths and weaknesses observed.

2.1 Question 1: Approximations, Fractions, Decimals and Percentages

This question had three parts, (a), (b) and (c). In part (a), the candidates were required to express $0.\overset{\square\square}{11}36$ in a simple fraction. In part (b), they were required to round off 0.00070482 to 3 significant figures and 1233388 to the nearest ten thousands. In part (c), the candidates were given a word problem which stated that "Three fifths of the pupils in a certain school come from the city centre. What is the percentage of pupils who do not come from the city centre?"

The data analysis shows that 159,920 (28.79%) candidates passed, out of whom 77,114 (13.88%) candidates scored 4.0 to 6.0 marks. This indicates that the candidates' performance on this question was weak. Figure 1 summarizes the candidates' performance on this question.

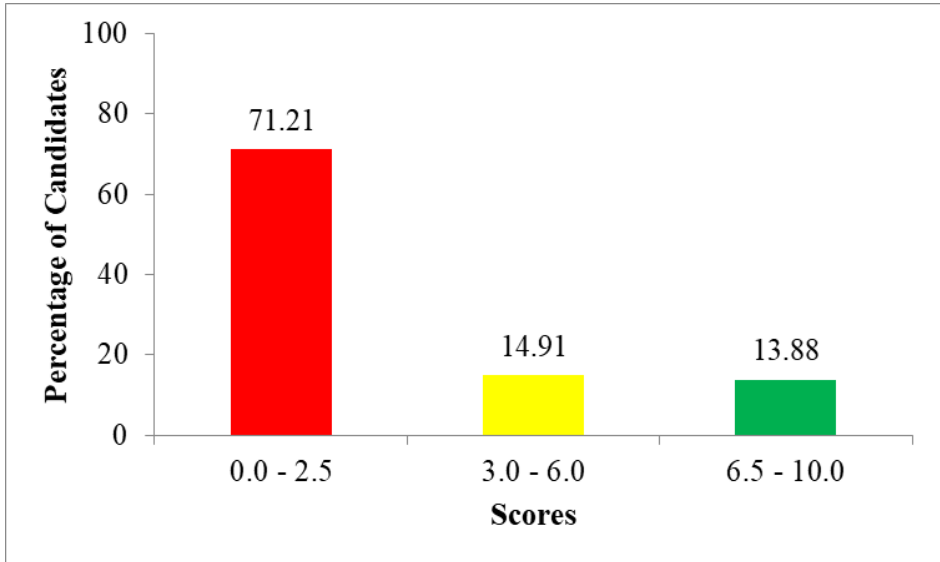


Figure 1: *Candidates' performance on question 1*

The analysis of responses reveals that, 54.10 percent of the candidates failed to answer this question correctly as a result, they scored 0. The candidates lacked knowledge on the concepts of fractions and decimals as well as approximations. In part (a), the candidates failed to separate non-repeating digits from repeating digits. They multiplied both sides of the equation $x = 0.1136$ by 1000 and obtained $1000x = 113.6$ instead of multiplying by 10000 to get $10000x = 1136.36$. In addition, some candidates subtracted $x = 0.1136$ from $100x = 11.36$ that led to an incorrect answer. Furthermore, some candidate ignored the repeated digits and wrote 0.1136 into fraction as $\frac{1136}{10000}$ which was incorrect. Further analysis shows that, some candidates incorrectly wrote the fraction as $\frac{36}{100}$. In part (b)(i), the candidates failed to recognize that the zeros between the digits after the decimal point are significant figures.

For instance, they approximated wrongly $0.00070482 \approx 0.0007048$ instead of $0.00070482 \approx 0.000705$ correct to 3 significant figures. Further analysis shows that, some candidates rounded off 0.00070482 to either 0.000704, 70.48 or 0.0007 wrongly as 3 significant figures, which are all incorrect answers. In part (b)(ii), they failed to identify the place value of ten thousands that was to be rounded off. For example, they rounded off 1,233,388 as 1,233,000, 1,200,000 and 1,233,400 which are incorrect. In part (c), the candidates incorrectly interpreted “three fifths” as the fraction of pupils who do not come from the city centre. They further computed $\frac{3}{5} \times 100\%$ to obtain 60% as percentage of pupils who do not come from the city centre. Besides, some candidates interpreted “three fifths” as 350, or 35. These responses were wrong and highlight a lack of knowledge on the examined concepts. Extract 1.1 shows a sample of responses from a candidate who answered this question incorrectly.

01.	a) Simple fraction	
	0.1136	
	= 0.114 Simple fraction.	
	b) 0.00070482 to 3 significant figures.	
	<u>solution</u>	
	0.00070482	
	<u>3 significant 0.001</u>	
	ii) 1233.388 to the nearest ten thousand.	
	<u>solution.</u>	
	1233.388	
	ten thousand	
	1233000	
	c) 53%	
	$\frac{53 \times 100}{10}$	$\frac{5300}{10}$
	The pupils does not come from the city Centre = 530%.	

Extract 1.1: A sample of incorrect responses to question 1

Extract 1.1 shows that, in part (a), the candidate failed to convert 0.1136 into a simple fraction. He/she rounded off the given decimal to the nearest thousandths. In part (b)(i), the candidate considered the two zeros after the decimal point as significant figures, hence incorrectly rounded off 0.00070482 as 0.001. In part (b)(ii), the candidate considered “three fifths” as 53 instead of $\frac{3}{5}$ which led to incorrect answer.

Despite the weak performance on this question, 4.21 percent of the candidates were able to answer correctly. This indicates that, the candidates had acquired knowledge and skills on the basic concepts of decimals and fractions, approximations as well as percentages. In part (a), the candidates managed to demonstrate mastery of all necessary steps for converting repeating decimals into fractions and vice versa. They were able to separate non-repeating digits from repeating digits by formulating two important equations, $100x = 11.\overline{36}$ and $10000x = 1136.\overline{36}$. Then, they solved for x to get $x = \frac{5}{44}$. In part (b), the candidates correctly applied the procedures of rounding off decimals and whole numbers. They were able to approximate $0.00070482 \approx 0.000705$ correct to 3 significant figures and $1233388 \approx 1230000$ to the nearest ten thousands. In part (c), the candidates correctly calculated the fraction of pupils who do not come from city centre and converted it into percentage to get 40% as required. Extract 1.2 shows a sample of responses from a candidate who answered this question correctly.

1 (a) Given: $0.\dot{1}1\dot{3}6$ into a simple fraction

Let the number be x

$$x = 0.\dot{1}1\dot{3}6$$

$$x = 0.113636\ldots \rightarrow \text{equation (i)}$$

Multiply equation (i) by 100 --- because recurring decimal number are two

$$100(x) = 100(0.113636\ldots)$$

$$100x = 11.3636\ldots \rightarrow \text{equation (ii)}$$

Subtract equation (i) from (ii)

$$100x = 11.3636\ldots$$

$$1x = 0.1136\ldots$$

$$99x = 11.2500$$

Then

$$99x = 11.25$$

$$99 \quad 99$$

$$x = \frac{1125}{9900} \quad \text{--- Simplify by dividing}$$

$$x = \frac{5}{44} \quad \text{225 to both numerator and denominator}$$

$$44$$

where: x was $0.\dot{1}1\dot{3}6$ which is now $\frac{5}{44}$

Therefore, into simple fraction, $0.\dot{1}1\dot{3}6$ is $\frac{5}{44}$

	(b)(i) 0.00070482 to 3.s.f	
	0.00070482	
	↳ 8 is greater than 5	
	∴ 0.00070482 ≈ 0.000705 in 3 significant figure.	
	(ii) 1 233 388 to nearest ten thousand	
	1 233 388	
	↳ 3 is less than 5	
	∴ 1 233 388 ≈ 1 230 000 in nearest ten thousand	
1	c) Let the fraction of pupils not coming from city centre be x	
	but $x + (\text{Fraction of pupils from city centre}) = (\text{One whole})$	
	$x + \frac{3}{5} = 1$	
	$x = 1 - \frac{3}{5}$	
	$x = \frac{5-3}{5}$	
	$x = \frac{2}{5}$	
	Then, percentage of pupils not from city centre = $x \times 100\%$	
	$= \frac{2}{5} \times 100\%$	
	$= \frac{200\%}{5}$	
	$= 40\%$	
	∴ 40% of pupils do not come from the city centre.	

Extract 1.2: A sample of correct responses to question 1

Extract 1.2 shows that the candidate was able to convert the repeating decimals into simple fraction by performing the necessary steps, round off the given numbers correctly as required. Also, he/she was able to find the fraction of candidates who do not come from city centre and managed to change it into percentage.

2.2 Question 2: Exponents, Radicals and Logarithms

This question had three parts, (a), (b) and (c). In part (a), the candidates were required to write the expression $27^n \times 9^{2n} \times 3$ as a single exponent. In part (b), they were required to rationalize the denominator of $\frac{\sqrt{2}+1}{\sqrt{2}-\sqrt{5}}$. In part (c), the candidates were required to find $\log 72$ by using $\log 2 = 0.3010$ and $\log 3 = 0.4771$.

The data analysis reveals that 152,318 (27.43%) candidates passed. Among these, 80,344 (14.47%) candidates scored 4.0 to 6.0 marks. This indicates that the candidates' performance on this question was weak. Figure 2 presents a summary of candidates' performance on this question.

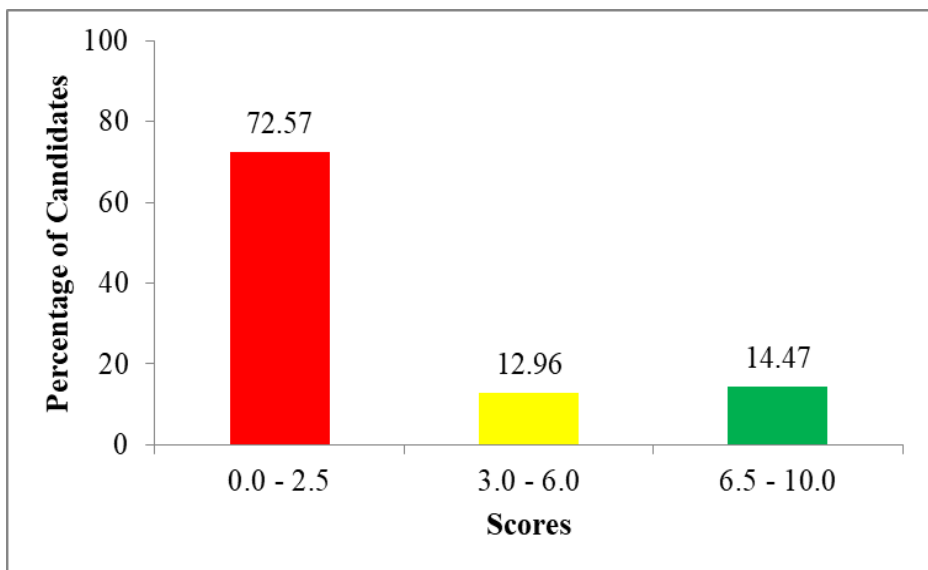


Figure 2: *Candidates' performance on question 2*

Further analysis shows that, 60.25 percent of the candidates performed poorly on this question due to insufficient knowledge and skills in the basic concepts of logarithms, exponents and radicals. In part (a), the candidates failed to express $27^n \times 9^{2n} \times 3$ as an exponent with the same base. In addition, the candidates were unable to apply the product law of exponents to write $27^n \times 9^{2n} \times 3$ as a single exponent. In part (b),

some candidates failed to perform the correct basic radical operations. In part (c), they were unable to express 72 as the product of its prime factors, which led to incorrect expression for $\log 72$. Also, some candidates failed to apply the product law of logarithms, hence they got incorrect answers. Moreover, there were candidates who failed to perform basic arithmetics after appropriate substitution of values of $\log 2$ and $\log 3$. Extract 2.1 shows a sample of responses from a candidate who answered this question incorrectly.

Q. a)	$27^n \times 9^{2n} \times 8$	
	<u>Soln</u>	
	$27^n \times 9^{2(n)}$	
	$27^n \times 18^n$	
	$479^n \times 3$	
	$n = 1437!$	
	$n = 1437.$	
Q. B:	$\sqrt{2} + 1$	
	$\sqrt{2} - \sqrt{5}$	
	<u>Soln</u>	
	$\sqrt{2} + 1 \times R.F$	
	$\sqrt{2} - \sqrt{5}$	
	$\frac{\sqrt{2} + 1}{\sqrt{2} - \sqrt{5}} \times \frac{\sqrt{2} - \sqrt{5}}{\sqrt{2} - \sqrt{5}}$	
	$\frac{\sqrt{2} + \sqrt{10} + \sqrt{2} + \sqrt{5}}{\sqrt{2} + \sqrt{10} + \sqrt{2} + \sqrt{5}}$	
	$\frac{\sqrt{2} + \sqrt{10} + \sqrt{2} + \sqrt{5}}{\sqrt{2} + \sqrt{10} + \sqrt{2} + \sqrt{5}}$	
	$\frac{2 + \sqrt{10} + \sqrt{2} + \sqrt{5}}{0 + 5}$	
	$\frac{2 + \sqrt{10} + \sqrt{2} + \sqrt{5}}{5}$	
	$\therefore$ These four answers are: $\frac{2 + \sqrt{10} + \sqrt{2} + \sqrt{5}}{5}$	
	7.	

	c) soln.	
	$\log 2 = 0.3010$ and $\log 3 = 0.4771$, $\log 72 = x$	
	$\log 72 = \log_1 + \log_2$	
	$\log 72 = 0.3010 + 0.4771$	
	$\log 72 = 0.7781$.	

Extract 2.1: A sample of incorrect responses to question 2

Extract 2.1 shows that, in part (a), the candidate performed direct multiplication of the bases of the given expression contrary to the laws of exponents. In part (b), the candidate failed to determine the rationalizing factor. In part (c), the candidate added together the given values of $\log 2$ and $\log 3$ instead of using laws of logarithms.

Despite the weak performance on this question, analysis of responses shows that, 5.84 percent of the candidates answered this question correctly. The candidates demonstrated adequate knowledge and skills on the basic concepts of logarithms, exponents and radicals. In part (a), the candidates were able to write the expression $27^n \times 9^{2n} \times 3$ in the same base as $3^{3n} \times 3^{4n} \times 3^1$, then they applied the product law of exponents to get 3^{7n+1} , which is the correct answer. In part (b), the candidates correctly determined the rationalizing factor $\sqrt{2} + \sqrt{5}$ and rationalized the denominator by writing $\left(\frac{\sqrt{2}+1}{\sqrt{2}-\sqrt{5}} \right) \times \left(\frac{\sqrt{2}+\sqrt{5}}{\sqrt{2}+\sqrt{5}} \right)$. They managed to perform the basic operations to get $-\frac{1}{3}(2 + \sqrt{10} + \sqrt{2} + \sqrt{5})$. In part (c), the candidates were able to write $\log 72$ as the product of its prime factors and made suitable substitutions of $\log 2 = 0.3010$ and $\log 3 = 0.4771$ to obtain $\log 72 = 1.8572$ as required. Extract 2.2 shows a sample of responses from a candidate who answered this question correctly.

02(a)	<u>Solution</u>	
	$27^n \times 9^{2n} \times 3 = 3^{3n} \times 3^{2 \times 2n} \times 3^1$	
	$= 3^{3n} \times 3^{4n} \times 3^1$	
	$= 3^{(3n+4n+1)}$	
	$= 3^{(7n+1)}$	
b)	<u>Solution</u>	
	Given; $\frac{\sqrt{2}+1}{\sqrt{2}-\sqrt{5}}$, Rationalizing factor (R.F) = $\sqrt{2}+\sqrt{5}$	
	$\frac{\sqrt{2}+1}{\sqrt{2}-\sqrt{5}} = \frac{(\sqrt{2}+1)(\sqrt{2}+\sqrt{5})}{(\sqrt{2}-\sqrt{5})(\sqrt{2}+\sqrt{5})}$	
	$= \frac{\sqrt{2}(\sqrt{2}+\sqrt{5}) + 1(\sqrt{2}+\sqrt{5})}{\sqrt{2}(\sqrt{2}+\sqrt{5}) - \sqrt{5}(\sqrt{2}+\sqrt{5})}$	
	$= \frac{2 + \sqrt{10} + \sqrt{2} + \sqrt{5}}{2 + \sqrt{10} - \sqrt{10} - 5}$	
	$= \frac{2 + \sqrt{10} + \sqrt{2} + \sqrt{5}}{2 - 5}$	
	$= \frac{2 + \sqrt{10} + \sqrt{2} + \sqrt{5}}{-3}$	
	$= \frac{-2 - \sqrt{10} - \sqrt{2} - \sqrt{5}}{3}$	
	$\therefore \frac{\sqrt{2}+1}{\sqrt{2}-\sqrt{5}} = \frac{-2 - \sqrt{10} - \sqrt{2} - \sqrt{5}}{3}$	

2 (c)	Solution-	
	$\log 2 = 0.3010$	
	$\log 3 = 0.4771$	
	$\log 72 = ?$	
	$\log 72 = \log (2 \times 2 \times 2 \times 3 \times 3)$	
	$= \log (2^3 \times 3^2)$	
	$= \log 2^3 + \log 3^2$	
	$= 3 \log 2 + 2 \log 3$	
	from $\log 2 = 0.3010$	
	$\log 3 = 0.4771$	
	$= (3 \times 0.3010) + (2 \times 0.4771)$	
	$= 0.903 + 0.9542$	
	$= 1.8572$	
	$\therefore \log 72 = 1.8572$	

Extract 2.2: A sample of correct responses to question 2

Extract 2.2 shows that, in part (a), the candidate managed to express the given expression as a single exponent correctly after applying the product law of exponents. In part (b), the candidate was able to determine the rationalizing factor and perform all necessary steps to get the answer. In Part (c), the candidate expressed $\log 72$ into its prime factors that led to obtain the correct answer.

2.3 Question 3: Sets and Probability

The question had two parts, (a) and (b). In part (a), the candidates were given a word problem which stated that “A certain school has 260 students. Out of these students, 130 study Physics, 150 study Chemistry and 40 study both Physics and Chemistry.” By using formula, find the number of students who study; (i) Physics only and (ii) neither Physics nor Chemistry.” In part (b), they were required to use Venn diagram to find the probability of getting a person who keeps goats only from a

sample of 35 animal keepers, whereby 18 keep goats, 20 keep cows and 3 keep both goats and cows.

According to data analysis, a total of 191,534 (34.49%) candidates passed, of whom 102,672 (18.49%) candidates had scores ranging from 4.0 to 6.0 marks. This shows that the candidates' performance on this question was average. Figure 3 shows a summary of the candidates' performance on this question.

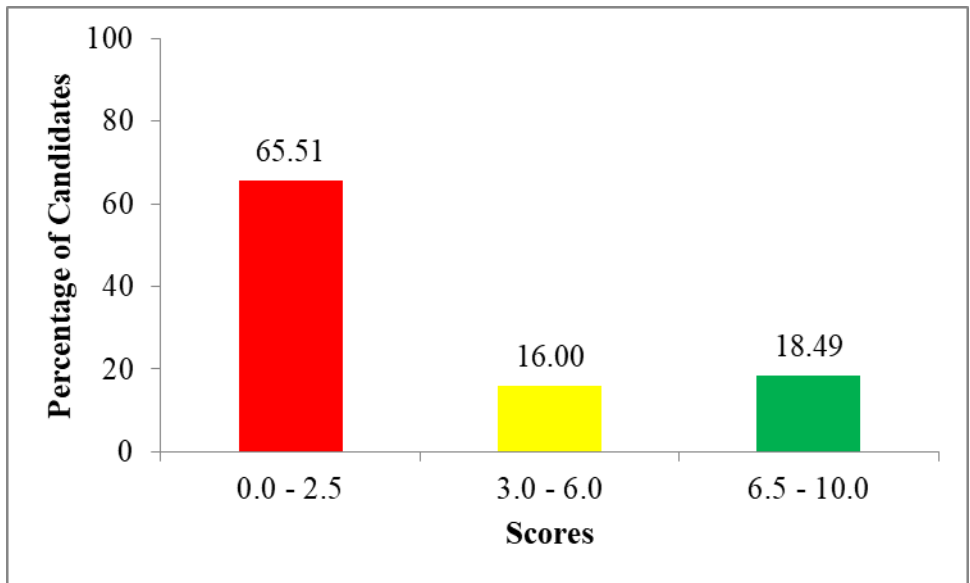


Figure 3: *Candidates' performance on question 3*

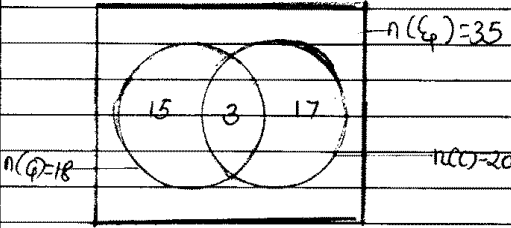
The analysis indicates that 6.79 percent of the candidates responded correctly to this question. These candidates demonstrated good understanding of the concepts of sets and probability. In part (a), the candidates applied the formulae $n(P \cup C) = n(P) + n(C) - n(P \cap C)$ and $n(P \cup C) + n(P \cup C)' = n(\mu)$, where P and C are the sets of candidates who study Physics and Chemistry, respectively. They made suitable substitutions and got 90 as the number of candidates who study neither Physics nor Chemistry. In part (b), the candidates presented the information in a Venn diagram correctly and used it to obtain 15 as the number of people who keep goats only. In addition,

they applied probability formula $P(E) = \frac{n(E)}{n(S)}$ or

$P(G \text{ only}) = \frac{n(G \text{ only})}{n(\mu)}$, with proper substitutions and got $\frac{3}{7}$ as the

probability of getting a person who keeps goats only. Extract 3.1 shows a sample of responses from a candidate who answered the question correctly.

3. (a)	Total number of students $n(E) = 260$
	Number of students studying physics $n(P) = 130$
	Number of students studying chemistry $n(C) = 150$
	Number of students studying both physics and chemistry $n(P \cap C) = 40$
(i)	Number of students studying physics only $n(P \cap C')$
	from
	$n(P \cap C') = n(P) - n(P \cap C)$
	$n(P \cap C') = 130 - 40$
	$n(P \cap C') = 90$
	$\therefore 90$ students study physics only
(ii)	neither physics nor chemistry $n(P \cup C)'$
	from $n(E) = n(P \cup C) + n(P \cup C)'$
	$n(P \cup C) = n(P) + n(C) - n(P \cap C)$
	$n(P \cup C) = 130 + 150 - 40$
	$n(P \cup C) = 240$
	$n(P \cup C) = 240$
	Then
	$260 = 240 + n(P \cup C)'$
	$260 - 240 = n(P \cup C)'$
	$20 = n(P \cup C)'$
	$\therefore 20$ students study neither physics nor chemistry

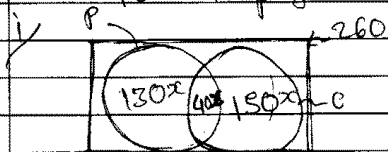
3. (b) Given	
Total animal/keeper $n(E) = 35$	
Those keeping goats $n(G) = 18$	
Those keeping cows $n(C) = 20$	
Those keeping both $n(G \cap C) = 3$	
Venn diagram	
	
Number of goats only $n(E) = 15$	
Then probability	
$P(E) = \frac{n(E)}{n(E)}$	
$= \frac{15}{35}$	
$= \frac{3}{7}$	
$\therefore \frac{3}{7}$ is the probability of keeping goats only.	

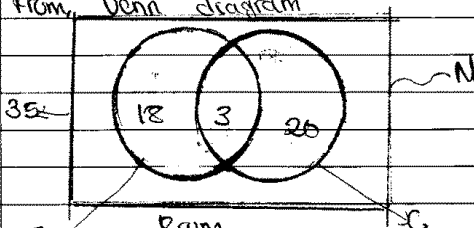
Extract 3.1: A sample of correct responses to question 3

In Extract 3.1, part (a), the candidate applied the correct formulae and got the required answers. In part (b), the candidate presented the given information in a Venn diagram correctly and then computed the probability of getting a person who keeps goats only.

On the other hand, analysis shows that 44.82 percent of the candidates responded incorrectly to this question, indicating insufficient knowledge and skills on sets and probability. In part (a), the candidates applied incorrect formula such as $n(P \cup C) = n(P) + n(C) + n(P \cap C)$ instead of $n(P \cup C) = n(P) + n(C) - n(P \cap C)$. Others wrote incorrect formula $n(P \cup C)' = n(\mu) + n(P \cup C)$ instead of

$n(P \cup C)' = n(\mu) - n(P \cup C)$. In addition, they used Venn diagrams instead of formula contrary to the requirement of the question. In part (b), they were not able to recall and apply the correct probability formula to get the person who keeps goats only. For instance, they wrote $P(E) = \frac{n(S)}{n(E)}$ instead of $P(E) = \frac{n(E)}{n(S)}$. Extract 3.2 shows a sample of responses from a candidate who answered the question incorrectly.

3	① 130 physics 150 chemistry 40 both physics and chemistry  $130 + 40x + 150 = 260$ $40x + 280 = 260$ $40x = 260 - 280$ $40x = -20$ $\frac{40x}{40} = \frac{-20}{40}$ $x = -2$ $x = 2$ ∴ the student stud physics only is 2 ii/ $40x = 260 - 280$ $40x = -20$ $\frac{40x}{40} = \frac{-20}{40}$ $x = -2$ ∴ the student study neither nor chemistry is -2	
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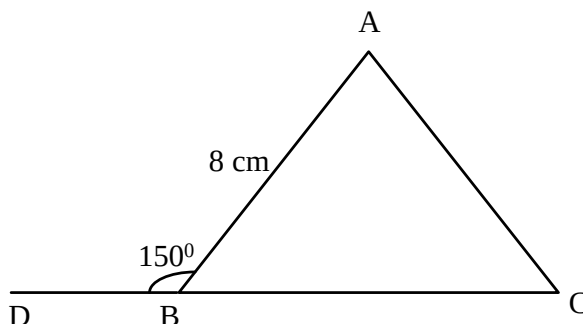
e	b).	Solution.	
		from Venn diagram	
			
		from $P(B C) = \frac{n(B \cap C)}{n(C)}$	
		$= \frac{18}{35}$	
		$\therefore$ The probability of getting a person of 'good' govt of is $18/35$	

Extract 3.2: A sample of incorrect responses to question 3

Extract 3.2, part (a) shows that the candidate used a Venn diagram with incorrect inputs instead of using the formula as required. In part (b), the candidate failed to present the given information in a Venn diagram.

2.4 Question 4: Geometry, Perimeters and Areas

The question consisted of two parts, (a) and (b). In part (a), the candidates were required to find the length $\overline{BC}$ in the following figure given that $\overline{AB} = 8\text{cm}$, $\angle ABD = 150^\circ$ and the area of triangle ABC is 22.6cm^2 .



In part (b), the candidates were required to find the perimeter of a regular pentagon inscribed in a circle whose radius is 10 m.

The data analysis points out that 104,282 (18.78%) candidates passed, whereby 52,662 (9.49%) candidates scored 4.0 to 6.0 marks. This indicates that the candidates' performance on this question was weak. Figure 4 summarizes the candidates' performance on this question.

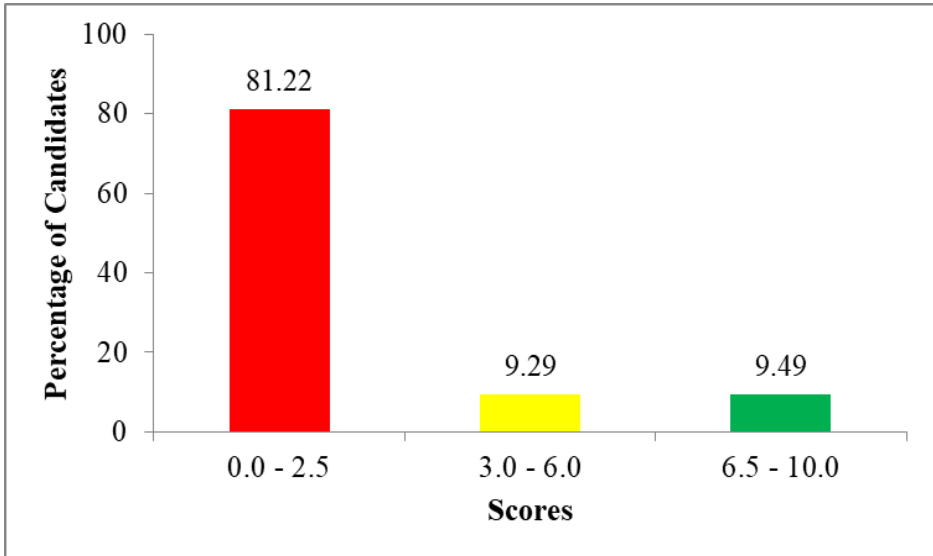


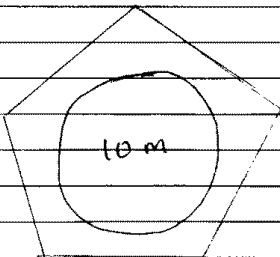
Figure 4: *Candidates' performance on question 4*

The candidates' responses analysis shows that, 75.88 percent of the candidates who responded to this question failed to get the correct answer. In part (a), the candidates failed to apply the correct formula for finding the area of a triangle. In addition, some candidates substituted an incorrect angle 150° into $A = \frac{1}{2} \overline{AB} \times \overline{BC} \times \sin \hat{A}BC$ instead of 30°

which is the included angle between the sides $\overline{AB}$ and $\overline{BC}$. In part (b), they failed to apply the correct formula for finding the perimeter of a regular polygon inscribed in a circle. For example, they wrote

$$P = 2nr \sin\left(\frac{360^\circ}{n}\right) \text{ instead of } P = 2nr \sin\left(\frac{180^\circ}{n}\right).$$

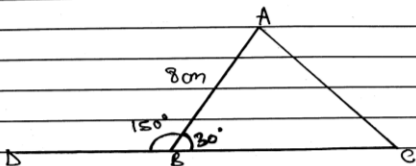
Extract 4.1 shows a sample of responses from a candidate who answered the question incorrectly.

4	a)	$22.6 \text{ cm}^2 = \frac{1}{2} \times 1 \text{ cm} \times BC$	
		$22.6 \text{ cm}^2 = 4 \text{ cm} \times BC$	
		$\frac{22.6 \text{ cm}^2}{4 \text{ cm}} = \frac{4 \cancel{1} 8}{4 \cancel{1} 8}$	
		$\frac{22.6 \text{ cm}^2}{4 \text{ cm}} = 5.65 \text{ cm}$	
		$BC = 5.65 \text{ cm}$	
		$\therefore$ The length of BC is 5.65 cm	
	b)	son	
			
		from $P = 2\pi r$	
		$2 \times \frac{22}{7} \times 10$	
		$= \frac{44 \times 10}{7}$	
		$P = \frac{440}{7} = 62.86 = 63.7$	

Extract 4.1: A sample of incorrect responses to question 4

Extract 4.1, part (a) shows that the candidate ignored the sine of the angle between the line segments $\overline{AB}$ and $\overline{BC}$ in the calculations. In part (b), the candidate applied a wrong formula $P = 2\pi r$ instead of $P = 2nr \sin\left(\frac{180^\circ}{n}\right)$ for the perimeter of a regular polygon inscribed in a circle.

On the other hand, the analysis shows that 6.11 percent of the candidates answered this question correctly. In part (a), the candidates applied the correct formula $A = \frac{1}{2} \overline{AB} \times \overline{BC} \sin \hat{ABC}$, then made appropriate substitutions and computation to get $\overline{BC} = 11.3\text{cm}$, which is the correct answer. In part (b), they applied the correct formula $P = 2nr \sin\left(\frac{180^\circ}{n}\right)$ with suitable substitution of n and r to obtain the correct answer, $P = 58.78\text{m}$. Extract 4.2 shows a sample of responses from a candidate who answered the question correctly.

4	
(a)	 Given $A = 22.6 \text{ cm}^2$ $\hat{ABD} = 150^\circ$ from $\hat{ABD} + \hat{ABC} = 180^\circ$ $150^\circ + \hat{ABC} = 180^\circ$ $\hat{ABC} = 180 - 150^\circ$ $\hat{ABC} = 30^\circ$ Then from Area = $\frac{1}{2} ab \sin C$ Area = $\frac{1}{2} AB \times BC \times \sin \hat{B}$ $22.6 = \frac{1}{2} \times 8 \times BC \times \sin 30^\circ$ $22.6 = \frac{4BC \times \frac{1}{2}}{1}$ $22.6 = \frac{2BC}{2}$ $\therefore \text{length } BC = 11.3 \text{ cm}$
(b)	Given : $r = 10\text{m}$, $n = 5$ from $P = 2nr \sin\left(\frac{180}{n}\right)$ $P = 2 \times 5 \times 10\text{m} \times \sin\left(\frac{180}{5}\right)$ $P = 2 \times 5 \times 10\text{m} \times \sin 36^\circ$ $P = 2 \times 5 \times 10\text{m} \times 0.5878$ <u>$P = 58.78 \text{ m}$</u>

Extract 4.2: A sample of correct responses to question 4

In Extract 4.2, the candidate applied the required formulae and made suitable substitution to obtain the length of $\overline{BC} = 11.3\text{cm}$ and perimeter $P = 58.78\text{m}$ as required.

2.5 Question 5: Rates and Variations

This question had two parts, (a) and (b). In part (a), the candidates were required to convert 27,600,000 Tanzanian shillings into US dollars, if the exchange rate between Tanzanian shillings and US dollar is 2,300 Tanzanian shillings to 1 US dollar. In part (b), the candidates were required to find h when $V = 1,200\text{cm}^3$ and $r = 5\text{cm}$ if the height h of a cylinder is directly proportional to its volume V and inversely proportional to the square of its radius r , given $h = 3\text{cm}$ when $V = 900\text{cm}^3$ and $r = 10\text{cm}$.

The data analysis indicates that 233,770 (42.09%) candidates passed and among them, 100,164 (18.03%) candidates scored 4.0 to 6.0 marks, indicating an average performance on this question. Figure 5 reveals a summary of the candidates' performance on this question.

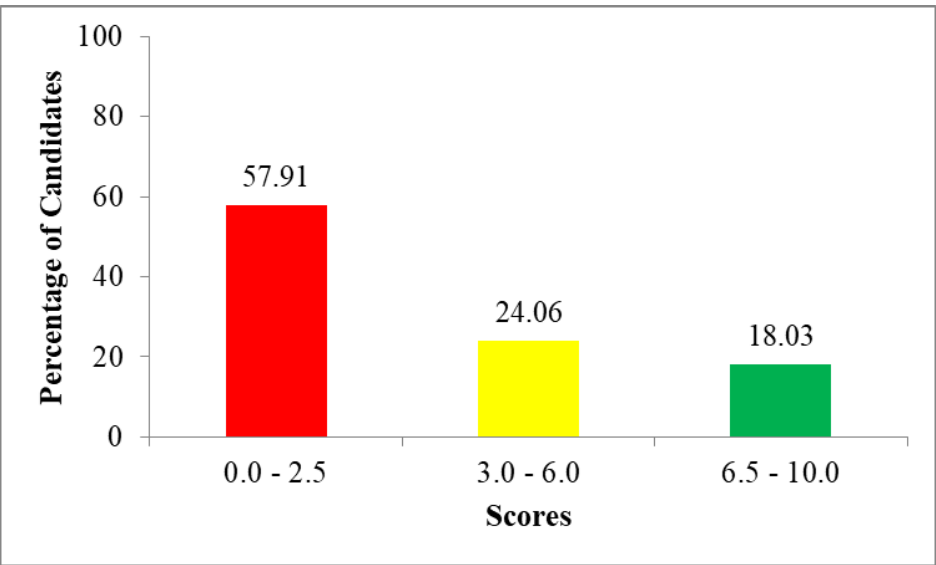


Figure 5: *Candidates' performance on question 5*

Further analysis shows that, 13.05 percent of the candidates answered this question correctly. In part (a), the candidates were able to convert 27,600,000 Tanzanian shillings into US dollars. They performed correctly all necessary computational steps that led to the correct answer which is 12,000 US dollars. This indicates that, the candidates had adequate knowledge on currency conversion. In part (b), they were able to formulate the equation $h = \frac{KV}{r^2}$ from the word problem and made suitable substitution, followed by correct computations to obtain $h = 16\text{cm}$. This shows that, the candidates had enough knowledge on the concepts of joint variations. Extract 5.1 shows a sample of responses of a candidate who answered this question correctly.

5.	(a) Since;	
	$1 \text{ U.S. dollar} = 2300 \text{ Tshs}$	
	$x \text{ U.S. dollars} = 27\,600,000 \text{ Tshs.}$	
	$x = \frac{1 \text{ U.S. dollar} \times 27\,600\,000 \text{ Tshs.}}{2300 \text{ Tshs}}$	
	$x = 12000 \text{ U.S. dollars.}$	
	$\therefore 12000 \text{ U.S. dollars is equivalent to } 27\,600\,000$	
	<u>Tanzanian shillings.</u>	
	(b) Solution.	
	from;	
	$h \propto V \text{ and } h \propto \frac{1}{r^2}$	
	$h \propto V \cdot \frac{1}{r^2}$	
	$h \propto \frac{V}{r^2}$	
	$h = k \frac{V}{r^2}$	
	$k = h \div \frac{V}{r^2}$	
	$k = h \times \frac{r^2}{V}$	
	$k = \frac{hr^2}{V}$	
	Given; $h = 3 \text{ cm}$, $V = 900 \text{ cm}^3$, $r = 10 \text{ cm}$	
	$k = \frac{3 \text{ cm} \times (10 \text{ cm})^2}{900 \text{ cm}^3}$	
	$k = \frac{3 \text{ cm} \times 100 \text{ cm}^2}{900 \text{ cm}^3}$	
	$k = \frac{1}{3}$	
5.	(b) Then;	
	$h = k \frac{V}{r^2}$	
	$h = \frac{1}{3} \times \frac{1200 \text{ cm}^3}{(5 \text{ cm})^2}$	
	$h = \frac{400 \text{ cm}^3}{25 \text{ cm}^2}$	
	$h = 16 \text{ cm.}$	
	$\therefore 16 \text{ cm is the value of } h.$	

Extract 5.1: A sample of correct responses to question 5

Extract 5.1, part (a) shows that in the candidate was able to perform proper currency conversion, hence obtained the correct answer. In part (b), the candidate managed to formulate the proportionality equation and succeeded to obtain the correct answer.

On the contrary, 53.26 percent of the candidates scored 0 on this question. In part (a), the candidates performed inappropriate computations which led to incorrect conversion. They wrote $\frac{1 \text{ USD} \times 2,300 \text{ sh}}{27,600,000 \text{ sh}}$ instead of $\frac{27,600,000 \text{ sh} \times 1 \text{ USD}}{2,300 \text{ sh}}$. In addition, other

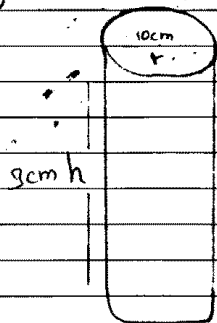
candidates calculated the sum or the difference between the two currencies. This reveals that, candidates had insufficient knowledge and skills of solving problems on currency conversion. In part (b), candidates failed to interpret the given word problem, hence they could not formulate the correct proportionality equation. They wrote $h = \frac{V}{r^2}$

instead of $h \propto \frac{V}{r^2}$. Also, some candidates failed to differentiate between

direct and inversely variations. They wrote $h \propto Vr^2$ instead of $h \propto \frac{V}{r^2}$,

while others incorrectly substituted the values of h , V and r which led to an incorrect value of the proportionality constant. Furthermore, some candidates failed to perform algebraic computations, hence they got incorrect value of height h . This shows that, the learning process did not give the intended outcomes on the concepts of variation. Extract 5.2 shows a sample of responses from a candidate who failed to answer this question correctly.

5 a)	Soln.	
	1 Tanzania shillings = 2300 US dollar	
	~~27,600,000~~ $\times$	
	$x = 2300 \times 27600,000$	
	$x = 63,480,000,000$	
	$= \text{7 } 63,480,000,000 \text{ US dollars.}$	

5	(b)	
		
	<u>Soln</u>	
	If $h = 3\text{cm}$	
	Volume (V) = $1,200\text{ cm}^3$	
	$r = 5\text{cm}$	
	Also	
	$V = 900\text{ cm}^3$	
	$r = 10\text{ cm}$	
	$K \propto \frac{V}{r}$	
	$K = \frac{1200}{5}$	
	$K = 240^3$	
	If $H = 5$	
	~~$3 = 20$~~	
	$\frac{3h}{2h} = \frac{240^3}{3}$	
	$h = 80\text{ cm}$	
	<u>So that height is 80cm.</u>	

Extract 5.2: A sample of incorrect responses to question 5

Extract 5.2 shows that, in part (a), the candidate used incorrect conversion which led to a wrong answer. In part (b), the candidate was unable to formulate a proportionality equation, hence he/she obtained an incorrect answer.

2.6 Question 6: Coordinate Geometry and Vectors

The question had two parts, (a) and (b). In part (a), the candidates were given the vectors $\underline{a} = 2\underline{i} - \underline{j}$, $\underline{b} = -\underline{i} + 3\underline{j}$ and $\underline{c} = 3\underline{i} - 4\underline{j}$ and were required to determine the magnitude of $\underline{a} + \underline{b} + \underline{c}$ in the form $n\sqrt{m}$. In part (b), the question stated that “The mid-point of a line segment is (3, 5). If one of the end points is (6, 7), find the other end point.”

The data analysis shows that 96,366 (17.35%) candidates passed. Out of whom 47,839 (8.61%) candidates scored 4.0 to 6.0 marks. Generally, the candidates’ performance on this question was weak. Figure 6 summarizes the candidates’ performance on this question.

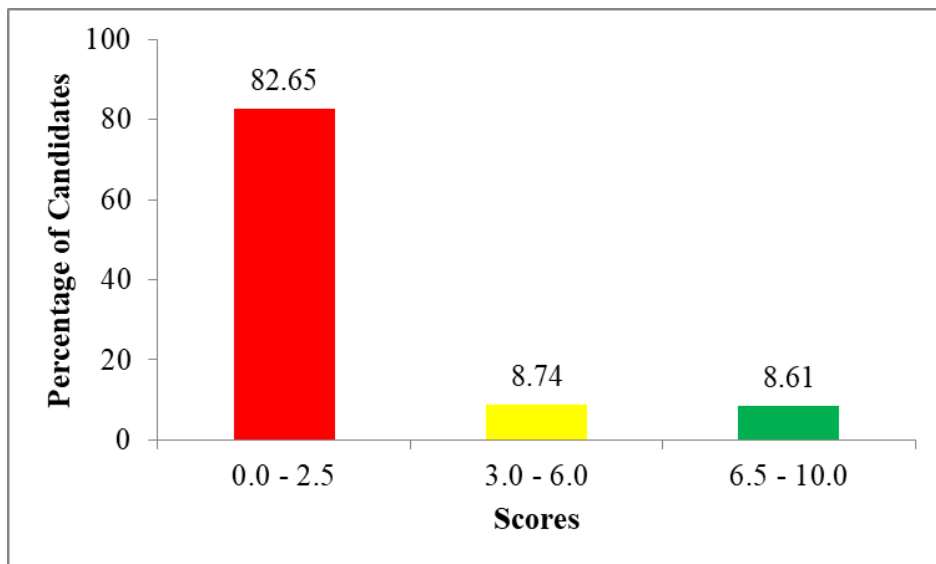


Figure 6: *Candidates’ performance on question 6*

Further analysis reveals that, 67.75 percent of the candidates scored 0 on this question. The analysis of responses indicates that, the candidates had insufficient knowledge and skills on the basic concepts of vectors and coordinate geometry. In part (a), the candidates incorrectly calculated the magnitude of the individual vectors such as $|\underline{a}| + |\underline{b}| + |\underline{c}|$ and got $5 + \sqrt{5} + \sqrt{10}$ which is incorrect. Other candidates lacked the knowledge on operation of vectors, hence they could not add correctly the given vectors. In part (b), they were unable to recall and apply the

midpoint formula correctly. For example, they wrote $M(x, y) = \left(\frac{x_1 - x_2}{2}, \frac{y_1 - y_2}{2} \right)$ instead of $M(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$. Also, some candidates incorrectly substituted the given points into $M(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ to get $M(x, y) = \left(\frac{3+6}{2}, \frac{5+7}{2} \right) = \left(\frac{9}{2}, 6 \right)$ which is incorrect. Moreover, there were candidates who added the points (3,5) and (6,7) as (3+5, 6+7) to get (8,13) which is a wrong answer. Extract 6.1 shows a sample of responses of a candidate who responded to this question incorrectly.

Q	a) $a = 2i - j$ $b = -i + 3j$ $c = 3i - 4j$	
	$a + b + c$ $\therefore \text{m}$	
	$2i - j + -i + 3j + 3i - 4j$	
	$2i + i + 3i - j + 3j - 4j$	
	$6i + 2j$	
	$6i + 2j$	
	$\therefore \underline{6i + 2j}$	
	b. Line segment (3,5) End point (6,7).	
	End point (5,7).	

Extract 6.1: A sample of incorrect responses to question 6

Extract 6.1, part (a) shows that the candidate failed to perform operations on the given vectors as required. Thus, he/she could not get the required answer. In part (b), the candidate used only the y values in the given points as the end point of a line segment which is incorrect.

On the other hand, 5.53 percent of the candidates managed to answer this question correctly. They demonstrated good understanding of the concepts of magnitude of vectors and midpoint of a line segment. In part (a), the candidates added the corresponding vector components correctly. Then, they applied the formula for finding the magnitude $|d| = |\underline{a} + \underline{b} + \underline{c}|$ to get $2\sqrt{5}$. In part (b), they were able to apply the

midpoint formula to get the coordinates of the other end point of a line segment, which is $(0,3)$. Extract 6.2 shows a sample of responses from a candidate who answered this question correctly.

6. Solution	
a) $\underline{a} + \underline{b} + \underline{c} = (2\underline{i} - \underline{j}) + (-\underline{i} + 3\underline{j}) + (3\underline{i} - 4\underline{j})$	
$= 2\underline{i} - \underline{j} - \underline{i} + 3\underline{j} + 3\underline{i} - 4\underline{j}$	
$= 2\underline{i} - \underline{i} + 3\underline{i} - \underline{j} + 3\underline{j} - 4\underline{j}$	
$= 4\underline{i} - 2\underline{j}$	
Then, $ \underline{a} + \underline{b} + \underline{c} = \sqrt{x^2 + y^2}$	
$ \underline{a} + \underline{b} + \underline{c} = \sqrt{4^2 + (-2)^2}, x = 4 \text{ and } y = -2$	
$ \underline{a} + \underline{b} + \underline{c} = \sqrt{4^2 + (-2)^2}$	
$= \sqrt{16 + 4}$	
$= \sqrt{20}$	
$= 2\sqrt{5}$	
$\therefore \text{Magnitude of } \underline{a} + \underline{b} + \underline{c} = 2\sqrt{5}$	

b)	Given, Mid point (M) = (3, 5)	
	First point $(x_1, y_1) = (6, 7)$	
	Second point $(x_2, y_2) = ?$	
	From, $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$	
	$(3, 5) = \left(\frac{6 + x_2}{2}, \frac{7 + y_2}{2} \right)$	
		
	So, $\frac{6 + x_2}{2} = 3$	
	$6 + x_2 = 6$	
	$x_2 = 6 - 6$	
	$x_2 = 0$	
	Again, $\frac{7 + y_2}{2} = 5$	
	$7 + y_2 = 10$	
	$y_2 = 10 - 7$	
	$y_2 = 3$	
	$\therefore$ The other end point is (0, 3)	

Extract 6.2: A sample of correct responses to question 6

Extract 6.2 shows that in part (a), the candidate calculated the sum of the given three vectors and then computed the magnitude of the resulting vector. In part (b), the candidate made appropriate substitutions of the given points into the midpoint formula and got the correct answer.

2.7 Question 7: Accounts, Ratios, Profit and Loss

This question had two parts, (a) and (b). In part (a) the question stated that, “In making a concrete wall, a builder decides to mix gravel, sand and cement in the ratio of their minimum amounts of 500 kg, 600 kg and 200 kg, respectively. If the concrete wall of mass of 39,000 kg is to be made, how many kilograms of cement will be needed?” In part (b), the candidates were required to find the net profit using the following

information: Opening stock 2,000/=-, Sales 30,000/=-, Purchases 13,000/=-, Expenses 6,500/=- and Closing Stock 500/=-.

Based on data analysis, a total of 110,793 (19.95%) candidates passed, out of whom 32,848 (5.91%) candidates scored 4.0 to 6.0 marks. This shows that the candidates' performance on this question was weak. The summary of the candidates' performance on this question is presented in Figure 7.

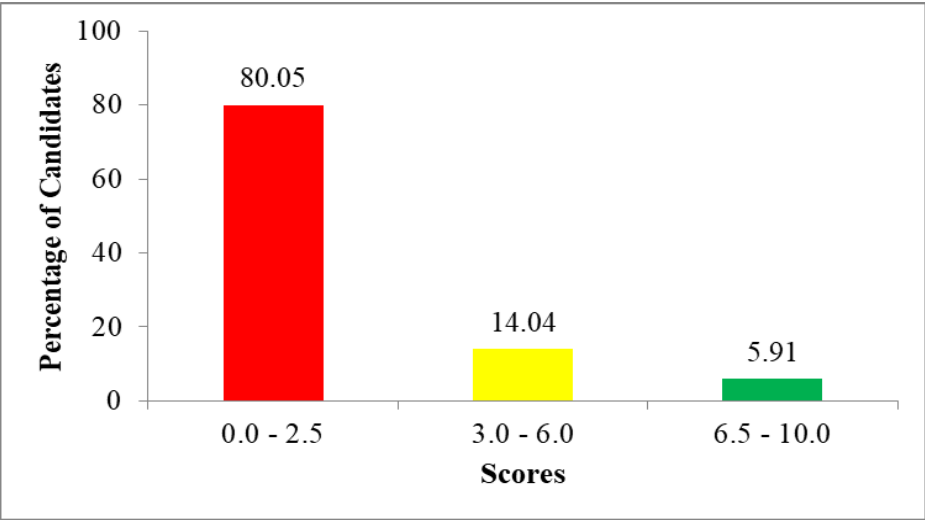


Figure 7: *Candidates' performance on question 7*

The analysis of candidates' responses shows that, 69.16 percent of the candidates failed to answer the question correctly. In part (a), the candidates were unable to write the respective masses of gravel, sand and cement into their equivalent ratios. In addition, they failed to divide the given mass of the concrete wall, which led to incorrect calculations of the required kilograms of cement. This shows that, the candidates lacked basic concepts of ratios. In part (b), the candidates failed to compute the net profit by using the given information. For instance, they were not able to recall the formulae for ascertaining the Cost of Goods Sold (COGS), Gross Profit (GP), and Net Profit (NP). Those candidates were incompetent in preparing the trading, profit and loss accounts. Extract 7.1 shows a sample of responses from a candidate who failed to answer this question correctly.

07	a). 500 kg x 600 kg x 200 kg	
	= 300,000 kg x 200 kg = 60,000,000	
	= 60,000,000 kg	
	39,000 kg	
	= 3 kg	
	∴ 3 kg of cement will be needed.	
7b)	soln:	
	Opening stock 2,000/-	
	Sales 30,000/-	
	Purchases 13,000/-	
	Expenses 6,500/-	
	Closing stock 500/-	
	Total 52,000/-	
	∴ Net profit = 52,000/-	

Extract 7.1: A sample of incorrect responses to question 7

In Extract 7.1, in part (a), the candidate failed to compute the number of kilograms of cement using the given mass of a concrete wall and the ratios of gravel, sand, and cement. He/she wrongly multiplied the given masses of gravel, sand and cement. In part (b), the candidate added all the given entries instead of opening the trading, profit and loss account hence failed to find the correct net profit.

Despite the weak performance on this question, 3.52 percent of the candidates answered this question correctly. In part (a), the candidates managed to write the given masses which are 500 kg, 600 kg and 200 kg of gravel, sand and cement, respectively into their equivalent ratio which is 500:600:200. They correctly calculated the amount (A) of cement needed by writing $A = \frac{200}{500 + 600 + 200} \times 39,000 \text{ kg}$ to get 6,000 kg. This shows that, the candidates had sufficient knowledge on the basic concepts of ratios. In part (b), the candidates were able to apply the correct formulae, $\text{COGS} = \text{OP} + \text{P} - \text{CS}$, where

OP = Opening Stock, P = Purchases, and CS = Closing stock ;
 GP = Sales – COGS and NP = GP – Expenses. They substituted the
 given entries to get the correct net profit, which is 9,000/=. This shows
 that, the candidates mastered the basic concepts on how to prepare the
 trading, profit and loss account. Extract 7.2 shows a sample of
 responses from a candidate who answered the question correctly.

07	(a) let 'g' be gravel	
	's' be sand	
	'c' be cement	
	$g:s:c = 500:600:200$	
	$= 5:6:2$	
	Mass of wall - 39000kg	
	for cement, $\frac{200}{1300} \times 39000$	
	$= \frac{2}{13} \times 39000$	
	$= \frac{78000}{13}$	
	$= 6000 \text{ kg}$	
	<u>$\therefore 6000 \text{ kg of cement will be needed.}$</u>	

07	b)	<u>Solution:</u>	
		Net profit = Gross profit - Expenses	
		But Gross profit = ?	
		From:	
		Gross profit = Sales - Cost of goods sold.	
		But Cost of goods sold = ?	
		From:	
		Cost of goods sold = Opening stock + Purchases - Closing stock	
		= 2,000 + 13,000 - 500	
		= 14,500/=	
		Now:	
		Gross profit = 30,000/= - 14,500/=	
		= 15,500/=	
		Net profit = Gross profit - Expenses.	
		= 15,500/= - 6,500/=	
		= 9,000/=	
		∴ Net profit = <u>9,000/=</u>	

Extract 7.2: A sample of correct responses to question 7

Extract 7.2 shows that, in part (a) the candidate calculated correctly the ratio of gravel, sand and cement, and computed the number of kilograms of cement as required. In part (b), the candidate managed to calculate the trading, profit and loss account to get the correct answer.

2.8 Question 8: Sequences and Series

This question had two parts, (a) and (b). In part (a), the candidates were required to find the amount of money that was accumulated after 3 years if Tsh 10,000 was deposited in a bank which pays 5% interest compounded annually. In part (b), they were required to find the possible values of x if 3, $x-1$ and 27 are three consecutive terms of a geometric progression.

The data analysis shows that, a total of 83,720 (15.07%) candidates passed, out of whom 40,836 (7.35%) candidates scored 4.0 to 6.0 marks. This indicates that the candidates' performance on this question was weak. Figure 8 is a summary of the candidates' performance on this question.

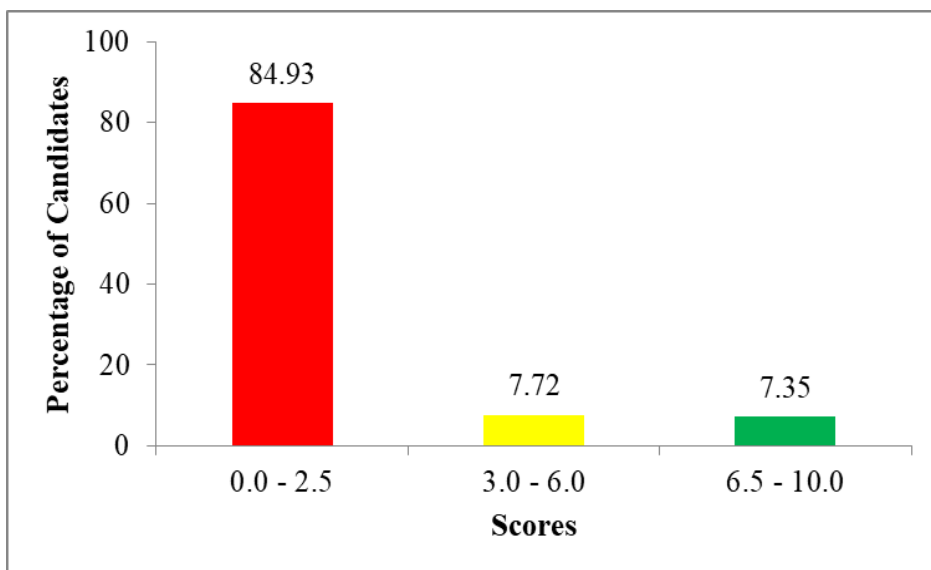


Figure 8: *Candidates' performance on question 8*

The analysis of the candidates' responses shows that, 79.32 percent of the candidates failed to answer this question correctly. In part (a), the candidates failed to interpret the question correctly. For example, they used the formula for finding the amount (A) as $A = P - I$ instead of

$$A = P \left(1 + \frac{RT}{100} \right)^n, \text{ where } P \text{ is the principal, } I \text{ is the interest, } R \text{ is the}$$

interest rate, T is the time, and n is the number of times the interest is compounded. In addition, other candidates made direct substitution of the values of P and I in the formula $A = P + I$ which is a wrong approach. In part (b), the candidates failed to apply the formula for finding the common ratio of a geometric progression, that is,

$$r = \frac{G_2}{G_1} = \frac{G_3}{G_2}. \text{ For example, they used the formula } G_2 = \frac{G_1 + G_3}{2}, \text{ which}$$

is incorrect. Extract 8.1 shows a sample of responses from a candidate who failed to answer this question correctly.

8a)	Data given	
	Joshua deposited Tsh 10,000 bank	
	pays 5% interest compounded annually	
	How money accumulate after 3 years?	
	<u>Solution</u>	
	$I = \frac{PRT}{100}$	
	$I = \frac{10,000 \times 5 \times 3}{100}$	
	$I = 150,000$	
	$I = 1500$	
	The accumulate after 3 years Tsh 1500	
8b	b) From:	Solution:
	$S_n = \frac{1}{2}n(2A_1 + (n-1)d)$	
	$S_3 = \frac{1}{2} \times 3(2 \times 3 + (3-1)27)$	
	$S_3 = 6(6 + 2 \times 27)$	
	$S_3 = 6(60)$	
	$S_3 = 360$	
	$\therefore$ The possible values of x is 360	

Extract 8.1: A sample of incorrect responses to question 8

Extract 8.1 shows that, in part (a) the candidate substituted incorrect input for Time which led to incorrect answer. Part (b) shows that, the candidate applied the formula for finding the sum of n^{th} term of an arithmetic progression contrary to the task intended in the question.

On the other hand, 3.37 percent of the candidates responded correctly to this question. The candidates were able to apply the knowledge and skills gained after studying the concepts of sequences and series. In part

(a), they applied the formula $A = P \left(1 + \frac{RT}{100} \right)^n$ correctly and got Tshs 11,576.25 which is the correct answer. Further analysis reveals that, some candidates applied the formulae $I = \frac{PRT}{100}$ and $A = P + I$

simultaneously to get the amounts for first, second and finally the third year. In part (b), they were able to apply either the common ratio or geometric mean formula. That is, $\frac{G_2}{G_1} = \frac{G_3}{G_2}$ or $G_2 = \pm\sqrt{G_1G_3}$, with correct substitution to get $x = -8$ or $x = 10$. Moreover, some candidates used the formula $G_n = G_1r^{n-1}$ for $n = 3$ and obtained $r = \pm 3$. Then, they substituted these values into $G_2 = rG_1$ as $x - 1 = 3(3)$ or $x - 1 = -3(3)$ to get $x = -8$ or $x = 10$. Extract 8.2 shows a sample of responses from a candidate who answered this question correctly.

8. (a) soln:	
$P = \text{Tshs } 10,000$	
$R = 5\%$	
$n = 3 \text{ yrs.}$	
compounded annually.	
$A = P \left(1 + \frac{RT}{100} \right)^n$	
$A = 10,000 \left(1 + \frac{5 \times 1}{100} \right)^3$	
$A = 10,000 (1 + 0.05)^3$	
$A = 10,000 (1.05)^3$	
$A = 11,576.25$	
$\therefore$ The amount of money is Tshs 11,576.	

08	(b) Given	
	$G_1 = 3$	
	$G_2 = X - 1$	
	$G_3 = 27$	
	From	
	$r = \frac{G_2}{G_1} = \frac{G_3}{G_2}$	
	$\frac{X-1}{3} = \frac{27}{X-1}$	
	$(X-1)(X-1) = 3(27)$	
	$X^2 - 2X + 1 = 81$	
	$X^2 - 2X - 80 = 0$	
	By using calculator	
	$X = 10 \text{ or } X = -8$	
	$\therefore$ The values of X are 10 and -8.	

Extract 8.2: A sample of correct responses to question 8

Extract 8.2 shows that, in parts (a) and (b), the candidate applied the correct formulae and made proper substitutions that resulted to correct answers.

2.9 Question 9: Pythagoras' Theorem and Trigonometry

The question had two parts, (a) and (b). In part (a), the candidates were required to find the largest angle of the triangle whose sides are 7 cm, 6 cm and 8 cm. In part (b), they were required to find the length $\overline{BC}$ and $\tan C$ in a triangle ABC , where $\hat{A}BC$ is a right angle, $\overline{CA} = 6\text{cm}$ and $\overline{AB} = 3\text{cm}$.

The data analysis shows that, out of 90,053 (16.22%) candidates who passed, a total of 17,472 (3.16%) candidates scored 4.0 to 6.0 marks. This indicates that the candidates' performance on this question was weak. Figure 9 summarizes the candidates' performance on this question.

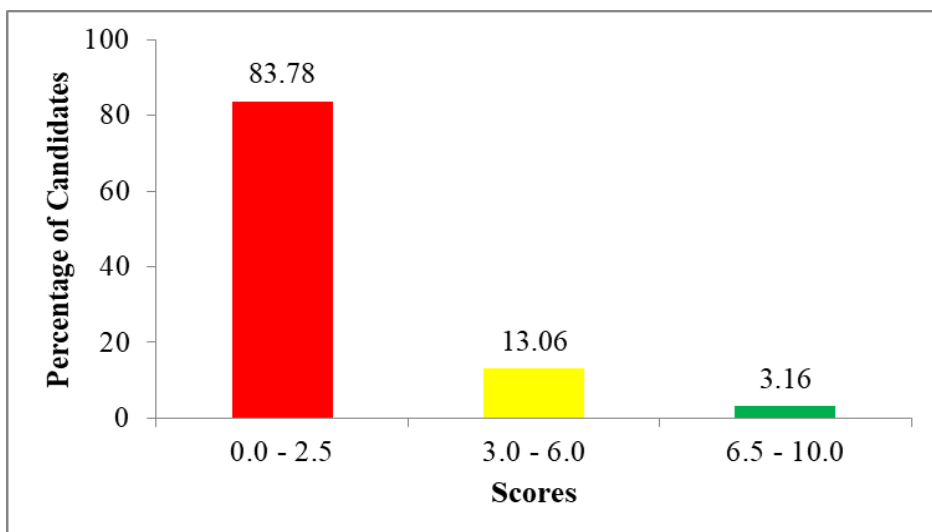
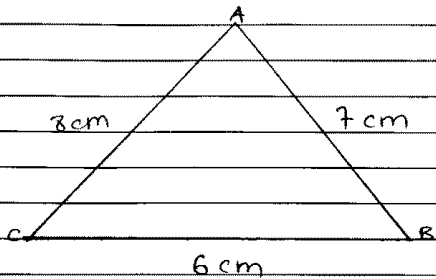


Figure 9: *Candidates' performance on question 9*

The analysis of the candidates' responses shows that, 71.09 percent of the candidates performed poorly on this question. They were incompetent in the concepts of Pythagoras' theorem and trigonometry. In part (a), the candidates used incorrect formulae such as $a^2 = b^2 - c^2 + 2bc \cos A$ and $a^2 = b^2 + c^2 + 2bc \cos A$ instead of $a^2 = b^2 + c^2 - 2bc \cos A$ that led to incorrect answers. In part (b), the candidates failed to draw a right-angled triangle and apply Pythagoras' theorem correctly. Consequently, they were unable to calculate the adjacent side $\overline{BC}$. Furthermore, the analysis reveals that, some candidates used a wrong formula such as $\tan C = \frac{\overline{AB}}{\overline{AC}}$ instead of $\tan C = \frac{\overline{AB}}{\overline{BC}}$. Extract 9.1 shows a sample of responses from a candidate who failed to answer this question correctly.

09 a) Find the largest angle of a triangle whose sides are 7cm, 6cm and 8cm.

solution



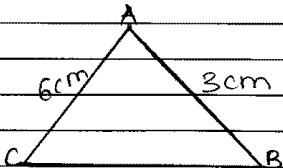
$$\Delta \frac{1}{2} = 7\text{cm} + 8\text{cm} + 6\text{cm}$$

$$\frac{1}{2} = \frac{21}{2}$$

$$= 10.5\text{cm}^2$$

= The largest angle of a triangle side 10.5cm²

b)



$$\Delta \frac{1}{2} = 6\text{cm} \times 3\text{cm} = ?$$

$$\frac{1}{2} = \frac{18}{2}$$

$$= 9\text{cm}$$

The length of BC = 9cm.

Extract 9.1: A sample of incorrect responses to question 9

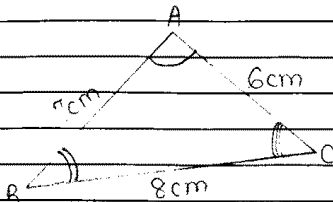
In Extract 9.1, part (a), the candidate calculated half of the sum of the given lengths of a triangle instead of calculating largest angle. In part (b), the candidate was unable to find length $\overline{BC}$ and $\tan C$ instead, he/she calculated half of the product of the sides for the given triangle.

On the other hand, the analysis shows that, 1.77 percent of the candidates performed well on this question. The candidates were competent in applying Pythagoras theorem and trigonometric ratios correctly. In part (a), the candidates managed to identify the largest

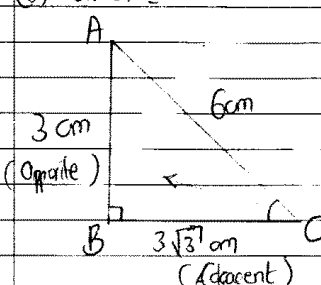
angle of the triangle. Then, they determined its measure by applying the cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$ to obtain 75.5° . In part (b), they were able to extract information and presented in a right-angled triangle

ABC and then obtained $\overline{BC} = 3\sqrt{3}\text{cm}$ and $\tan C = \frac{\sqrt{3}}{3}$ using

Pythagoras' theorem and trigonometric ratios, respectively. Extract 9.2 shows a sample of responses from a candidate who answered this question correctly.

9.	(a)	
		From cosine rule; $a^2 = b^2 + c^2 - 2bc \cos \hat{A}$
		Largest angle is the one which corresponds to the largest side
		$8^2 = 7^2 + 6^2 - 2(7 \times 6) \times \cos \hat{A}$
		$64 = 49 + 36 - 2 \times 42 \cos \hat{A}$
		$64 = 85 - 84 \cos \hat{A}$
		$85 - 64 = 84 \times \cos \hat{A}$
		$84 \cos \hat{A} = 85 - 64$
		$\cos \hat{A} = \frac{21}{84}$
		$\hat{A} = \cos^{-1} \left(\frac{21}{84} \right)$
		$\hat{A} = 76^\circ 31'$
		$\therefore$ The value of the largest angle is $76^\circ 31'$

9 (b) Given:



from Pythagoras' theorem

$$(\overline{AB})^2 + (\overline{BC})^2 = (\overline{AC})^2$$

$$(3\text{ cm})^2 + (\overline{BC})^2 = (6\text{ cm})^2$$

$$9\text{ cm}^2 + (\overline{BC})^2 = 36\text{ cm}^2$$

$$(\overline{BC})^2 = 36\text{ cm}^2 - 9\text{ cm}^2$$

where:

$$(\overline{BC})^2 = 27\text{ cm}^2$$

Apply square root both sides.

$$\sqrt{(\overline{BC})^2} = \pm \sqrt{27\text{ cm}^2}$$

Negative root (square root) is ignored since length is not in negative measurements (magnitude)

$$\underline{\overline{BC} = 3\sqrt{3}\text{ cm}}$$

where:

$$\tan C = \frac{\text{Opposite length } (\overline{AB})}{\text{Adjacent length } (\overline{BC})}$$

$$\tan C = \frac{3\text{ cm}}{3\sqrt{3}\text{ cm}} \times \frac{\sqrt{3}}{\sqrt{3}} \text{ --- where } \sqrt{3} \text{ is Rationalizing factor}$$

$$\tan C = \frac{3\sqrt{3}}{9}$$

$$\tan C = \frac{\sqrt{3}}{3} \approx 0.5774$$

$\therefore$ The length of $\overline{BC}$ is $\underline{3\sqrt{3}\text{ cm}}$ where the value of $\tan C$ is $\underline{\frac{\sqrt{3}}{3}}$

Extract 9.2: A sample of correct responses to question 9

Extract 9.2 shows that, in part (a) the candidate applied the cosine rule and got $75^\circ 31'$ as the measure of the largest angle of the given triangle. In part (b), the candidate applied the Pythagoras' theorem and trigonometric ratios correctly, hence he/she managed to get the required answers.

2.10 Question 10: Algebra and Quadratic Equations

The question consisted of two parts, (a) and (b). In part (a), the candidates were required to express the equation $\frac{2}{t^{10}} - \frac{3}{t^5} + 1 = 0$ in form $ax^2 + bx + c = 0$, given that $x = \frac{1}{t^5}$. In part (b), they were required to solve for x in the quadratic equation obtained in part (a).

The data analysis shows that 40,756 (7.34%) candidates passed, out of whom 31,513 (5.68%) candidates scored 4.0 to 6.0 marks. This indicates that the candidates' performance on this question was weak. Figure 10 summarizes the candidates' performance on this question.

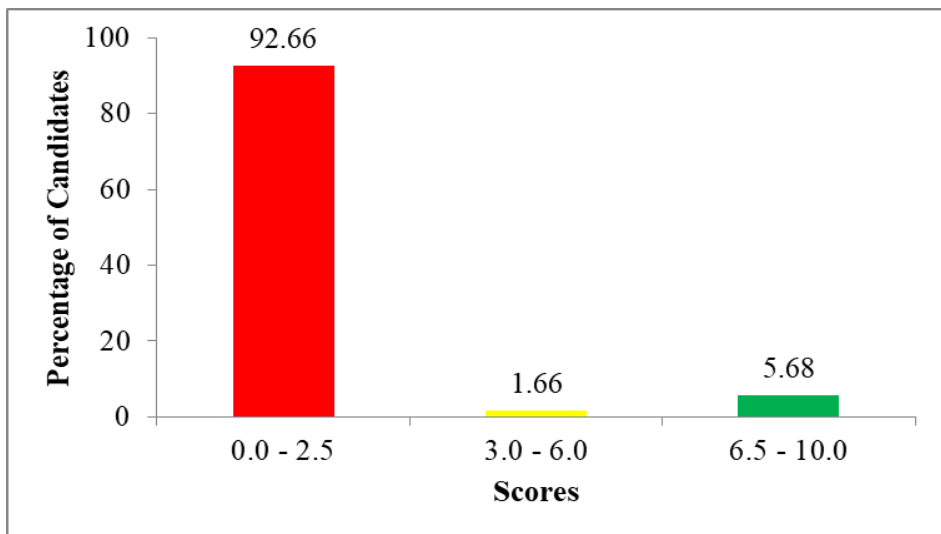


Figure 10: *Candidates' performance on question 10*

The analysis of responses indicates that, 89.63 percent of the candidates responded incorrectly to this question. In part (a), the candidates failed to apply the laws of exponents to transform the given equation into a quadratic equation. In part (b), they failed to answer the question as a result of failure to obtain the required quadratic equation in (a). Extract 10.1 shows a sample of responses from a candidate who answered the question incorrectly.

10.	(a)	$\frac{2}{t^10} - \frac{3}{t^5} + 1 = 0$
		$2 \times \frac{1}{t^5} \times \frac{1}{t^5} - 3 \times \frac{1}{t^5} + 1 = 0$
		but $\frac{1}{t^5} = x$
		$2 \times x \times x - 3 \times x + 1 = 0$
		$2x^2 - 3x + 1 = 0$
		$\therefore 2x^2 - 3x + 1 = 0$
	(b)	$2x^2 - 3x + 1 = 0$
		$2x^2 - 2x - x + 1 = 0$
		$(2x^2 - 2x) + (-x + 1) = 0$
		$2x(x-1) - 1(x-1) = 0$
		$(2x-1)(x-1) = 0$
		$2x-1=0 \quad x-1=0$
		$x = \frac{1}{2} \text{ or } x = 1$
		$\therefore x = \frac{1}{2} \text{ or } x = 1$

Extract 10.2: A sample of correct responses to question 10

Extract 10.2 shows that, the candidate managed to apply appropriate laws of exponent and used the given substitution to obtain the required quadratic equation and finally solved it correctly.

2.11 Question 11: Statistics

This question consisted of two parts, (a) and (b). The question stated that “In a Biology examination done by 100 students in a certain school, the marks scored were grouped in the following distribution table:

Marks	65 – 69	70 – 74	75 – 79	80 – 84	85 – 89	90 – 94
Number of Students	10	12	55	10	5	8

In part (a), the candidates were required to determine the number of students who scored marks ranging from 75 to 79. In part (b), they were required to find the median from the frequency distribution table to the nearest whole number.

The data analysis shows that 226,909 (40.86%) candidates passed, out of whom 140,939 (25.38%) candidates scored 6.5 to 10.0 marks. This indicates that the candidates' performance on this question was average. Figure 11 summarizes the candidates' performance on this question.

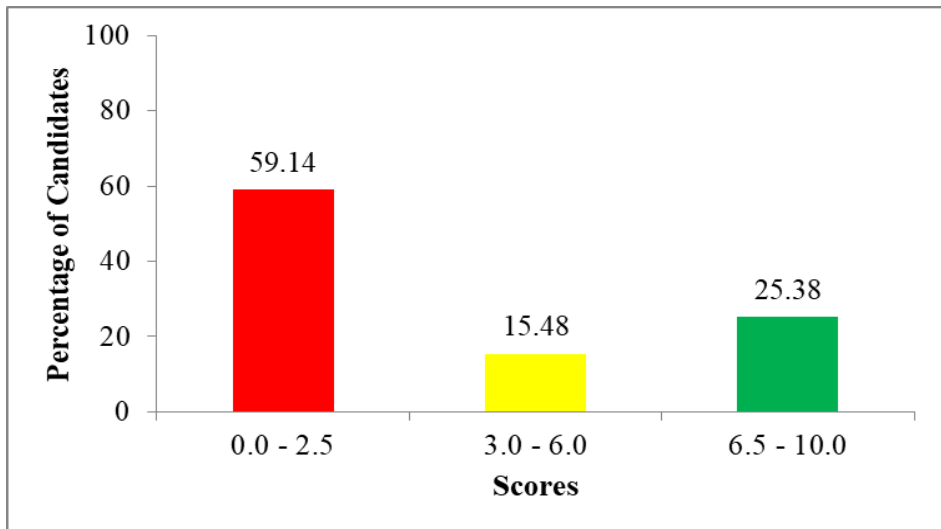


Figure 11: *Candidates' performance on question 11*

Further analysis reveals that 14.24 percent of the candidates scored full marks on this question. The responses of candidates demonstrated sufficient knowledge in statistics and approximations. In part (a), the candidates were able to recognize that 55 is the number of candidates who scored marks ranging from 75 to 79. In part (b), the candidates were able to apply the correct formula for finding the median. They substituted the correct values for computing the median and got $77.05 \approx 77$ as the median of the distribution approximated to the

nearest whole number. Extract 11.1 shows a sample of responses from a candidate who answered the question correctly.

11	The frequency distribution table.			
	Class interval	Real limit	frequency	Cumulative frequency
			f	
	65 - 69	64.5 - 69.5	10	10
	70 - 74	69.5 - 74.5	12	22
	75 - 79	74.5 - 79.5	55	77
	80 - 84	79.5 - 84.5	10	87
	85 - 89	84.5 - 89.5	5	92
	90 - 94	89.5 - 94.5	8	100
			$N = 100$	

11 (a) 55 students scored marks ranging from 75 to 79.

(b) from.

$$\text{Position of median} = \left(\frac{n}{2}\right)^{\text{th}}$$

$$= \left(\frac{100}{2}\right)^{\text{th}}$$

$$= 50^{\text{th}}$$

then

$$L = 74.5$$

$$f_c = 22$$

$$f_m = 55$$

$$C = 5$$

$$\text{Median} = L + \left(\frac{N/2 - f_c}{f_m}\right)C$$

$$= 74.5 + \left(\frac{100/2 - 22}{55}\right) \times 5$$

$$= 74.5 + 2.545$$

$$= 77.05$$

$$\approx 77 \text{ in nearest whole number}$$

$\therefore$ The median of distribution is 77

Extract 11.1: A sample of correct responses to question 11

Extract 11.1 shows that, in part (a), the candidate was able to identify the number of students who scored marks ranging from 75 to 79 from

the table. In part (b), the candidate applied the formula to calculate the median of the distribution correctly.

On the other hand, the analysis of responses indicates that, 35.34 percent of the candidates failed to answer this question correctly due to lack of competence on basic concepts of statistics and approximations. In part (a), the candidates computed the difference between 79 and 75 and then concluded it as a number of candidates who scored marks ranging from 75 to 79. In part (b), some candidates failed to substitute the correct values in the median formula. In addition, the candidates failed to perform basic operations in computing the median. Moreover, some candidates applied incorrect formulae such as

$$\text{Median} = L + \left(\frac{t_1}{t_1 + t_2} \right) c \text{ or } \text{Median} = \frac{\sum fx}{N} \text{ which produced wrong}$$

answers. Extract 11.2 shows a sample of responses from a candidate who answered the question incorrectly.

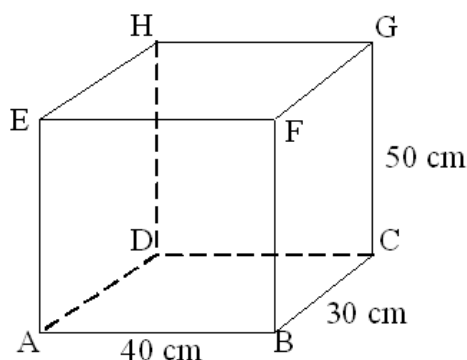
11	a) soln	
	There are	
	75-79 marks	
	student = ?	
	So, $\frac{75+79}{2}$	
	$= \frac{154}{2}$	
	$= 77$	
	$\therefore$ There are 77 student who scored marks	
	ranging from 75-79.	
	b) Median	
	solution.	
	10 12 55 10 38	
	$\frac{55+10}{2} = 65$	
	$= 22.5$	
	$\therefore$ The median of the distribution to the	
	nearest whole number is 22.5.	

Extract 11.2: A sample of incorrect responses to question 11

Extract 11.2 shows that, in part (a), the candidate had a misconception since he/she computed the class mark of the interval 75 to 79. In part (b), the candidate computed median for ungrouped data using inappropriate data. He/she considered wrongly the frequencies of the distribution as the data to be used.

2.12 Question 12: The Earth as a Sphere and Three-Dimensional Figures

This question comprised of two parts, (a) and (b). In part (a), the candidates were required to use the substitution $\frac{2\pi R}{360^\circ} = 111.6$, where R is the radius of the Earth to calculate the distance in kilometres along the circle of latitude between the places located at $X(60^\circ N, 30^\circ E)$ and $Y(60^\circ N, 40^\circ E)$. In part (b), they were given a closed rectangular box ABCDEFGH as shown in the following figure:



In part (b)(i), the candidates were required to calculate the length of $\overline{AG}$, leaving the answer in surd form and in (b)(ii), they were required to find the total area that is to be painted if the faces of the sides are to be painted with colour on the outer surfaces.

The data analysis shows that 133,527 (24.04%) candidates passed, out of whom, 56,290 (10.13%) candidates scored 6.5 to 10.0 marks. This indicates that the candidates' performance on this question was weak. Figure 12 summarizes the candidates' performance on this question.

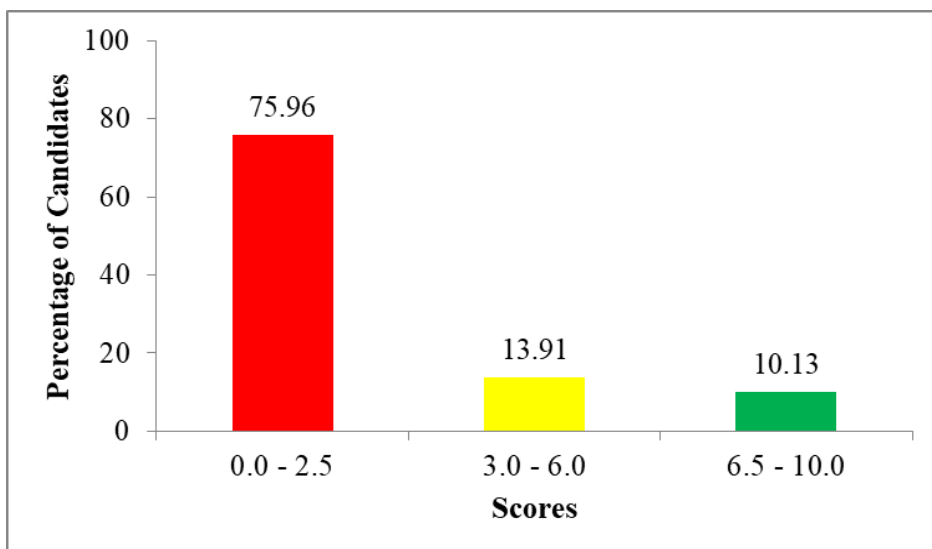
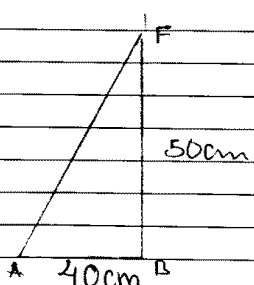


Figure 12: *Candidates' performance on question 12*

The analysis of the candidates' responses shows that, 62.08 percent of the candidates failed to answer this question correctly. In Part (a), they used the formula for calculating the distance along the great circle that is $\text{distance} = \frac{\theta}{360^\circ} \times 2\pi R \text{ km}$ instead of using the formula for calculating the distance along the circle of latitude that is $\text{distance} = \frac{2\pi R}{360^\circ} \cos \alpha \times \theta \text{ km}$. Further analysis reveals that, some candidates computed incorrectly the change in degree in longitude α . They added 30° and 40° to get 70° instead of subtracting 30° from 40° to get 10° , which is the correct measure of angle α . Furthermore, other candidates failed to use the substitution $\frac{2\pi R}{360^\circ} = 111.6$ in the formula, $\text{distance} = \frac{2\pi R}{360^\circ} \cos \alpha \times \theta \text{ km}$. In part (b)(i), the candidates were not able to identify the right-angled triangle which includes the length $\overline{AG}$ from the given closed rectangular box ABCDEFGH. This led to incorrect calculation of the length $\overline{AG}$. In part (b)(ii), the candidates failed to calculate the total surface area (A) of outer surfaces of the closed rectangular box due to the use of wrong formulae such as $A = l \times w \times h$ or $A = l^2$ instead of

$A = 2 \times (\text{sum of areas of faces } ABCD, ABEF \text{ and } BCGF)$. This indicates that, the candidates lacked basic knowledge and skills of calculating the lengths and surfaces areas of three-dimensional figures. Extract 12.1 shows a sample of responses from a candidate who answered to this question incorrectly.

12. (a)	where by	
	$\pi = 3.14$	
$d = \frac{2\pi R (B - \alpha)}{360}$	$R = 6400$	
	$B = 40$	
	$\alpha = 30$	
$d = \frac{2(3.14) \times 6400 (40 - 30)}{360} \text{ km}$		
$= \frac{40192(10)}{360}$		
$\left(\frac{401920}{360} \right) \text{ km}$		
1116.44 km.		
$\therefore \text{ distance of the circle of latitude are}$		
1116.44 km.		

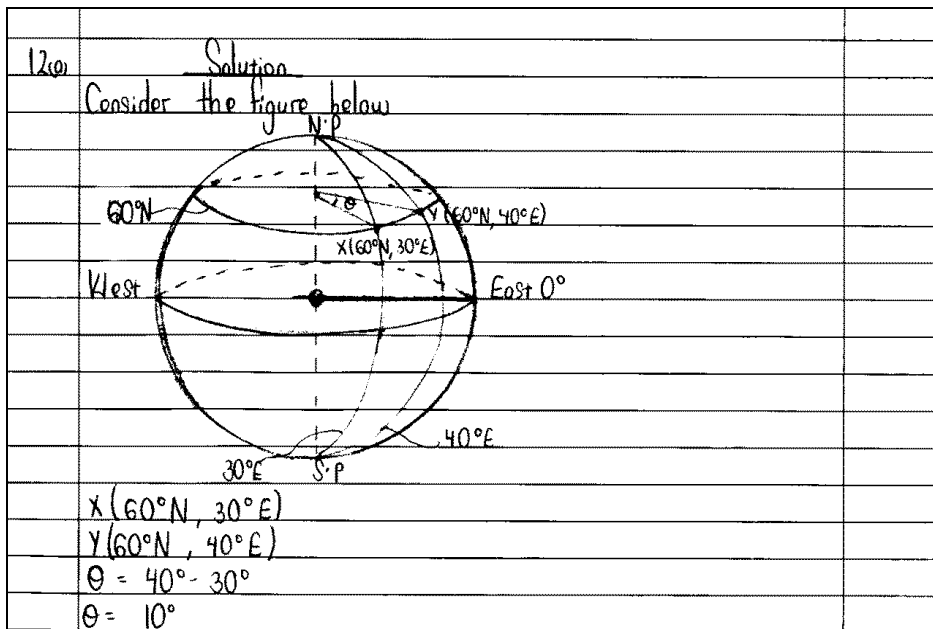
12	bs(i)	Solution	
			
		$\overline{AB}^2 + \overline{BF}^2 = \overline{AF}^2$ $(40\text{cm})^2 + (50\text{cm})^2 = \overline{AF}^2$ $1600\text{cm} + 25000\text{cm} = \overline{AF}^2$ $\sqrt{4100} = \sqrt{\overline{AF}^2}$ $\overline{AF} = 64.03$	
	(ii)	Total area = $\frac{1}{2}$ (area of base) $\times$ height $= \frac{1}{2} (40\text{cm} \times 30\text{cm}) \times 50\text{cm}$ $= (600 \times 50)\text{cm}$ $= 30,000\text{cm}^2$ ∴ Total area was 30000cm² to be painted.	

Extract 12.1: A sample of incorrect responses to question 12

Extract 12.1 shows that, in part (a) the candidate was unable to use the appropriate formula, and the given substitution. In part (b)(i), the candidate failed to identify the right-angled triangle containing the side $\overline{AG}$ which led to incorrect answer. In part (b)(ii), the candidate used a wrong formula to calculate the total surface area of a closed rectangular figure.

On the other hand, 2.98 percent of the candidates answered the question correctly. The candidates demonstrated sufficient competence in the

basic tenets of the Earth as a sphere and three-dimensional figures. In part (a), they used the correct formula for the distances between places along the circle of latitudes, that is, distance = $\frac{2\pi R}{360^\circ} \cos \alpha \times \theta$ km. Then, they made the correct substitution $\frac{2\pi R}{360^\circ} = 111.6$ and computed the distance along the circle of latitude to get 558 km. In part (b)(i), the candidates were able to extract and draw a right-angled triangle ACG from the closed rectangular box $ABCDEFGH$. They calculated the length of $\overline{AG} = 50\sqrt{2}$ cm as required. In part (b)(ii), they calculated the total surface area of the outer surfaces by using the formula $A = 2 \times (\text{sum of areas of faces } ABCD, ABEF \text{ and } BCGF)$ and got $9,400\text{cm}^2$ which is the correct answer. The candidates demonstrated good mastery of basic concepts of three-dimensional figures. Extract 12.2 shows a sample of responses from a candidate who answered the question correctly.



12. (a) From: Distance = $\frac{\theta}{360^\circ} \times 2\pi R \cos L$

$$= \frac{2\pi R \theta}{360^\circ} \times \cos L$$

where $\frac{2\pi R}{360^\circ} = 111.6$

$$= 111.6 \theta \times \cos L$$

$$= 111.6 \times 10 \times \cos L$$

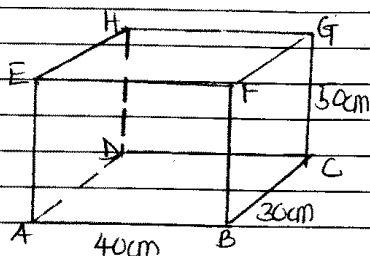
$$= 1116 \times \cos 60$$

$$= 558 \text{ kilometers}$$

$\therefore$ Distance = 558 kilometers

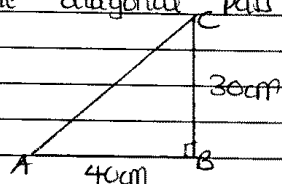
12. (b) Solution

Consider the diagram



(i) The length of $\overline{AG}$

Consider the diagonal $\overline{AC}$ pass in $\overline{ABCD}$



From pythagoras' theorem

$$(\overline{AB})^2 + (\overline{BC})^2 = (\overline{AC})^2$$

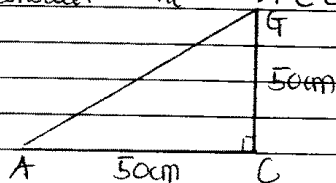
$$(40)^2 + (30)^2 = (\overline{AC})^2$$

$$1600 + 900 = \overline{AC}^2$$

$$\overline{AC} = \sqrt{2500}$$

$$\underline{\overline{AC} = 50\text{cm}}$$

Then consider the $\triangle ACG$



12.	(b) (i) From Pythagoras' theorem	
	$(AC)^2 + (GC)^2 = (AG)^2$	
	$(50)^2 + (50)^2 = (AG)^2$	
	$2500 + 2500 = (AG)^2$	
	$AG^2 = 5000 \text{ cm}^2$	
	$\therefore AG = 50\sqrt{2} \text{ cm}$	
	♣ The length AG is $50\sqrt{2} \text{ cm}$	
	(ii) Solution	
	Total surface area	
	$2(\text{Area of rectangle } AB EF) + 2(\text{Area of } BCFG) + (\text{Area of } ABCD) \times 2$	
	$= 2(40 \text{ cm} \times 30 \text{ cm}) + 2(30 \text{ cm} \times 50 \text{ cm}) + 2(40 \text{ cm} \times 50 \text{ cm})$	
	$= 2(1200 \text{ cm}^2) + 2(1500 \text{ cm}^2) + 2(2000 \text{ cm}^2)$	
	$= 2400 \text{ cm}^2 + 3000 \text{ cm}^2 + 4000 \text{ cm}^2$	
	$= 9400 \text{ cm}^2$	
	$\therefore$ The total area that is to be painted is 9400 cm^2	

Extract 12.2: A sample of correct responses to question 12

Extract 12.2 shows that, in part (a), the candidate was able to recall the correct formula and calculate the distance along the circle of latitude as required. In part (b), the candidate applied correctly the Pythagoras' theorem after extracting a right-angled triangle. Also, he/she applied the correct formula to calculate the total surface area of a closed rectangular prism to obtain the required answer.

2.13 Question 13: Matrices and Transformations

This question comprised two parts, (a) and (b). In part (a), the candidates were required to find the value of a if $G = \begin{pmatrix} -1 & 11 \\ a & 3 \end{pmatrix}$ is a

singular matrix. In part (b), they were required to use the matrix method to solve the simultaneous equations $5x + 3y = 9$ and $10x + 7y = 11$.

The data analysis shows that 155,751 (28.05%) candidates passed, out of whom, 99,231 (17.87%) candidates scored 6.5 to 10.0 marks. This indicates that the candidates' performance on this question was weak. Figure 13 summarizes the candidates' performance on this question.

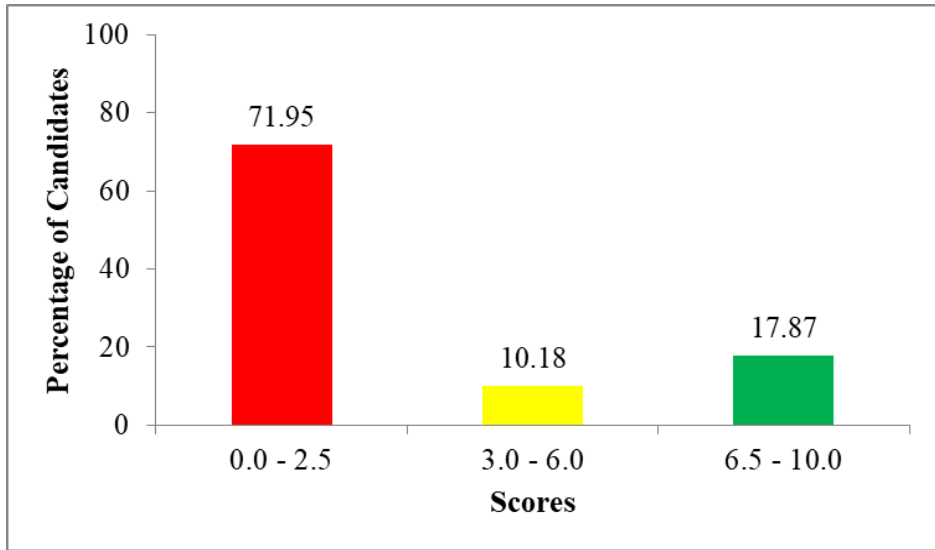


Figure 13: *Candidates' performance on question 13*

The analysis of the candidates' responses shows that, 62.87 percent of the candidates failed to answer this question correctly. In part (a), the candidates could not recognize that the determinant of a singular matrix is zero. Further analysis reveals that, there were candidates who failed to perform operations on integers that led to obtaining a wrong value of a . In part (b), they failed to re-write the system of simultaneous equations in matrix form. For instance, they wrote $\begin{pmatrix} 5 & 10 \\ 3 & 7 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 9 \\ 11 \end{pmatrix}$

instead of $\begin{pmatrix} 5 & 3 \\ 10 & 7 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 9 \\ 11 \end{pmatrix}$. In addition, some candidates performed

wrong computations of the determinant. They wrote $\begin{vmatrix} 5 & 3 \\ 10 & 7 \end{vmatrix} = (10 \times 3) - (5 \times 7) = -5$ instead of $\begin{vmatrix} 5 & 3 \\ 10 & 7 \end{vmatrix} = (5 \times 7) - (10 \times 3) = 5$.

Further analysis shows that, the candidates failed to interchange the elements in the leading diagonal and signs in the main diagonal in the process of finding the inverse. This reveals that, the candidates lacked skills on the basic operations and inverse of matrices. Extract 13.1 shows a sample of responses from a candidate who failed to answer this question correctly.

13.(a) Solution:	
$G = \begin{pmatrix} -1 & 11 \\ a & 3 \end{pmatrix}$	
$3 + a = 11$	
$a = 11 - 3$	
$a = 8$	
$\therefore$ The value of $a = 8$.	
(b) Solution:	
$\begin{cases} 5x + 3y = 9 \\ 10x + 7y = 11 \end{cases}$	
$\begin{array}{r} -5x + -4y = -2 \\ -5x - 4y = -2 \\ \hline +5x = 12 \\ \hline \end{array}$	
$x = \frac{2}{5} \text{ or } 0.4$	
$\begin{array}{r} 5x + 3y = 9 \\ 5(0.4) + 3y = 9 \\ 2 + 3y = 9 \\ 3y = 9 - 2 \\ 3y = 7 \\ \hline y = \frac{7}{3} \end{array}$	
$y = 2.3$	
$\therefore x = 0.4, y = 2.3$	

Extract 13.1: A sample of incorrect responses to question 13

Extract 13.1 shows that, in part (a), the candidate was unable to calculate the determinant of the given matrix, hence failed to get the

correct answer. In part (b), the candidate subtracted the second equation from the first and performed irrelevant computations that were meaningless.

Despite the weak performance on this question, the analysis of candidates' performance shows that, 10.14 percent of the candidates answered this question correctly. This indicates that the candidates acquired and mastered the required basic concepts on operations and inverse of matrices. In part (a), the candidates were able to recognize that the determinant of a singular matrix is zero. Then, they formulated an equation from the determinant and solved it to get $a = -\frac{3}{11}$. In part (b), they managed to re-write the system of simultaneous equations in the form $\begin{pmatrix} 5 & 3 \\ 10 & 7 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 9 \\ 11 \end{pmatrix}$. Then, they calculated correctly the inverse of the coefficient matrix. Finally, pre-multiplication was done to obtain $x=6$ and $y=-7$. Extract 13.2 shows a sample of responses from a candidate who answered the question correctly.

13	Qn Solution Given: $G = \begin{pmatrix} -1 & 11 \\ a & 3 \end{pmatrix}$ For singular matrix, determinant is 0 ($G = 0$) $ G = \begin{vmatrix} -1 & 11 \\ a & 3 \end{vmatrix}$ $0 = (-1 \times 3) - (a \times 11)$ $0 = -3 - 11a$ $\frac{11a}{11} = \frac{-3}{11}$ $\therefore$ The value of a is $\frac{-3}{11}$	

13 (b)

Solution.

Given:
$$\begin{cases} 5x + 3y = 9 \\ 10x + 7y = 11 \end{cases}$$

By matrix method

Expressing the equation into matrix form

$$\begin{pmatrix} 5 & 3 \\ 10 & 7 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 9 \\ 11 \end{pmatrix}$$

First finding its inverse

Let A represent matrix $\begin{pmatrix} 5 & 3 \\ 10 & 7 \end{pmatrix}$

$$|A| = \begin{vmatrix} 5 & 3 \\ 10 & 7 \end{vmatrix}$$

$$|A| = (5 \times 7) - (3 \times 10)$$

$$|A| = 35 - 30$$

$$|A| = 5$$

$$\text{Adjoint of } A = \begin{pmatrix} 7 & -3 \\ -10 & 5 \end{pmatrix}$$

$$A^{-1} = \frac{1}{|A|} \times \text{adjoint of } A$$

$$A^{-1} = \frac{1}{5} \times \begin{pmatrix} 7 & -3 \\ -10 & 5 \end{pmatrix}$$

$$A^{-1} = \begin{pmatrix} 7 \times \frac{1}{5} & -3 \times \frac{1}{5} \\ -10 \times \frac{1}{5} & 5 \times \frac{1}{5} \end{pmatrix}$$

	$A^{-1} = \begin{pmatrix} \frac{7}{5} & -\frac{3}{5} \\ -\frac{10}{5} & \frac{5}{5} \end{pmatrix}$	
	Pre-multiply A^{-1} on both sides of the matrix equation.	
	$\begin{pmatrix} \frac{7}{5} & -\frac{3}{5} \\ -\frac{10}{5} & \frac{5}{5} \end{pmatrix} \begin{pmatrix} 5 & 3 \\ 10 & 7 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \frac{7}{5} & -\frac{3}{5} \\ -\frac{10}{5} & \frac{5}{5} \end{pmatrix} \begin{pmatrix} 9 \\ 11 \end{pmatrix}$	
	Since $A \times A^{-1} = I$ where $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$	
	Then,	
	$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \frac{7}{5} \times 9 + -\frac{3}{5} \times 11 \\ -\frac{10}{5} \times 9 + \frac{5}{5} \times 11 \end{pmatrix}$	
	$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \frac{63}{5} - \frac{33}{5} \\ -\frac{90}{5} + \frac{55}{5} \end{pmatrix}$	
	$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \frac{30}{5} \\ -\frac{35}{5} \end{pmatrix}$	
	$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 6 \\ -7 \end{pmatrix}$	
	<u>$\therefore$ The value of x is 6 and y is -7</u>	

Extract 13.2: A sample of correct responses to question 13

Extract 13.2 shows that, in part (a), the candidate was able to find the value of a by performing the necessary steps. In part (b), the candidate was able to use the inverse of matrix to solve the given simultaneous equations.

2.14 Question 14: Functions and Linear Programming

The question consisted of two parts, (a) and (b). In part (a), the candidates were required to find the product of $f^{-1}(x)$ and $g^{-1}(x)$, given that $f(x) = x + 2$ and $g(x) = 3x - 2$. In part (b), the question stated that, “A tailor has 150 m^2 of cotton material and 90 m^2 of wool material. He wants to make two types of clothes. A suit requires 1 m^2 of cotton and 2 m^2 of wool while a gown requires 3 m^2 of cotton and 1 m^2 of wool. If a suit is sold at Tsh 40,000 and a gown at Tsh 60,000; formulate the objective function and the linear inequalities representing this information.”

The data analysis shows that 91,539 (16.48%) candidates passed, out of whom 37,942 (6.83%) candidates scored 6.5 to 10.0 marks. This indicates that the candidates’ performance on this question was weak. Figure 14 summarizes the candidates’ performance on this question.

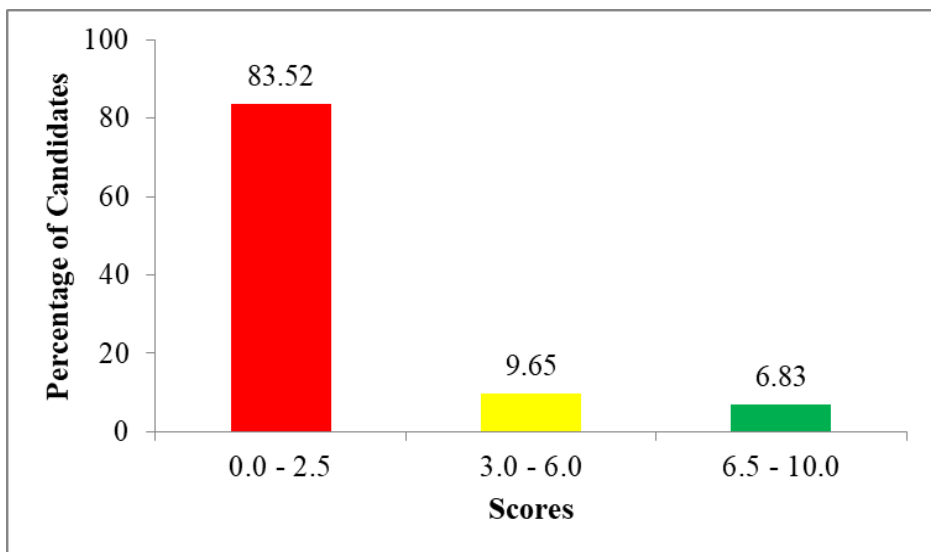


Figure 14: *Candidates’ performance on question 14*

The analysis of the candidates’ responses shows that, 76.14 percent of the candidates failed to respond to this question correctly. This shows that, the candidates were incompetent in finding the inverse of linear functions and formulation of linear programming models. In part (a),

the candidates failed to find the inverse of $f(x)$ and $g(x)$ as well as the product of $f^{-1}(x)$ and $g^{-1}(x)$. In part (b), some candidates failed to define the decision variables correctly and used inappropriate inequality signs $\geq$, $>$, $=$ and $<$ instead of $\leq$. For example, they wrote $x+3y \geq 150$, $2x+y \geq 90$ instead of $x+3y \leq 150$, $2x+y \leq 90$. Extract 14.1 shows a sample of responses from a candidate who answered the question incorrectly.

4 a. Product of Inverse
 $(y+2)(3y-2)$
 $y(3y-2) + 2(3y-2)$
 $3y^2 - 2y + 6y - 4$
 $3y^2 + 4y - 4$
 product of the inverse equals to
 $3y^2 + 4y - 4$

14. b. soln
 Table to represent the information

Clothes	Cotton	wool	minimum
Suit	1	2	40,000 Ish.
Gown	3	1	60,000 Ish.
Total	150	90	

let x number of cotton
 y number of wool
 objective function
 $150x + 90y$
 but
 linear inequalities
 $x + 2y \leq 40,000$
 $3x + y \leq 60,000$
 $x \leq 0$
 $y \leq 0$

Extract 14.1: A sample of incorrect responses to question 14

Extract 14.1 shows that, in part (a), the candidate calculated the product of the functions provided contrary to the requirement of the question. In part (b), the candidate defined the decision variables wrongly and formulated incorrect constraints by using the given prices which is a wrong approach.

Despite the weak performance on this question, 1.78 percent of the candidates answered this question correctly. In part (a), the candidates managed to perform all the necessary steps in finding the inverses of the given functions. Finally, they were able to get the product of the inverse functions, that is, $f^{-1}(x)g^{-1}(x) = \frac{x^2 - 4}{3}$. In part (b), they were able to define correctly the decision variables x and y to represent the number of suits and gowns, respectively. They managed to formulate the objective function *maximize* $f(x, y) = 40,000x + 60,000y$ and its constraints $x + 3y \leq 150$, $2x + y \leq 90$, $x \geq 0$ and $y \geq 0$. Extract 14.2 shows a sample of responses from a candidate who answered the question correctly.

14.	(a). Solution.	
	$f(x) = x+2.$	
	let $f(x)$ be $y.$	
	$y = x+2$	
	$x = y-2$ (interchange 'x' and 'y')	
	$x-2 = y$	
	thus $y = f(x)$	
	$f^{-1}(x) = x-2.$	
	$g(x) = 3x-2.$	
	let $g(x) = y.$	
	$y = 3x-2.$	
	$x = \frac{y+2}{3}$ (interchange 'x' and 'y').	
	$\frac{x+2}{3} = \frac{3y}{3}.$	
	$\frac{x+2}{3} = y.$	
	$g^{-1}(x) = \frac{x+2}{3}$	
	Req. product of $f^{-1}(x)$ and $g^{-1}(x)$	
	$f^{-1}(x) \times g^{-1}(x) = (x-2) \left(\frac{x+2}{3} \right)$	
	$f^{-1}(x) \times g^{-1}(x) = x \left(\frac{x+2}{3} \right) - 2 \left(\frac{x+2}{3} \right)$	
14.	(a) $\frac{x^2+2x}{3} - \frac{2x-4}{3}$	
	$\frac{x^2-4}{3}$	
	$\therefore$ Product of $f^{-1}(x)$ and $g^{-1}(x) = \frac{x^2-4}{3}.$	

(b) <u>Solution:</u>			
	SUIT	GOWN	TOTAL
Cotton	1 x	3 y	150 m ²
Wool	2 x	1 y	90 m ²
Sold at	40,000 x	60,000 y	
Let: x be the number of Suits			
y be the number of gowns			
Therefore:			
The objective function is			
$\max f(x,y) = 40,000x + 60,000y$ Subject to			
the following constraints:-			
$x + 3y \leq 150$ — (i)			
$2x + y \leq 90$ — (ii)			
$x \geq 0$ — (iii)			
$y \geq 0$ — (iv)			

Extract 14.2: A sample of correct responses to question 14

Extract 14.2 shows that, in part (a), the candidate succeeded to obtain the product of the inverses by performing all the required steps. In part (b), the candidate was able to formulate the linear programming model with the correct objective function and its constraints.

3.0 ANALYSIS OF CANDIDATES' PERFORMANCE ON EACH TOPIC

The data analysis reveals that, out of 25 topics which were examined in Basic Mathematics in CSEE 2025, four (04) topics had an average performance. The topics were: Rates and Variations (42.09%), Statistics (40.86%), Sets and Probability (34.49%). The rest of the topics had a weak performance. Those topics include: Approximations, Fractions, Decimals and Percentages (28.79%), Matrices and Transformations

(28.05%), Exponents, Radicals, and Logarithms (27.43%), The Earth as a Sphere and Three-Dimensional Figures (24.04%), Accounts, Ratios, Profit and Loss (19.95%), Geometry, Perimeters and Areas (18.78%), Coordinate Geometry and Vectors (17.35%), Functions and Linear Programming (16.48%), Pythagoras' Theorem and Trigonometry (16.22%), Sequences and Series (15.07%), Algebra and Quadratic Equations (7.34%). A summary of the candidates' performance by topic is presented in the Appendix provided at the end of this report.

4.0 CONCLUSION

Basic Mathematics is an essential subject that provides a foundation for learning in various academic disciplines and fosters the development of key skills, including logical reasoning, problem-solving, and critical thinking. Also, it has various applications in daily life, particularly in measurement, financial calculations, and interpretation of data. Consequently, strong competence in Basic Mathematics is necessary for both academic success and practical use.

The analysis of candidates' responses in the 2025 Certificate of Secondary Education Examination (CSEE) in Basic Mathematics indicates that overall performance is weak. A large proportion of candidates faced challenges in recalling and correctly applying mathematical formulae, rules, and laws, as well as in formulating and simplifying mathematical expressions and solving equations. Additional difficulties were observed in interpreting figures and diagrams and in performing basic computational procedures, reflecting inadequate mastery of fundamental concepts in most topics examined.

Enhancing performance in Basic Mathematics requires coordinated efforts from both teachers and students. Teachers should place emphasis on strengthening foundational concepts and employ effective learner-centred teaching strategies, while students are encouraged to participate actively in learning through regular practices. These combined efforts are expected to lead to improved performance in future examinations.

5.0 RECOMMENDATIONS

Based on the analysis of candidates' responses in the 2025 Certificate of Secondary Education Examination (CSEE) in Basic Mathematics, the following recommendations are provided to address the key weaknesses identified:

(a) Improving Correct Formulation of Mathematical Expressions and Equations

Teachers should emphasize systematic interpretation of questions by guiding learners to identify given information, unknown quantities, and required relationships before writing the solutions. More practices should be provided in formulating expressions, equations, objective functions, and linear inequalities from word problems involving rates, ratios, variations, functions, linear programming, and algebra. Learners should also be trained to sketch clear and relevant diagrams as part of problem formulation, particularly in geometry, coordinate geometry, and three-dimensional figures.

(b) Strengthening Application of Mathematical Concepts and Formulae

Teachers should guide learners to understand the conditions under which specific formulae, theorems, and laws are applied rather than memorizing them. Emphasis should be placed on deriving formulae for perimeters, areas, volumes, trigonometric ratios, and algebraic relationships. Real-life applications drawn from the learners' environment—such as measurements, financial transactions, and construction-related examples—should be used to reinforce correct application of concepts in geometry, trigonometry, statistics, probability, and sequences.

(c) Enhancing Procedural Knowledge and Computational Accuracy

Teachers should reinforce step-by-step solution procedures, particularly in topics such as algebraic manipulation, quadratic equations, exponents, radicals, logarithms, matrices, and statistics. Learners should be trained to show logical working, apply mathematical laws consistently, and verify answers where possible. Regular drills, guided practice, and feedback should be used to improve accuracy and fluency in computation.

(d) Improving Interpretation, Reasoning, and Problem-solving Skills

Teachers should place greater emphasis on interpretation of tabular and diagrammatic information in coordinate geometry, vectors, statistics, sets, and probability. Learners should be encouraged to explain results in mathematical terms and relate answers to the context of the problem. Continuous assessment activities such as short tests, quizzes, and remedial exercises should focus on reasoning and problem-solving skills.

APPENDIX**Candidates' Performance by Topic in CSEE 2025**

S/N	Topic(s)	Question Number	Percentage of Candidates who Scored 30% or Above	Remarks
1.	Rates and Variations	5	42.09	Average
2.	Statistics	11	40.86	Average
3.	Sets and Probability	3	34.49	Average
4.	Approximations, Fractions, Decimals and Percentages	1	28.79	Weak
5.	Matrices and Transformations	13	28.05	Weak
6.	Exponents, Radicals, and Logarithms	2	27.43	Weak
7.	The Earth as a Sphere and Three Dimensional Figures	12	24.04	Weak
8.	Accounts, Ratios, Profit and Loss	7	19.95	Weak
9.	Geometry, Perimeters and Areas	4	18.78	Weak
10.	Coordinate Geometry and Vectors	6	17.35	Weak
11.	Functions and Linear Programming	14	16.48	Weak
12.	Pythagoras' Theorem and Trigonometry	9	16.22	Weak
13.	Sequence and Series	8	15.07	Weak
14.	Algebra and Quadratic Equations	10	7.34	Weak

The first part of the paper discusses the importance of understanding the local context in which a project is implemented. This includes a thorough analysis of the social, cultural, and economic factors that may influence the success or failure of the intervention. It is essential to engage with local stakeholders from the outset to ensure that the project is relevant and sustainable.

The second part of the paper focuses on the design and implementation of the project. This involves developing a clear set of objectives and a detailed plan of action. It is important to monitor and evaluate the progress of the project regularly to ensure that it is on track and making a positive impact.

The third part of the paper discusses the challenges and opportunities that may arise during the implementation of the project. This includes identifying potential risks and developing strategies to mitigate them. It is also important to recognize the strengths and resources of the local community and build on these to achieve the project's goals.

The final part of the paper provides a conclusion and a summary of the key findings. It emphasizes the importance of ongoing communication and collaboration between all stakeholders involved in the project. The paper also offers some suggestions for further research and practice in this area.