

**THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA**



**STUDENTS' ITEM RESPONSE ANALYSIS  
REPORT FOR THE FORM TWO NATIONAL  
ASSESSMENT (FTNA) 2015**

**041 BASIC MATHEMATICS**

**THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA**



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**041 BASIC MATHEMATICS**

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## Table of Contents

FOREWORD.....	iv
1.0 INTRODUCTION .....	1
2.0 ANALYSIS OF STUDENTS' PERFORMANCE IN EACH QUESTION .....	2
2.1 Question 1: Algebra.....	2
2.2 Question 2: Approximations .....	3
2.3 Question 3: Geometry .....	5
2.4 Question 4: Algebra.....	6
2.5 Question 5: Algebra.....	7
2.6 Question 6: Algebra.....	8
2.7 Question 7: Algebra.....	9
2.8 Question 8: Perimeters and Areas .....	11
2.9 Question 9: Exponents and Radicals .....	12
2.10 Question 10: Algebra.....	14
2.11 Question 11: Algebra.....	15
2.12 Question 12: Fractions, Decimals and Percentages.....	16
2.13 Question 13: Fractions and Units .....	18
2.14 Question 14: Algebra.....	19
2.15 Question 15: Algebra.....	20
2.16 Question 16: Logarithms .....	21
2.17 Question 17: Numbers.....	22
2.18 Question 18: Coordinate Geometry.....	24
2.19 Question 19: Perimeters and Areas .....	25
2.20 Question 20: Ratio, Profit and Loss .....	26
2.21 Question 21: Perimeters and Areas .....	28
2.22 Question 22: Logarithms .....	29
2.23 Question 23: Trigonometry .....	31
2.24 Question 24: Sets.....	32
2.25 Question 25: Similarity .....	34
3.0 ANALYSIS OF STUDENTS' PERFORMANCE IN EACH TOPIC.....	36
4.0 CONCLUSION.....	37
5.0 RECOMMENDATIONS.....	37
Appendix I.....	38
Appendix II.....	39
Appendix III .....	40

## **FOREWORD**

The Students' Item Response Analysis Report has been prepared in order to provide feedback to teachers, students, policy makers and other education stake holders on how the students responded to the questions of the Form Two National Assessment (FTNA) 2015 in Basic Mathematics subject. The analysis of students' responses shall be one of the indicators that show areas where students were capable and keen in learning and those which they were not.

The analysis of students' responses shows that the reasons that have contributed to students failing to attempt some of the questions correctly are: lack of knowledge and skills in a specific topic; the use of incorrect formula, concepts and laws; inability to identify the task of the questions; and failure of students to interpret word problems mathematically and diagrammatically. Extracts of the students' responses from the scripts were used in this report to illustrate the reasons behind the poor or good performance and could be used as a helpful and practical guide by teachers and students.

The National Examinations Council of Tanzania believes that the education stakeholders will work on the challenges the students faced while attempting the assessment questions in order to take appropriate measures to improve the performance in this subject.

The National Examinations Council of Tanzania will highly appreciate comments and suggestions from teachers, students and the public in general for improving future Students' Item Response Analysis Reports.

Finally, the Council would like to thank all the Examination Officers and others who participated in the preparation of this report.



Dr. Charles E. Msonde  
**EXECUTIVE SECRETARY**

## **1.0 INTRODUCTION**

This report presents the analysis of the students' performance in each question of the 041 Basic Mathematics Paper for the Form Two National Assessment (FTNA) 2015. The analysis highlights the strengths and weaknesses that were observed from the students' responses in order to provide a general picture of the students' performance.

The 041 Basic Mathematics paper consisted of two (2) sections namely A and B with a total of 25 questions set in accordance with the 2005 revised syllabus. The paper focused only on the topics taught in Form one and Form two. The duration of this assessment paper was two and half hours. Section A contained the first 20 questions, each carrying 3 marks; while section B contained the last 5 questions each carrying 8 marks. All questions in both sections A and B were compulsory.

In 2015, a total of 362,965 students sat for the 041 Basic Mathematics paper, out of which 55,217 (15.21%) students passed. As compared to the FTNA 2014 results, 69,332 (18.15%) students passed. This indicates that the performance in 2015 has dropped by 2.94 percent.

An analysis of the individual questions is herein presented. It comprises a brief account of the requirements of the questions and the performance of students. The factors that accounted for good and poor performance in each question have been indicated and illustrated using samples of students' responses.

## 2.0 ANALYSIS OF STUDENTS' PERFORMANCE IN EACH QUESTION

This section gives the analysis of the students' performance in each question. The performance in each question was considered as good; average or weak if the percentage of students who scored 30 percent or more of the marks allocated for the question lied in the intervals 50 – 100, 30 – 49 and 0 – 29 respectively.

### 2.1 Question 1: Algebra

The students were required to find the value of  $x + y + 2z - 12$ , when  $x = 5$ ,  $y = 8$  and  $z = 9$ .

The question was done by 362,965 students of which 44.9 percent scored from 1 to 3 marks. Among them 37.2 percent scored all the 3 marks. This question was therefore averagely performed.

The students who scored full marks were able to substitute the given values in the expression  $x + y + 2z - 12$  correctly and performed the associated addition, subtraction and multiplication operations accurately to get the required answer. A sample response from one of the students is shown in Extract 1.1.

#### Extract 1.1

Solution

$$\begin{aligned} &= x + y + 2z - 12 \\ &\quad \text{where } x=5, y=8, z=9 \text{ (substitute)} \\ &= 5 + 8 + 2 \times 9 - 12 \\ &= 5 + 8 + 18 - 12 \\ &= 13 + 18 - 12 \\ &= \frac{31}{19} - 12 \end{aligned}$$

---

$\therefore x + y + 2z - 12 = 19$

In Extract 1.1, the student substituted the given values in the expression and computed the required answer correctly.

It was noted that a number of students (7.7%) who performed averagely were able to substitute the given numbers in the expression correctly but failed to get the final correct answer because they could not add, subtract and multiply the numbers correctly. A sample answer from one of such students is shown in Extract 1.2.

### Extract 1.2

$$\begin{aligned}x+y+2z-12 & \text{ solution} \\ & \text{When } x=5, y=8 \text{ and } z=9 \\ x+y+2z-12 & = 5+8+2(9)-12 \\ & = 29-12 \\ & = 17\end{aligned}$$

$\therefore$  The value of  $x+y+2z-12 = 17$

---

In Extract 1.2, the student substituted the values of  $x=5$ ,  $y=8$  and  $z=9$  correctly in the expression but performed incorrectly the associated operations to get  $29-12=17$  instead of  $31-12=19$ .

It was also observed that about half of the students (55.1%) who attempted this question scored a 0 mark. These students lacked algebraic and computation skills. Extract 1.3 is a sample answer from one of the students illustrating how they failed to answer this question.

### Extract 1.3

$$\begin{aligned}x+y+2z-12 \\ = 5(x)+8(y)+9(2z)-12 \\ 5x+8y+18z-12 \\ \text{Answer } 5x+8y+18z-12\end{aligned}$$

In Extract 1.3, the student considered the given values as coefficients of  $x$ ,  $y$  and  $z$  in the expression  $x+y+2z-12$ , indicating lack of skills to perform algebraic operations.

## 2.2 Question 2: Approximations

In this question, the students were given that the number of students who sat for the Primary School leaving Examination in 2013 was 844,938 and they were then required to express this number in standard notation.

The question was poorly performed as 77.3 percent of the students who attempted it scored a 0 mark and only 22.7 percent scored from 1 to 3 marks.

The students who scored 0, lacked knowledge and skills on how to write numbers in standard notation. They could not express the given number in the form  $A \times 10^n$  where  $1 \leq A < 10$  and  $n$  is an integer, that is  $844,938 = 8.44938 \times 10^5$ . Analysis of students' responses shows that several students were using incorrect values of  $A$  and  $n$  (see Extract 2.1); while others were not aware of the concept of standard form. As

a result they presented solutions that were not related to question demand (see Extract 2.2.)

**Extract 2.1**

$$\begin{aligned} & \text{Soln.} \\ 844,938 &= X \times 10^n \\ &= 844.938 \times 10^3 \\ \therefore 844,938 &= 844.938 \times 10^3 \end{aligned}$$

In Extract 2.1, the student expressed the number wrongly as  $844.938 \times 10^3$  instead of  $8.44938 \times 10^5$  indicating that he/she had inadequate knowledge on the concept of standard form.

**Extract 2.2**

$$\begin{aligned} & \text{Soln.} \\ & (8 \times 100000) + (4 \times 10000) + (4 \times 1000) + (9 \times 100) + (3 \times 10) + 8 \\ & 800000 + 40000 + 4000 + 900 + 30 + 8 \end{aligned}$$

In Extract 2.2, the student represented the number in expanded form instead of writing it in standard form.

Nevertheless, there were few students (21.9%) who answered this question correctly and scored all the 3 marks. Extract 2.2 is an example of such good response.

**Extract 2.2**

$$\begin{aligned} & \text{solution} \\ 844,938 & \Rightarrow 8.44938 \times 10^5 \\ \Rightarrow 8 \overbrace{44} \overbrace{93} \overbrace{8} & \therefore \text{Answer} = \\ & \underline{8.44938 \times 10^5} \end{aligned}$$

In Extract 2.2, the student expressed 844,938 in standard notation correctly indicating that he/she had an adequate knowledge on the tested concepts of writing numbers in standard form.

### 2.3 Question 3: Geometry

The students were required to determine angles A and B given that they are complementary angles and angle A is  $18^\circ$  less than angle B.

This was the worst performed question in this assessment. The majority of the students (94.7%) scored 0.

The poor performance in this question was due to the fact that many students could not apply the definition of complementary angles in answering this question. The students were unable to recognize that since A and B were complementary angles, then the sum of degrees of A and B should be  $90^\circ$ . By using this concept and the given data, the students were then required to solve the equations  $A = B - 18^\circ$  and  $A + B = 90^\circ$  in order to get the required values of A and B. Generally, the students lacked knowledge and skills in Geometry and Algebra. Extract 3.1 is a sample answer from one of the students illustrating this case.

#### Extract 3.1

Soln

$$A + B = 180$$

$$A - 18 + B = 180$$

$$2x - 18 + 18 = 180$$

$$2x = 180 + 18$$

$$2x = 198$$

$$x = 99$$

$$A = 99 - 18 = 81$$

$$B = 99$$

$\therefore A = 81^\circ$  and  $B = 99^\circ$

In Extract 3.1 the student considered angles A and B as supplementary angles instead of complementary angles as demanded in the question.

On the other hand, there were few students (1.7%) who scored full marks. These students were able to interpret the given geometry word problem into two equations that were in terms of A and B. Thereafter they solved them as required. Extract 3.2 shows the work of one of such students.

#### Extract 3.2

Soln:

$$A + B = 90$$

But  $A = B - 18^\circ$

$$B - 18^\circ + B = 90$$

$$2B - 18^\circ = 90$$

$$2B = 90 + 18^\circ$$

$$\frac{2B}{2} = \frac{108^\circ}{2}$$

$$B = 54^\circ$$

from:

$$A = B - 18^\circ$$

$$A = 54^\circ - 18^\circ$$

$$A = 36^\circ$$

$\therefore A = 36^\circ$  while  $B = 54^\circ$

Extract 3.2 shows that the student had understood well and applied correctly the concepts of complementary angles in answering the question.

## 2.4 Question 4: Algebra

The students were required to find the value of  $x$  in the equation  $\frac{6}{x+1} = 12$ .

This question was poorly performed as many students (77.8%) could not answer it correctly and hence scored 0. These students were unable to apply the technique of cross multiplication to obtain the linear equation  $12(x+1) = 6$ , which they would solve to get the required value of  $x = -\frac{1}{2}$ . This suggests that the technique of cross multiplication was not clear to most of the students. Extract 4.1 is a sample answer illustrating how the students failed to answer this question.

### Extract 4.1

$$\begin{array}{l} \text{Soln.} \\ \frac{6}{x+1} = 12 \\ 6 = 12x + 1 \\ 6 = 12x + 1 \\ 6 - 1 = 12x \\ \frac{5}{12} = \frac{12x}{12} \\ \therefore x = \frac{5}{12} \end{array}$$

In Extract 4.1, the student multiplied 12 by  $(x + 1)$  to get  $12x + 1$  instead of  $12x + 12$ , an error that made him/her to obtain  $x = \frac{5}{12}$  instead of  $x = -\frac{1}{2}$ .

Only few students (13.2%) were successful in applying the knowledge and skills of algebra to solve the equation and hence scored full marks. A sample answer from one of the students is shown in Extract 4.2.

### Extract 4.2

$$\begin{aligned} \frac{6}{x+1} &= 12 & \frac{12x}{12} &= \frac{-6}{12} \\ \frac{6}{x+1} \times \frac{12}{1} & & x &= \frac{-1}{2} \\ 12(x+1) &= 6(1) & & \\ 12x+12 &= 6 & & \\ 12x &= 6-12 & & \end{aligned}$$

In Extract 4.2, the student reduced the given equation into  $12x + 12 = 6$  and then solved it as required.

## 2.5 Question 5: Algebra

The students were required to simplify the expression  $9(a - 3b) + 5(4b + a) - b$ .

In this question, more than one third of the students (37.6%) scored from 1 to 3 marks and among them 13.0 percent scored all the 3 marks. This indicates that this question was averagely performed.

The students who scored full marks were able to expand the brackets correctly to obtain  $9a - 27b + 20b + 5a - b$  and collect like terms to get the required expression  $14a - 8b$  (see Extract 5.1). These students mastered well the concepts of adding, subtracting and multiplying the terms in algebraic expressions.

### Extract 5.1

$$\begin{aligned} &\text{solution:} \\ &= 9(a-3b) + 5(4b+a) - b \\ &= 9a - 27b + 20b + 5a - b \\ &= 14a - 7b - b \\ &= 14a - 8b \\ &\therefore \Rightarrow 14a - 8b. \end{aligned}$$

In Extract 5.1, the student was able to simplify the expression to obtain the required answer after adding or subtracting the coefficient of like terms.

Analysis of the students' responses shows that few students (15.9%) were able to expand the brackets correctly and awarded 1 mark but failed to proceed to obtain the final answer. These students made errors either while collecting like terms or during performing the algebraic operations. Further analysis of the students' responses shows that 62.4 percent of the students who attempted this question scored a 0 mark.

Some of these students provided solutions that were contrary to the demand of the question while others made errors while opening the brackets. Extract 5.2 illustrates this case.

### Extract 5.2

$$\begin{aligned}
 & 9(a-3b) + 5(4b+a) - b \\
 &= 9a - 27b + 20b + 5a - 5b \\
 &= 9a - 5a + 27b + 20b + 5b \\
 &= 4a + 52b \\
 &= 56ab \\
 \therefore 9(a-3b) + 5(4b+a) - b &= 56ab
 \end{aligned}$$


---

In Extract 5.2, the student opened the first and second brackets correctly but erroneously multiplied 5 by  $-b$ , a term which was outside the second bracket to obtain  $9a - 27b + 20b + 5a - 5b$  instead of  $9a - 27b + 20b + 5a + b$ .

## 2.6 Question 6: Algebra

The students were given that “when 6 is subtracted from a certain number, the result is greater than 29” and were then required to write down an inequality that represents the possible values of this number.

In this question, 91.8 percent of the students who attempted it scored a 0 mark and only 1.1 percent scored all the 3 marks that were allocated for the question. This question was therefore poorly performed.

The majority of the students who scored 0 were unable to translate the word problem mathematically into the inequality  $x - 6 > 29$  that would be simplified to obtain the possible values of the number as  $x > 35$ . Some students were unable to differentiate between inequalities from equations as they used the equal sign ( $=$ ) instead of the greater than sign ( $>$ ) and ultimately ended up with incorrect answer. Other students incorrectly used the greater than or equal sign ( $\geq$ ) an indication that they did not understand well the concept of inequalities in one unknown. Extract 6.1 is a sample answer from one of the students illustrating some of the difficulties the students faced while answering this question.

### Extract 6.1

$$\begin{array}{l} \text{Soln.} \\ 6 - x = > 29 \\ \therefore 6 - x = > 29 \\ -x = > 29 - 6 \\ -x = > 29 - 6 \\ \hline x = 29 + 6 \\ x = > 35 \end{array}$$

---

In Extract 6.1, the student formulated the inequality  $6 - x = > 29$  instead of  $x - 6 > 29$ , indicating incorrect interpretation of the word problem.

On the other hand, few students who performed well in this question were able to express the word problem mathematically and then simplified it as required (see Extract 6.2).

### Extract 6.2

$$\begin{array}{l} \text{Soln} \\ \text{Let the number be } x \\ x - 6 > 29 \\ x - 6 + 6 > 29 + 6 \\ x > 35 \\ \therefore x : x > 35 \end{array}$$

Extract 6.2 shows that the student was able to formulate the inequality correctly and then simplified it to obtain the required solution. The student seemed to have adequate knowledge of solving inequalities.

## 2.7 Question 7: Algebra

The students were required to evaluate  $\frac{(0.136)^2 - (0.148)^2}{0.136 + 0.148}$  without using

mathematical tables.

The majority of the students (83.6%) scored 0 mark and only 16.1 percent scored from 1 to 3 marks in this question, indicating that the question was poorly performed.

The students who scored 0 were unable to apply the formula for the difference of two squares i.e.  $a^2 - b^2 = (a-b)(a+b)$  to simplify the given expression as required. It was noted that several students evaluated the expression without using this formula. Some students calculated the value of the expression by first computing the square of 0.136, 0.148 and then calculated the value of the numerator of the expression which they later on divided by the value of denominator. Such students made errors while squaring the numbers. As a result they ended up with an incorrect final answer. Other students evaluated the expression using mathematical tables contrary to the given instructions. Also, the students faced problems in using the mathematical tables and as a result failed to obtain the final correct answer (see Extract 7.1).

### Extract 7.1

$$\begin{array}{l}
 \begin{array}{ccc}
 \text{No} & \text{SF} & \text{log} \\
 (0.136)^2 & (136)^2 \times 10^{-7} & (\overline{1.1335})^2 \\
 (0.148)^2 & (148)^2 \times 10^{-7} & (\overline{1.1703})^2
 \end{array} \\
 \\
 \begin{array}{ccc}
 0.136 & (136)^2 \times 10^{-7} & - \overline{1.335} \\
 & & \times \\
 0.148 & (148)^2 \times 10^{-7} & \overline{1.1708} \\
 \hline
 3692 & 234 = & \overline{1.26105} \\
 & & 0.234
 \end{array}
 \end{array}$$

In Extract 7.1, the student used mathematical tables in finding the value of the expression which was contrary to the given instructions.

Despite this poor performance, there were few students (3.1%) who answered this question correctly and scored full marks. A sample answer from one of such students is shown in Extract 7.2.

## Extract 7.2

$$\begin{aligned} & \text{solution} \\ & = \frac{(0.136)^2 - (0.148)^2}{0.136 + 0.148} \\ & = \frac{(0.136 + 0.148)(0.136 - 0.148)}{(0.136 + 0.148)} \\ & = 0.136 - 0.148 \\ & = -0.012 \end{aligned} \quad \begin{aligned} & \circ \frac{(0.136)^2 - (0.148)^2}{0.136 + 0.148} = \underline{\underline{-0.012}} \text{ (Answer)} \\ & \circ \circ \end{aligned}$$

In Extract 7.2, the student applied the formula for the difference of two squares to find the value of the numerical expression correctly.

## 2.8 Question 8: Perimeters and Areas

The students were given that the length of one side of a square is  $(3x + 4)$  cm. They were required to find the equation for the perimeter after the lengths of the square were doubled.

The analysis of data shows that many students (93.7%) scored 0, indicating that this question was poorly performed.

The students were unable to apply the concepts of algebra and perimeters to translate the word problem mathematically. They did not recognize that the new length of the square would be given by length =  $2(3x + 4)$  cm and thus the required perimeter =  $4 \times [2(3x + 4) \text{ cm}] = (24x + 32)$  cm. Extract 8.1 is a sample answer from one of the students showing how they failed to identify the demand of this question.

### Extract 8.1

Soln

$$\begin{aligned} \text{Length} &= (3x+4)^2 \text{ cm} \\ &= (3x+4)(3x+4) \\ &= 9x^2 + 12x + 12x + 16 \\ &= \underline{\underline{9x^2 + 24x + 16}} \end{aligned}$$

In Extract 8.1, the student squared the length instead of doubling it in order to obtain the new length of the square and he/she did not proceed to find the perimeter as demanded.

However, there were few students (1.3%) who performed well in this question. They managed to find the new length of the square and its corresponding perimeter correctly as illustrated in a sample answer from one of the students in Extract 8.2.

### Extract 8.2

Soln

$$\begin{aligned} \text{perimeter} &= 4 \times l = 4l \\ \text{given } l &= 3x+4 \text{ cm} \\ \text{after being doubled} & \\ \text{new length} &= 2(3x+4) \text{ cm} \end{aligned}$$

$\begin{aligned} \text{New length} &= 6x+8 \\ \text{perimeter} &= 4(6x+8) \\ &= \underline{\underline{(24x+32) \text{ cm}}} \end{aligned}$
--

Extract 8.2 shows that the student was able to write down the right formula for finding the perimeter of a square and applied it correctly in answering the question.

## 2.9 Question 9: Exponents and Radicals

The students were required to find the value of  $\frac{a}{b}$ , given that  $3^a \times 5^b = 675$ .

This question was generally poorly performed because 78.9 percent of the students who attempted it scored 0 mark and only 21 percent scored from 1 to 3 marks.

Many students could not express 675 in terms of its prime factors i.e.  $3^a \times 5^b = 3^3 \times 5^2$  and thereafter to equate the exponents of the left and right hand

side of this equation to determine the values of  $a$ ,  $b$  and subsequently the required answer  $\frac{a}{b}$ . Generally the students lacked knowledge and skills on the concepts of prime factorization and exponents (see Extract 9.1).

$$\begin{array}{l}
 \text{Soln.} \\
 3^a \times 5^b = 676 \\
 3^a \times 5^b = 676 \\
 \frac{15^{ab}}{15^a} = \frac{676}{15} \\
 ab = \frac{676}{15} \quad \text{Ans}
 \end{array}$$

In Extract 9.1, the student wrongly multiplied the base and exponent numbers on the left hand side of the given equation, indicating lack of knowledge on the topic of exponents.

Despite the general poor performance in this question, there were few students (7.9%) who managed to provide complete and correct solutions. A sample solution from one of the students is shown in Extract 9.2.

### Extract 9.2

$$\begin{array}{l}
 \text{Find prime factors of } 675 \\
 \begin{array}{r}
 3 \overline{) 675} \\
 \underline{3 \ 225} \\
 3 \ 75 \\
 \underline{3 \ 25} \\
 5 \ 25 \\
 \underline{5 \ 5} \\
 1 \\
 = 3^3 \cdot 5^2
 \end{array}
 \end{array}$$

**SOLUTION.**

$$\begin{array}{l}
 3^a \times 5^b = 675 \\
 \therefore 3^a \times 5^b = 3^3 \times 5^2 \\
 \text{The value of } a = 3 \\
 \text{The value of } b = 2 \\
 \text{The value of } \frac{a}{b} = \frac{3}{2} \\
 \therefore \text{The value of } \frac{a}{b} = \frac{3}{2}
 \end{array}$$

In Extract 9.2, the student expressed 675 as a product of its prime factors correctly i.e.

$675 = 3^3 \times 5^2$  and then applied the laws of exponents to get  $a$ ,  $b$  and  $\frac{a}{b}$  as required.

## 2.10 Question 10: Algebra

The students were given that the football ground at Merisa Secondary School is  $12\frac{1}{2}$  times as long as the length of its basketball ground. They were further given that the football ground is 100 meters long and were then required to find the length of the basketball ground.

This question was poorly performed as 91.0 percent of the students who attempted it scored 0 and only 8.7 percent scored from 1 to 3 marks.

The majority of the students were unable to identify the demand of the question. These students could not translate the word problem into the equation  $100\text{ m} = 12\frac{1}{2} \times x$ , which they were to solve for  $x$ , the required length of the basketball ground. The students were instead performing meaningless calculations on the numbers that were given in the question. Extract 10.1 illustrates this case.

### Extract 10.1

Soln  
 $12\frac{1}{2}$  length - ground 100 meter length  
 $12\frac{1}{2} \times 100$   
 $\frac{25 \times 100 = 2500}{2}$   
length 1250  
length 1250

In Extract 10.1, the student was unable to find the length of the basketball ground as he/she failed to interpret the given word problem mathematically.

Only few students (4.5%) were able to answer this question correctly and scored full marks. A sample answer from one of these students is shown in Extract 10.2.

## Extract 10.2

Solution  
let the length of basketball be  $x$   
Football ground is 100 meters long

$$100\text{m} = 12\frac{1}{2}x$$

$$100\text{m} = \frac{25x}{2}$$

$$\frac{200\text{m}}{25} = \frac{25x}{25}$$

$$8\text{m} = x$$

But  $x$  is the length of basketball ground.

$\therefore$  The length of basketball ground is 8m

In Extract 10.2, the student was able to represent the word problem in terms of an equation and then solved it correctly to get the length of the basketball ground as required.

### 2.11 Question 11: Algebra

The students were required to represent the solution set of the inequality  $3x + 4 \geq 25$  on a number line.

In this question, 71.8 percent of the students who answered it scored 0, 22.8 percent scored from 1 to 2 marks and only 4.7 percent scored 3 full marks. This question was therefore poorly done.

The analysis of the students' responses shows that the majority of the students who scored 0 lacked knowledge and skills on inequalities. Some students obtained  $3x \geq 25 + 4$  because they made sign error while solving the inequality and as a result ended up with an incorrect solution set  $x \geq \frac{29}{3}$ . Other students wrongly replaced the greater equal sign with equal sign to obtain the equation  $3x + 4 = 25$  and thereafter determined the value of  $x$  (see Extract 11.1). The majority of the students were unable to carry out the basic steps of solving the inequality i.e.

$$3x + 4 - 4 \geq 25 - 4; 3x \geq 21; x \geq \frac{21}{3} \text{ and thus } x \geq 7.$$

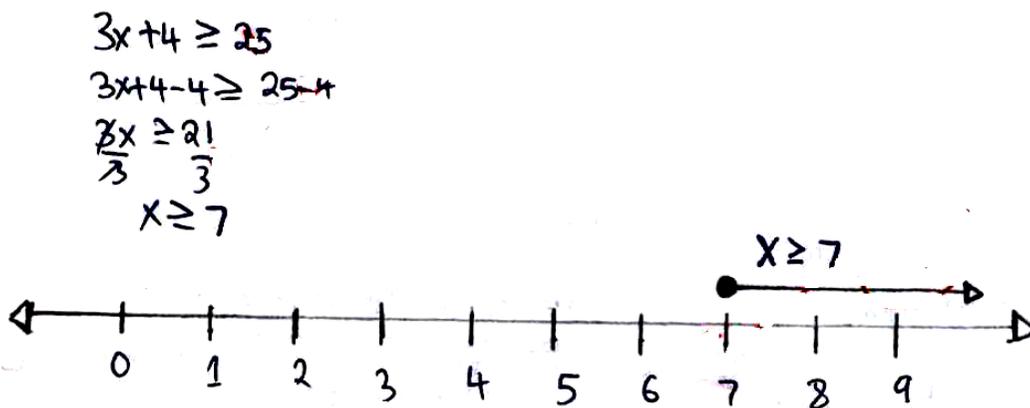
### Extract 11.1

$$\begin{array}{l} \text{a) } 3x = 25 - 4 \\ 3x = 21 \\ \underline{3 \quad 3} \\ x = 7 \end{array} \quad \begin{array}{l} \text{b) } |3x - 4| = 25 \\ 3x = 5 + 4 \\ 3x = 9 \\ \underline{3 \quad 3} \\ x = 3 \end{array} \quad x = 7 \text{ or } x = 3 \text{ Ans}$$

In Extract 11.1, the student changed the given inequality into an equation, an indication of lack of knowledge on the topic of Algebra.

Nevertheless, there were few students (4.7%) who answered this question correctly and scored full marks. A sample answer from one of the students is presented in Extract 11.2.

### Extract 11.2



Extract 11.2, shows that the student was able to solve the inequality and represented the solution set on a number line correctly.

## 2.12 Question 12: Fractions, Decimals and Percentages

The students were given that in a certain animal's farm 10% of the animals are horses,  $\frac{1}{4}$  are goats, 0.15 are sheep and  $\frac{1}{2}$  are cattle. The students were required to arrange these numbers in ascending order.

In this question, 83.7 percent of the students who answered it scored 0 mark, 9.1 percent scored from 1 to 2 marks and only 5.9 percent scored full marks. Generally, the question was poorly performed.



## 2.13 Question 13: Fractions and Units

The students were required to write 750 grams as a fraction of 5 kilograms.

In this question, 85.1 percent of the students who attempted it scored 0, 8.0 percent scored from 1 to 2 marks and only 3.2 percent scored full marks. This question was also poorly done.

Most of the students were unable to convert either 750 grams into kilograms or the 5 kilograms into grams before finding the required fraction. The students were using incorrect conversion measurements between grams and kilograms. For instance some used 1 kilogram = 100 grams instead of 1 kilogram = 1,000 grams and hence ended up with incorrect answers. Extract 13.1 is a sample answer from one of the students showing how they failed to convert the grams to kilograms and vice versa. It was noted that several students were dividing the 750 grams by the 5 kilograms without changing them to the same unit. This showed that the students lacked the basic knowledge and skills on performing operations on units of mass.

### Extract 13.1

$$\begin{array}{r} 1\text{g} = 100\text{kg} \\ 750\text{g} = 500\text{kg} \\ = \frac{500\text{kg}}{750\text{g}} = \frac{10\text{kg}}{15} \end{array}$$

In Extract 13.1, the student used 1g = 100 kg instead of 1kg = 1000 g and subsequently performed meaningless calculations on the given measurements.

Few students who answered this question correctly demonstrated good understanding on how to express the given units of mass as a fraction. Extract 13.2 illustrates this case.

### Extract 13.2

$$\begin{array}{l} 1\text{ kilogram} = 1000\text{ grams} \\ 5\text{ kilogram} = ? \\ ? = 5\text{kg} \times 1000\text{g} \\ 1\text{kg} \times = 5,000\text{grams} \end{array} \quad \begin{array}{l} = \frac{750\text{grams}}{5000\text{grams}} \\ = \frac{3}{20} \text{ Ans} \end{array} \quad \begin{array}{l} = \frac{3}{20} \text{ Answer} \end{array}$$

Extract 13.2 shows that the student was able to convert the units correctly and determined the required fraction accurately

## 2.14 Question 14: Algebra

The students were given that John is  $x$  years old and Mary is 3 years older than John and were required to write down the expression for the sum of their ages.

This question was poorly performed as many students (92.4%) scored 0 and only few students (6.9 %) scored from 1 to 3 marks.

Majority of the students were unable to formulate the required expression from the given word problem. They could not follow the following simple steps that were essential in obtaining the required expression i.e. denoting the age of John as  $x$  years; the age of Mary as  $(x + 3)$  years and finally finding the sum of their ages as:  $x$  years +  $(x + 3)$  years =  $(2x + 3)$  years. As illustrated in Extract 14.1, many students faced the difficulties in translating the information given in the question mathematically because of lack of knowledge and skills on the topic of Algebra and poor command of English.

### Extract 14.1

Soln:

Let John's age be  $x$   
Let Mary's age be  $3x$

Let the sum of their ages be  $y$ .

$$\Rightarrow x + 3x = 4x \therefore \underline{\text{The equation for the sum of their ages is } x + 3x = y}$$

In Extract 14.1, the student translated the information given in the question incorrectly to obtain  $x + 3x$  years instead of  $2x + 3$  years.

On the other hand, there were few students (3.0%) who answered the question correctly and scored all the 3 marks. A sample answer from one of the students is shown in Extract 14.2.

### Extract 14.2

Solution

John is  $x$  years old

But Mary is  $x + 3$  years old

$$x + (x + 3)$$

$$\therefore \underline{\text{The equation will be } x + (x + 3) \text{ or } 2x + 3}$$

In Extract 14.2, the student was able to use correct notations and formulated the expression for the sum of the ages of John and Mary as required.

## 2.15 Question 15: Algebra

The students were required to determine the value of  $x$  that satisfies the equation  $\frac{x - y^2}{x + 2} = 7$  given that  $y = 2$ .

This question was poorly done as only 20.8 percent of the students scored from 1 to 3 marks. Majority of the students (72.9%) did not score any mark.

Majority of the students could not substitute  $y = 2$  into the equation and cross multiply  $x + 2$  with 7 and  $x - y^2$  with 1 in order to get the equation  $7(x + 2) = x - 4$  that they would solve for  $x$ . As illustrated in Extract 15.1, the students lacked knowledge and skills to solve algebraic equations.

### Extract 15.1

$$\begin{array}{l} \frac{x+4}{x+2} = 7 \\ \cancel{x+2} = 1 \\ x+4 = 7x+2 \\ 7x+2 = x+4 \\ 7x-x = 4-2 \end{array} \qquad \begin{array}{l} \frac{6x}{6} = \frac{-6}{6} \\ \cancel{6} = \cancel{6} \\ x = -1 \\ \frac{6x}{6} = \frac{2}{6} \\ \cancel{6} = \cancel{6} \\ x = \frac{1}{3} \end{array}$$

In Extract 15.1, the student could not make correct substitution of  $y = 2$  into the equation. The student also cross multiplied the equation wrongly, an indicator of lack of knowledge and skills on the concepts of solving equations.

Despite of overall poor performance, there were few students (10.2%) who performed well in this question. A sample answer from one of the students is shown in Extract 15.1.

### Extract 15.1

$$\begin{array}{l} \text{Given } y=2 \\ \frac{x-y^2}{x+2} = 7 \\ \frac{x-(2)^2}{x+2} = 7 \\ = \frac{x-4}{x+2} = 7 \end{array} \qquad \begin{array}{l} x-4 = 7(x+2) \\ x-4 = 7x+14 \\ x-7x = 14+4 \\ -6x = 18 \\ \frac{-6x}{-6} = \frac{18}{-6} \\ x = -3 \end{array} \therefore \text{The value of } x \text{ is } -3$$

In Extract 15.2, the student managed to solve the equation for  $x$  correctly, indicating that he/she had an adequate knowledge on the topic of Algebra.

## 2.16 Question 16: Logarithms

The students were required to write down  $4\log 2 - \frac{1}{2}\log 64$  as a single logarithmic expression.

In this question, 86.0 percent of the students who attempted it scored 0, showing that the question was not clear to the majority of the students.

The students who scored 0 mark failed to apply the laws  $\log a^b = b\log a$  and  $\log\left(\frac{a}{b}\right) = \log a - \log b$  that were essential in simplifying the given expression.

Extract 16.1 is a sample answer showing how the students failed to apply these laws in answering the question.

### Extract 16.1

$$\begin{array}{l} \text{Soln} \\ 4\log 2 - \frac{1}{2}\log 64 \\ 2\log 4 - 64\log \frac{1}{2} \end{array}$$

In Extract 16.1, the student exchanged the exponent with the base numbers in the given logarithmic expression instead of simplifying it.

In spite of the poor performance, there were few students (4.3%) who answered this question correctly and hence scored all the 3 marks. The students used the laws of logarithms appropriately to obtain the simplified logarithmic expression  $\log 2$ . Extract 16.2 shows a sample answer from the script of one of the students who answered this question correctly.

### Extract 16.2

$$\begin{array}{l} \text{solution} \\ 4\log 2 - \log(64)^{\frac{1}{2}} \\ \log 2^4 - \log\sqrt{64} \\ \log 16 - \log 8 \\ \log \frac{16}{8} \\ \log 2 \\ \therefore \text{The answer is } \log 2. \end{array}$$

In Extract 16.2, the student applied the quotient and power laws of logarithm correctly to obtain the required answer.

## 2.17 Question 17: Numbers

The students were required to find the product of the G.C.F and L.C.M of 4, 8 and 12.

This was the best performed question in this assessment. In this question, 77.2 percent of the students who answered it scored from 1 to 3 marks and among them 25.8 percent scored the full 3 marks.

The students managed to write 4, 8 and 12 in terms of their prime factors which were then used to find the G.C.F and the L.C.M and hence the product of the two as required. Extract 17.1 is a sample answer picked from the script of one of the students showing how these students answered this question correctly.

### Extract 17.1

solution.

2	4	8	12
2	2	4	6
2	1	2	3
3	1	1	3
	1	1	1

$\therefore \text{LCM} = 24 \text{ and } \text{GCF} = 4$   
 $\text{Product} = \text{LCM} \times \text{GCF}$   
 $= 24 \times 4$   
 $= 96$

$\therefore \text{The product of GCF and LCM of 4, 8 and 12} = 96$

$\text{L.C.M} = 2 \times 2 \times 2 \times 3$   
 $= 24$   
 $\text{G.C.F} = 2 \times 2 = 4$

In Extract 17.2, the student used the prime factorization method correctly to obtain 96 which was the required product of the GCF and LCM.

It was observed that some students managed to compute the LCM and GCF correctly but did not proceed to find the product while others mixed the concept of the L.C.M with that of the G.C.F. Extracts 17.2 and 17.3 are sample solutions showing how the students responded to this question.

### Extract 17.2

2	4	8	12
2	2	4	6
2	1	2	3
3	1	1	3
1	1	1	1

2	4	8	12
2	2	4	6
2	1	2	3
3	1	1	3
1	1	1	1

$24 - 4 = 20$

The product of GCF and LCM of 4, 8 and 12 is 20

---

G.C.F =  $2 \times 2 = 4$  L.C.M =  $2 \times 2 \times 2 \times 3 = 24$

In Extract 17.2 the student computed the GCF and LCM correctly but used them to compute the difference instead of the product as instructed in the question. This shows that he/she interpreted wrongly the meaning of the word 'product'.

### Extract 17.3

2	4	8	12
2	2	4	6
2	1	2	3
3	1	1	3
1	1	1	1

G.C.F =  $2 \times 2 \times 2 \times 3 = 24$

L.C.M =  $2 \times 2$

$= 4$

$2 \times 2$

$= 4$

---

In Extract 17.3, the student wrongly regarded the GCF as the LCM and vice versa.

However, there were few students (21.4%) who scored 0 mark. These students did not have an idea on how to calculate the L.C.M and the G.C.F. Extract 17.4 is a sample answer from the script of one of the students to illustrate this case.

### Extracts 17.4

2	4	8	12
2	2	4	6
3	2	2	6
2	2	2	3
3	2	2	3
1	1	1	1

L.C.M =  $2 \times 2 \times 2 \times 3 \times 3 \times 1$

~~L.C.M = 48~~ 72

G.C.F =  $4 \times 3 = 12$

G.C.F = 12

L.C.M = 72

G.C.F = 12

In Extract 17.4, the student could not find the factors of 4, 8 and 12 and thus failed to obtain the product of the GCF and LCM.

## 2.18 Question 18: Coordinate Geometry

The students were given that the “straight line AB that is passing through the points A (2, 6) and B (t, 3) has gradient -1” and were required to find the value of  $t$ .

In this question, 81.5 percent of the students scored below 1 mark and among them 76.2 percent scored 0 mark. The question was therefore poorly performed.

It was noted that some students failed to identify the requirements of the question as they provided answers that were not related to the demand of the question while others were unable to recall the correct formula for the gradient of a straight line.

For instance, some students used the formula  $m = \frac{\text{change in } x}{\text{change in } y}$  instead of

$m = \frac{\text{change in } y}{\text{change in } x}$  and hence ended up with a wrong value of  $t$  (see Extract 18.1). It

was also noted that a number of students were able to recall the formula correctly but failed to apply it in answering the question. Extract 18.2 illustrates this case.

### Extract 18.1

Solution

gradient  $m = \frac{x_2 - x_1}{y_2 - y_1}$

$$m = \frac{t - 2}{3 - 6}$$

$$-1 = \frac{t - 2}{3 - 6}$$

$$-1 = \frac{t - 2}{-3}$$

$$-3 \times -1 = \frac{t - 2}{-3} \times -3$$

$$-3 \times -1 = t - 2$$

$$3 = t - 2$$

$$t = 2 + 3$$

$$t = 5$$

$\therefore$  The value of  $t = 5$

In Extract 18.1, the student interchanged  $x$  and  $y$  in the gradient formula and hence obtained  $t = 4$  instead of  $t = 5$  as required.

### Extract 18.2

Soln

$A(2, 6)$   $B(t, 3)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 6}{t - 2}$$

$$m = \frac{3 - 6}{t - 2}$$

$$= \frac{-3}{t - 2}$$

$\therefore$  The value of  $t = 2$

In Extract 18.2, the student quoted the formula correctly but failed to use it in finding the required value of  $t$ .

However, there were few students (10%) who answered the question correctly and scored all the 3 marks that were allocated. Extract 18.3 is a sample solution from one of such students.

**Extract 18.3**

$$\begin{aligned}
 m &= \frac{y_2 - y_1}{x_2 - x_1} \\
 -1 &= \frac{3 - 6}{t - 2} \\
 \times & \\
 -t + 2 &= -3 \\
 t &= 2 + 3 \\
 t &= 5
 \end{aligned}
 \qquad
 \underline{\underline{\therefore t = 5}}$$

In Extract 18.3, the student wrote the correct formula, substituted the values properly and finally determined the required value of  $t$ .

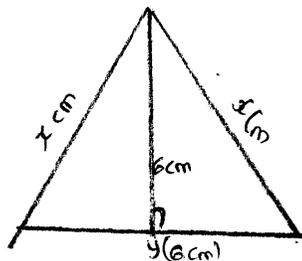
**2.19 Question 19: Perimeters and Areas**

The students were given that “a triangle has two equal sides of length  $x$  cm each and the third side measures 6 cm less than the length of each of these congruent sides”. Then they were required to write down an equation that represents the perimeter of this triangle.

This question was among the three questions which were very poorly performed. The majority of the students (96.8%) scored below 1 out 3 marks with 95.6 percent among them scoring 0 mark.

The analysis of students’ responses indicates that many students failed to interpret the word problem mathematically. The students were unable to identify the lengths of the sides of the triangle from the given information. They did not realize that the lengths were  $x$  cm,  $x$  cm,  $(x - 6)$  cm and thus the required perimeter would be  $(x + x + x - 6)$  cm =  $(3x - 6)$  cm. It was noted that some students used wrong formulae in calculating the perimeter while others provided answers which were unrelated to the demand of the question. Extract 19.1 is an example of such responses.

### Extract 19.1

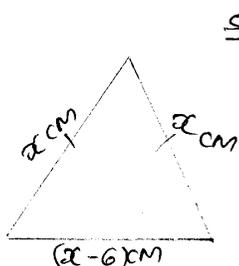


$$\begin{aligned}x & \quad x \text{ cm} \times x \text{ cm} \times 6 \text{ cm} = y \\ & \quad x^2 \times 6 \text{ cm} = y \\ & \quad \therefore 6x^2 = y\end{aligned}$$

In Extract 19.1, the student did not manage to identify the length of the third side of the given triangle and also failed to recall the formula for finding the perimeter.

Despite the poor performance, there were few students (1.1%) who performed well in this question. These students applied correctly the knowledge and skills acquired from the topic of perimeter in answering the question. Extract 19.2 is a sample answer from one of these students.

### Extract 19.2



$$\begin{aligned}\text{Perimeter of } \Delta &= \text{Side}_1 + \text{Side}_2 + \text{Side}_3 \\ &= x \text{ cm} + x \text{ cm} + (x+6) \text{ cm} \\ &= 2x \text{ cm} + x + 6 \\ &= (3x + 6) \text{ cm}\end{aligned}$$

$$\therefore \text{Perimeter of a triangle} = (3x + 6) \text{ cm}$$

In Extract 19.2, the student managed to present the given information on a triangle which was an important step in finding the required equation for the perimeter.

## 2.20 Question 20: Ratio, Profit and Loss

The students were provided with the statement “Kapona bought a computer for 250,000/= and sold it after one year at a loss of 5 percent” and were required to calculate the amount of the loss made.

In this question, 76.4 percent of the students scored 0 and only 23.5 percent scored from 1 to 3 marks. Therefore, majority of the students responded wrongly to this question.

The students who performed poorly lacked knowledge on the concepts of ratio, profit and loss. These students failed to realize that the amount of loss made was to

be calculated using the formula:  $\text{percentage loss} = \frac{\text{loss made}}{\text{buying price}} \times 100\%$ . The analysis

of the students' responses shows that several students used wrong formulae in computing the amount of loss made while others performed meaningless operations on the figures that were given in the question. Extracts 20.1 and 20.2 are examples of such solutions.

### Extract 20.1

from

$$I = \frac{PRT}{100\%}$$

Soln

$$\frac{250,000 \times 5 \times 1}{100\%} = \frac{120000}{100}$$

∴ The amount of the loss = 1200/=

In Extract 20.1, the student used the simple interest formula  $I = \frac{PRT}{100}$  instead of applying the formula for calculating the loss made.

### Extract 20.2

Soln

$$\frac{250,000}{5} = \frac{250,000}{5} \times 5$$

$$= 50,000$$

∴  $250,000 \div 5 = 50,000$

Extract 20.2 shows that the student performed calculations that were not related to the demand of the question.

On the other hand, few students (11.9%) answered this question correctly and thus awarded full marks. They substituted the given percentage loss and the buying price of the computer in the appropriate formula to obtain the required amount of loss made, that is 12,500/=. Extract 20.3 serves as an example of a student's good response.

### Extract 20.3

solution  
Buying price = 250,000/-  
Loss = 5%  
Amount loss = ?  
Percentage loss =  $\frac{\text{Loss}}{\text{Buying price}} \times 100\%$

$$5\% = \frac{\text{Loss}}{250,000} \times 100\%$$
$$\frac{5}{100} = \frac{L \times 100}{250,000}$$
$$\frac{100L}{100} = \frac{250,000 \times 5}{100}$$
$$L = 12,500$$

$\therefore$  Loss is 12,500/-

In Extract 20.3, the student applied the relevant formula and computed accurately the loss made.

### 2.21 Question 21: Perimeters and Areas

The students were required to find the perimeter of a rectangular room which has an area of  $1125 \text{ cm}^2$  and a length that is five times its width.

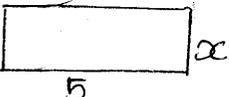
The question was generally poorly performed. Majority of the students (93.8%) scored below 3 out of 8 marks, with 88.2 percent of them scoring 0 mark.

The students who performed poorly were unable to apply the formula for the area of a rectangle to find the width, length and then use them to find the required perimeter. Extract 21.1 is a sample answer which shows how the students failed to answer this question.

#### Extract 21.1

Let  $x$  as width

Soln

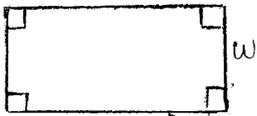

$$5x = 1125$$
$$\frac{5x}{5} = \frac{1125}{5}$$
$$\therefore x = 225 \text{ cm}^2$$

In Extract 21.1, the student interpreted the question wrongly as he/she considered the length of the rectangle as 5 instead of  $5x$  and as a result ended up with an incorrect width of the rectangle. The student did not find the perimeter as demanded by the question.

Only few students (3.3%) performed well and scored full marks in this question. These students managed to express the length in terms of the width i.e.  $l = 5w$  and then used this fact to obtain the equation  $5w^2 = 1125$  which they solved to get  $w = 15$  cm,  $l = 75$  cm. Finally they calculated the perimeter of the rectangular room as required. Extract 21.2 shows work of one of such students.

**Extract 21.2**

solution



$5 \times w = 5w$

Area =  $L \times W$

$1125 = 5w \times w$

$1125 = 5w^2$

$\frac{1125}{5} = \frac{5w^2}{5}$

$\sqrt{225} = \sqrt{w^2}$

$15 = w$

Width = 15 cm

Length =  $5 \times 15$

$= 75 \text{ cm}$

Perimeter =  $2(L + w)$

$P = 2(75 + 15)$

$P = 2(90)$

$P = 180$

$\therefore$  Perimeter is 180 cm.

---

In Extract 21.2, the student applied correctly the formula for perimeter and area of the rectangle in answering this question.

**2.22 Question 22: Logarithms**

The students were supposed to evaluate  $\frac{1.34 \times 5.804}{\sqrt{0.4391}}$  using logarithmic tables.

This question was poorly performed as many students (83.3%) scored 0. This poor performance was due to students' inability to use mathematical tables to multiply, divide and find roots of numbers. The students were unable either to write correct characteristic values for the numbers, read the correct value of the mantissa from the table, perform calculations using the laws of exponents and logarithms, or use antilogarithm tables to find the answer. Extract 22.1 is a sample answer illustrating how the students failed to answer this question.

### Extract 22.1

Number	Standard form	Logarithms
1.34	$= 1.34 \times 10^2$	2.4829
5.804	$= 5804 \times 10^3$	3.9033 +
		6.3862
0.4391	$0.4391 \times 10^4$	$\frac{1}{2}(4.6063)$ 2.30315
		6.38620 2.30315 4.08305
		Antilogarithm = $10^4 \times 0.8305$ $= 4.1020$

$$\therefore \frac{1.34 \times 5.804}{\sqrt{0.4391}} = 4.1020$$

In Extract 22.1, the student was unable to express the numbers in standard notation and as a result obtained incorrect characteristic values. The student failed to read the correct values of the mantissa from the logarithm tables indicating lack of knowledge and skills on how to perform calculations using mathematical tables.

Very few students (0.8%) performed well in this question. These students were able to use the four figure mathematical tables to multiply and divide numbers correctly. Extract 22.2 shows the sample solution from one of the students who attempted the question correctly.

### Extract 22.2

Solution		
Number	Standard form	Logarithm
1.34	$1.34 \times 10^0$	0.1271
5.804	$5.804 \times 10^0$	0.7637 +
	NUMERATOR:	0.8908
$(0.4391)^{\frac{1}{2}}$	$4.391 \times 10^{-1}$	$\frac{1}{2}(7.6426) = 7.8213$
	DENOMINATOR:	7.8213

$= 0.8908 + 7.8213$   
 $= 1.0695$   
 $= 1.173 \times 10^1$   
 $\therefore$  The answer is  $\frac{1.173 \times 10^1}{11.73}$

$$\therefore \frac{1.34 \times 5.804}{\sqrt{0.4391}} = 11.73$$

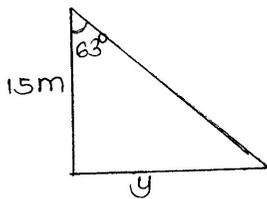
In Extract 22.2, the student was able to use four figure tables correctly to do calculations.

## 2.23 Question 23: Trigonometry

The students were given that “a ladder 15 m long rests against a vertical wall such that the top of the ladder makes an angle of  $63^\circ$  with the vertical wall”. The students were required to find the height of the wall.

The analysis of data shows that many students (95.8%) scored from 0 to 2 out of 8 marks and among them 91.1 percent scored a 0 mark showing that this question was poorly performed. This was the second poorly performed question in this assessment. This poor performance was due to the fact that the students were unable to represent the given information on a sketch that would have enabled them to find the height of the wall correctly. It was noted that some students lacked knowledge of trigonometric ratios that is definition of sine, cosine and tangent of an angle. Others lacked the skills to read the values of the trigonometric ratios from the trigonometrical tables. Extract 23.1 is a sample answer illustrating how the students failed to answer this question.

### Extract 23.1



$$\tan 63^\circ = \frac{\text{opposite}}{\text{Adjacent}}$$

$$1.963 = \frac{y}{15}$$

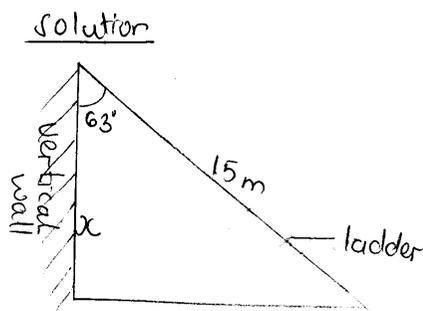
$$y = 1.963 \times 15$$

$$\therefore \text{Height} = \underline{29.445 \text{ m}}$$

In Extract 23.1, the student interpreted wrongly the given information and as a result computed the distance between the foot of the ladder and the wall instead of finding the height of the wall.

Despite this poor performance, few students (1.0%) were able to answer this question correctly and scored all the 8 marks. Extract 23.2 is a sample answer which illustrates how the students answered this question correctly.

### Extract 23.2



$$\cos 63^\circ = \frac{\text{Adjacent}}{\text{Hypotenuse}} = \frac{x \text{ m}}{15 \text{ m}}$$

$$x = (\cos 63^\circ) \times 15$$

$$\cos 63^\circ = 0.4540$$

$$x = 0.4540 \times 15$$

$$x = 6.8100$$

∴ The height of the wall is 6.81 meters.

In Extract 23.2, the student was able to represent the given information on a well labelled right angled triangle and managed to apply the definition of cosine trigonometrical ratio to compute the height of the wall as required.

### 2.24 Question 24: Sets

The students were given that “In a class of 50 students, 16 like watching television, 41 like reading story books and 7 do not like neither watching television nor reading story books”. The students were required to find the number of students who like both watching television and reading story books using the formula.

This question was poorly performed as 94.4 percent of the students who attempted it scored low marks from 0 to 2 out of 8 with 77.8 percent of them scoring zero.

The students who performed poorly in this question were unable to recall and apply the formula  $n(A \cup B) = n(A) + n(B) - n(A \cap B)$  in finding the number of students who like both watching television and reading story books. Some students managed to write down the formula correctly but failed to substitute correct data while others quoted the formula wrongly and hence ended up with incorrect solution. Extract 24.1 illustrates this case. It was noted that several students provided solutions that were not related to the demand of the question. This is an indicator of students' incompetence in sets (see Extract 24.2).

### Extract 24.1

Solution

Television =  $16 - x$  (A)  
 Reading books =  $41 - x$  (B)  
 neither = 7 (C)  
 Total = 50 ( $n(A \cup B)$ )  
 Both = ? ( $n(A \cap B)$ ) or  $x$

Formula:  
 $n(A \cup B) = n(A) + n(B) + n(A \cap B)$   
 $50 = 16 - x + 41 - x + x$   
 $50 = 16 + 41 - x - x + x$   
 $50 = 57 - x$

$50 - 50 + x = 57 - 50 - x + x$   
 $x = 57 - 50$   
 $x = 7$   
 $x = 7$

The students who like both watching television and reading story books are 7 students

In Extract 24.1, the student was able to summarize the information correctly using a Venn diagram but failed to determine the number of students who like both watching television and reading story books because he/she used incorrect formula.

### Extract 24.2

Student	frequency
10	16
20	41
30	7
40	21.33
50	

is 21.33 or 21  
the student who like both watching television

In Extract 24.2, the student constructed a meaningless frequency distribution table instead of applying an appropriate formula on the number of elements in a set.

However, there were only 2,983 (0.8%) students who attempted the question correctly. These students were able to recall and apply the correct formula and had the right skills in comprehending the given word problem. A sample answer from one of the students is shown in Extract 24.2.

### Extract 24.2

Soln

All students = 50  
Who do not like both = 7  
 $50 - 7 = 43$  students

Let the set of students who like watching television be A and those like reading story be B

$\therefore n(A \cup B) = n(A) + n(B) - n(A \cap B)$   
 $43 = 16 + 41 - n(A \cap B)$   
 $43 = 57 - n(A \cap B)$

$n(A \cap B) = 57 - 43$   
 $n(A \cap B) = 14$

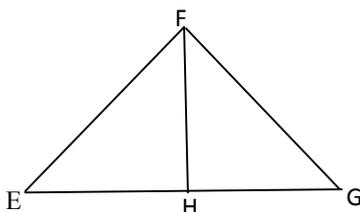
$\therefore$  The number of students who like both watching television and reading story books is 14 student

---

In Extract 24.2, the student understood well the demands of the question and applied the required formula correctly.

### 2.25 Question 25: Similarity

The students were given the following figure on which  $\overline{EF} = \overline{FG}$  and  $\overline{EH} = \overline{HG}$  and they were required to show that triangles EFH and GFH are similar.



Majority of the students (89.7%) scored from 0 to 2 out of 8 marks and among them 81.1 percent scored 0 mark, showing that the question was poorly performed.

The students were unable to apply either the AAA, SSS, SAS or RHS similarity theorems correctly in answering this question. Some students used concepts that were not related to the demand of the question such as the Pythagoras theorem in proving that triangles EFH and GFH are similar. Extract 25.1 is a sample answer illustrating how the students failed to answer this question.

### Extract 25.1

$$\begin{aligned} a^2 &= c^2 - b^2 \\ (\overline{FH})^2 &= (\overline{EF})^2 - (\overline{EH})^2 \\ \text{or } &= (\overline{FG})^2 - (\overline{HG})^2 \end{aligned}$$

$\therefore$   $\triangle EFH$  and  $\triangle GFH$  are similar

In Extract 25.1, the student used Pythagoras theorem instead of applying a similarity theorem to show that  $\triangle EFH$  and  $\triangle GFH$  are similar.

There were only few students (0.3%) who were able to apply the similarity theorems to show that the given triangles are similar. Extract 25.2 is a sample answer from the scripts of the students illustrating how they answered this question correctly.

### Extract 25.2

soln

Given:  $\triangle EFH$  and  $\triangle GFH$  and  $\overline{EF} = \overline{FG}$ ,  $\overline{EH} = \overline{HG}$

Required to prove:  $\triangle EFH \sim \triangle GFH$

Proof:  $\overline{EF} = \overline{FG}$  ----- given (s)  
 $\overline{EH} = \overline{HG}$  ----- given (s)  
 $\overline{FH}$  ----- Common (s)

$\therefore \triangle EFH \sim \triangle GFH$  by (SSS) similarity theorem

In Extract 25.2, the student applied the SSS similarity theorem correctly to show that the given triangles are similar.

### **3.0 ANALYSIS OF STUDENTS' PERFORMANCE IN EACH TOPIC**

The questionwise analysis on the 2015 041 Basic Mathematics paper shows that question 17 from the topic of Numbers was the only well performed question. In this question, 77.2 percent of the students who attempted it scored more than 30% of the 3 marks that were allocated.

The analysis also shows that questions 1 and 5 both from the topic of Algebra were averagely performed. The percentages of students who scored more than 30% of the marks allocated for these questions were 44.9 and 37.6 respectively.

Further analysis shows that the remaining 22 questions were poorly performed. In these questions, the percentage of students who scored more than 30% of the marks that were allocated for the questions was between 0 and 29. Moreover, question 3 on Geometry was the worst performed question, followed by question 19 on Perimeters and Areas and question 23 on Trigonometry.

In 2014, the questionwise analysis indicated that question 17 was also the only well performed question, questions 1 and 5 were also the only averagely performed questions and question 23 was also among the last three poorly performed questions. In 2014 questions 1 to 25 were set from the same topics as in the year 2015. The comparison of the students' performance questionwise is presented in Appendix I of this report.

The overall analysis based on the 13 topics that were assessed shows that the topic on Numbers had an average performance while the remaining 12 topics had poor performance. The topics with poor performance were: Algebra, Approximations, Geometry, Perimeters and Areas, Exponents and Radicals, Units and Fractions, Logarithms, Coordinate Geometry, Ratio, Profit and Loss, Trigonometry, Sets and Similarity. There was no well performed topic in the Basic Mathematics assessment. As compared to the students' performance in 2014, the topic on Numbers had also an average performance and the remaining topics had also poor performance. The analysis of the students' performance for each topic is presented in the Appendixes II and III of this report.

## **4.0 CONCLUSION**

In general, the analysis of the questions and the topics assessed shows that the overall performance in Basic Mathematics assessment has not improved.

The factors which have contributed to the general poor performance in this assessment include: lack of knowledge and skills in a specific topic; the use of incorrect formula, concepts and laws; inability to identify the task of the questions and failure of students to interpret word problems mathematically and diagrammatically. The reasons noted for the poor performance in the FTNA 2014 Basic Mathematics paper are similar to those noted in the FTNA 2015.

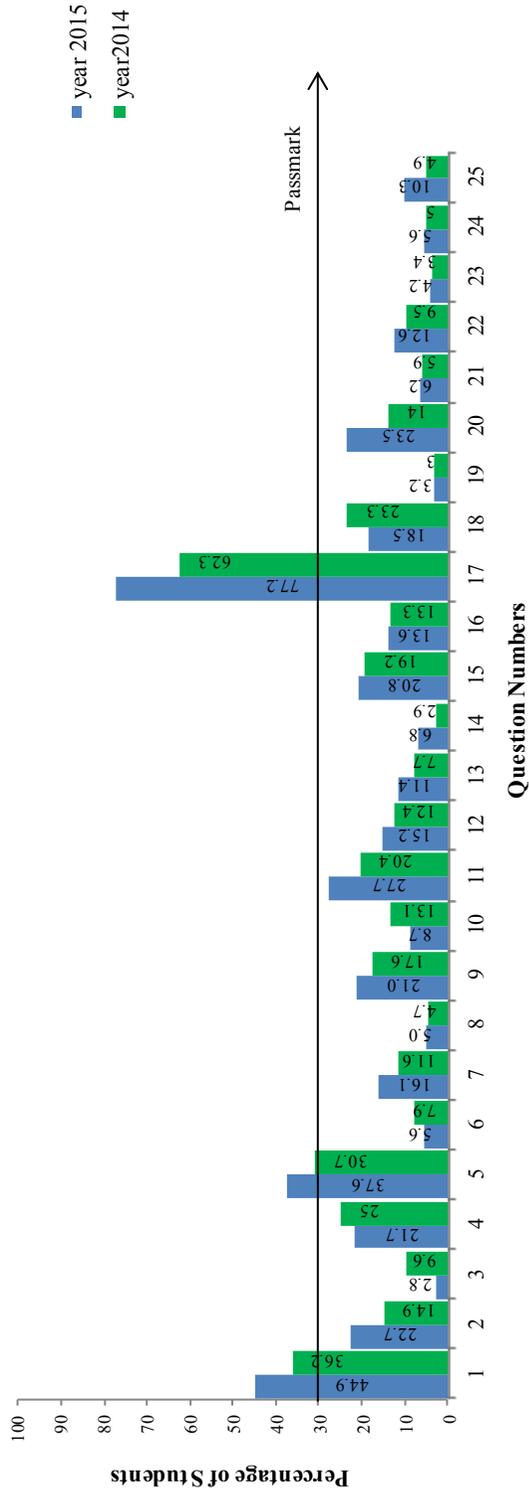
## **5.0 RECOMMENDATIONS**

In order to improve the standard of performance in this subject, it is recommended that:

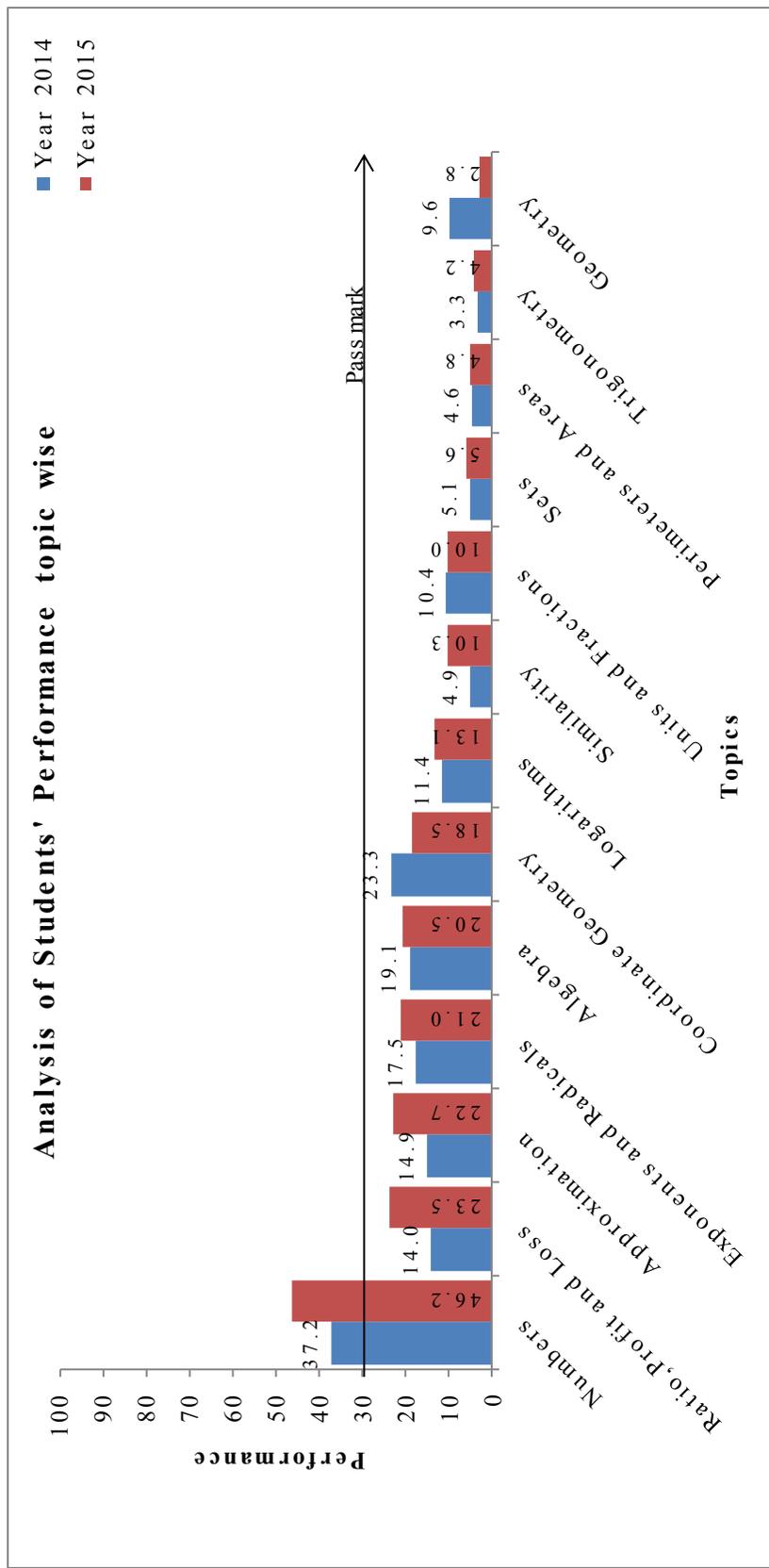
- (a) The students should cover all topics in Form 1 and Form 2 syllabus and make sure they understand the formula, concepts, and laws involved and that they can apply them in solving various questions.
- (b) The students should do many exercises which will enable them to get enough experience of applying formulae, concepts and laws in answering questions.
- (c) Teachers should guide students to build the habit of reading the questions carefully and identify the requirements before performing any task.
- (d) The teachers should cover all topics in Form 1 and 2 syllabus before the commencement of the assessment and make sure the students are able to use various concepts and formulae in doing calculations.
- (e) The School Quality Assurers should make close monitoring on the teaching and learning of the subject in order to identify areas that need special attention.
- (f) Finally, the Ministry of Education, Science and Technology is advised to use the information in this report to make sure that there is close monitoring on how teaching and learning are conducted in schools so as to raise the standard of performance in this subject.

# Appendix I

Comparison of Students' Performance Questionwise between FTNA 2014 and 2015



## Appendix II



## Analysis of Students' Performance per Topic in Basic Mathematics

S/N	Topic	Question Number	2014		2015	
			The Average Percentage of Students who Passed	Remarks	The Average Percentage of Students who Passed	Remarks
1	Numbers	12, 17	37.2	Average	46.2	Average
2	Ratio, Profit and Loss	20	14	Weak	23.5	Weak
3	Approximation	2	14.9	Weak	22.7	Weak
4	Exponents and Radicals	9	17.5	Weak	21.0	Weak
5	Algebra	1, 4, 5, 6, 7, 11, 14, 15	19.05	Weak	20.5	Weak
6	Coordinate Geometry	18	23.3	Weak	18.5	Weak
7	Logarithms	16, 22	11.4	Weak	13.1	Weak
8	Similarity	25	4.9	Weak	10.3	Weak
9	Units and Fractions	10, 13	10.4	Weak	10.0	Weak
10	Sets	24	5.1	Weak	5.6	Weak
11	Perimeters and areas	8, 19, 21	4.6	Weak	4.8	Weak
12	Trigonometry	23	3.3	Weak	4.2	Weak
13	Geometry	3	9.6	Weak	2.8	Weak

In this Appendix yellow and red colour represents average and weak performance respectively.

