Junior Lyceum Entrance Examination into Form I – May 2004

MATHEMATICS

CHIEF EXAMINER’S REPORT

General Comments about the examination paper

The main objective of the examination was to assess the children’s mathematical knowledge, skills and understanding at the end of their Primary Education.

Once again the validity and reliability of the examination were ensured by the adoption of a specification grid to ascertain that all the questions were within the syllabus and that the questions were pitched at appropriate levels to cater for different abilities. It was endeavoured to cover as much as possible of the syllabus content and to stay within the established weighting, namely:

- Problem Solving 20% $\pm$ 1%
- Number 40% $\pm$ 3%
- Measurement 15% $\pm$ 3%
- Shape and Space 15% $\pm$ 3%
- Data Handling 10% $\pm$ 1%

For further details regarding the estimation of the facility level and areas tested kindly refer to the specification grid at the end of this report. Naturally some divergence is bound to occur between the facility level as estimated by the paper setters’ panel and the actual outcome in the examination. This aspect will be treated further in the section “Markers’ comments”.

The candidates had to answer 20 questions carrying a total of 100 marks. The first ten questions carried 4 marks each and the remaining 10 carried 6 marks each. These questions were presented on a 12-page booklet, with ample space to allow the candidates display the necessary working. Clear diagrams contributed further to make the paper child-friendly. Once again particular attention was paid to the language used to ensure that the language was accessible to all candidates, even to those with special needs.

General comments about the performance of the candidates

The average mark for the paper was 59, the median mark was 62 whilst the standard deviation was 22.

57% of the candidates scored above the average mark of 59.

In general the performance of the children was very satisfactory. This is evident from the good number of passes - 72.5% of the students who sat the Examination. The average and the median mark further indicate that the performance of most students was quite good since half of the candidates scored a mark higher than 62. This is ample evidence that the paper was child friendly and that children are in possession of a good number of mathematical skills and concepts.

Nevertheless there are some shortcomings that must be addressed. Comments from the markers reveal that a good number of children find great difficulty to communicate mathematical ideas in writing. Another weakness concerns the concept of an angle as a measure of turn. In question 1 (c) the number, expressed in words as "one hundred and twenty thousand", presented some difficulty; a fact that should not be expected from an eleven-year-old child. The definition of the square was rarely expressed in good terms. Many children used "vertex" for "angle", showing clearly that they do not distinguish between a vertex, that is a point, and an angle, which is a measure of rotation. Very few answered correctly the question on the rotation of the flag! The weakness concerning the concept of an angle as a measure of rotation was manifested in another instance – the question on bearings to describe "two ways …".

Other aspects that require particular attention in the future concern the development of mathematical thinking and the ability of extracting information from a diagram. It was amply evident from the last three questions that required higher order thinking that many candidates simply had no idea where to start. Treating mathematics superficially, by simply stressing repetitive skills, is bad practice. There were diagrams that were intended to help the children and some included hints in the speech bubbles. Children need to watch out for clues. Problem eighteen "the table and chair problem", and problem twenty, "the tiling of the floor", are typical cases. They dealt with unfamiliar situations that required deeper thinking. It was possible in both questions to use various strategies. In question twenty, one could make use of a geometrical strategy. In both questions the number work was quite straightforward. Yet in solving these two problems many children got stuck.

Non-routine tasks are another hurdle. The question on measurement, question five, showed that many understood the quantity "80% of the line" but when asked to draw the length starting from A, they measured the length from 0, as they usually do! The indication here is that the children measure the distance by the numbers on the ruler not by the spaces between each number. Most children simply followed the numbers thus ending one space short!

The problems on time and weight revealed another weakness. Many committed mistakes when converting the units whereas in the estimation of the area of a copybook few chose the right answer, showing that the skill of estimating area needs to be reinforced. One must not treat area as simply multiplying length by breadth!

The facility index will further reveal where our children's strengths and weakness are. Children are good at basic repetitive skills but find difficulty with problem solving. Thinking deductively, as in the example on volume, or working by trial and error as in the case of multiplying 7 by 2 by 5 by 3 to get 210 is an essential skill. Certainly one should encourage this type of thinking!

Two more general remarks regarding geometric shapes and other diagrams are worth mentioning. The first concerns the orientation of a shape. Many confused the square with the diamond. Emphasis should be made in teaching on the fact that if a shape is rotated it will remain the same shape and children should be able to recognise that its properties are preserved in any orientation. Further to this, the diagrams of shapes should be taken as sketches. When shapes are drawn to scale, this will be stated in the problem. Otherwise the assumption is that the figures should not be used to measure lengths or angles, unless the question specifically asks for the measurement. Many students used the protractor to work out question seven when a calculation was required whereas in question 20 very few made use of the fact that it was a scale drawing!

More particular details will be shown in the exemplars and the markers' remarks in this report.

Question 1 shows good presentation of work. The multiplication method used is the one recommended in the syllabus.

Work out: 953
+217

1170

b) **Write down the sum of** $\boxed{3 \times 100}$ $\boxed{2 \times 10}$ $\boxed{5 \times 1}$

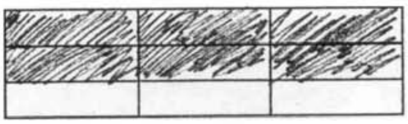
300 +
20
5
3 2 5

c) Write figures: **one hundred and twenty thousand** ~~120~~ 120,000

d) **Multiply 89 by 23.**

$$\begin{array}{r} 89\times \\ 20 \\ \hline 1780 \end{array} \qquad \begin{array}{r} 89 \\ 3 \\ \hline 267 \end{array} \qquad \begin{array}{r} 780+ \\ 267 \\ \hline 2047 \end{array}$$

In question 2 the addition of fractions is correct but the three wholes are improperly written giving the impression that it is thirty-six instead of six.



Complete

$$\frac{2}{3} \qquad \frac{6}{9}$$

c) Work out $3\frac{2}{\ } + \frac{1}{\ }$

$$3\frac{2}{3}+\frac{1}{9} \qquad 3\frac{6+1}{9} \qquad 3\frac{7}{9}$$

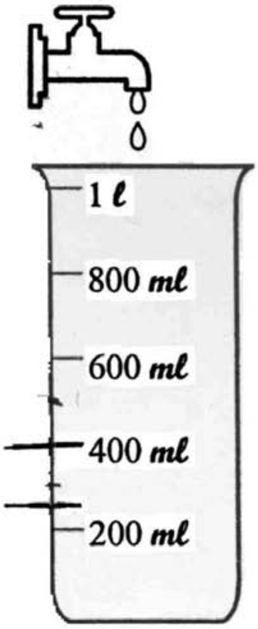
$3\frac{7}{9}$

d) class there **27 children**
Two thirds of the children boys.
Work out the number boys the class.

$$\frac{2}{\cancel{3}} \times \cancel{27}^{\,9} \qquad \begin{array}{r} 9 \\ \times 2 \\ 18 \end{array}$$

18

Method 1
In question number 6 note how this child marks the container to partition the required amounts. In a) 2/5 is equivalent to the 400ml mark, so the answer is 2 + 2 or 2 × 2 = 4 h. In part b) the mark between the 400ml and 600ml indicates half litre. So it's 2 + 2 + 1 h, that is, 5h. In part c) the mark between 200 and 400ml is further divided by two lines to get the amount of ½ h, i.e. 200 divided by 4 = 50, so the answer is 200 + 50 = 250 litres. This is a clever strategy showing good mathematical thinking. The strategy involved a geometrical interpretation of arithmetical data.



Water drips from a tap into an empty container.
It takes 2 hours to fill 200 *mℓ* of water.

a) How long does it take to fill **two fifths of one litre**?

4 hours

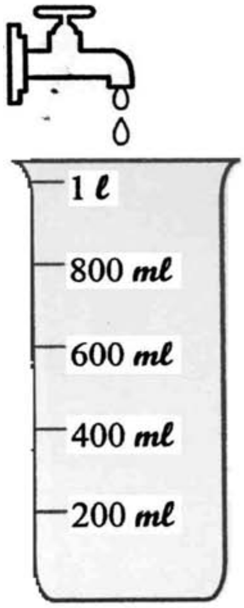
b) How long does it take to fill **half a litre**?

5 hours

c) How many **millilitres** of water are filled in $2\frac{1}{2}$ hours?

250 mℓ

Method 2
A different strategy is shown here. The important thing is to encourage children to devise their own strategies to arrive at a solution.



Water drips from a tap into an empty container.
It takes 2 hours to fill 200 ***mℓ*** of water.

a) How long does it take to fill **two fifths of one litre**?

2 hurs x 2 = 4 h

__4__ hours

b) How long does it take to fill **half a litre**?

2) 2 h = 1 h

4 h
1 h
5 h

__5__ hours

c) How many **millilitres** of water are filled in $2\frac{1}{2}$ hours?

__250__ ***mℓ***

This was one way of solving the problem in question 18. It is not possible, because of space, to show here all the strategies used by children but it was noted that there were many who simply multiplied Lm38 by 2 to get Lm76. Others multiplied Lm10 by 2 and Lm7 by 4 and added whereas others chose more complicated but equally valid strategies such as the one shown below.

18. **One table** and **four chairs** cost **Lm38**.

One table and **one chair** cost **Lm17**.

a) Find the cost of **one chair**.

38
−17
21

3/21
7

Lm 7

b) Find the cost of **one table**.

17
− 7
10

Lm 10

c) Work out the total cost of **two tables** and **eight chairs**.

10
× 2
20

38
−10
28

28
× 2
56

56
+ 20
76

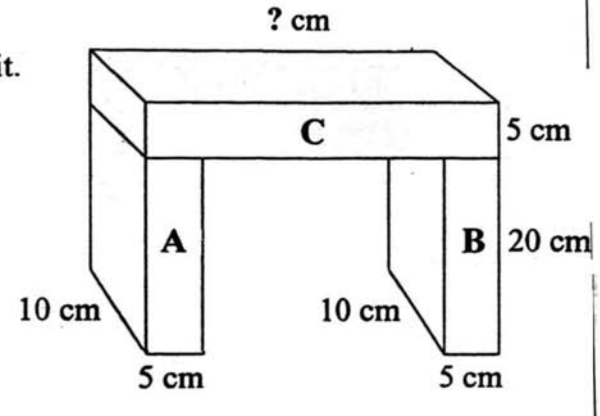
Lm 76

Question 19 required some thought. The number work was not so complicated, involving many multiples of 10. But finding the volume of C and the missing length was quite a bit of a problem. Rote learning of length × breadth × height is not enough. The strategy to find the volume of C is learned elsewhere in problems. The problem here is similar but in a different set-up. The problem of finding the length was demanding and few answered correctly. But the type of thinking required here is not to divide the volume by the area. It is rather the ability to use deductive reasoning. The type of question which children should ask at this stage is “which three numbers result in a volume of 1500 cm^3?” and proceed from there by trial and error. Certainly an amount of confidence with number work was also required.

19. Gejtu and Josephine visit the Neolithic Temples.

Gejtu makes a model of the entrance.
He uses 3 wooden cuboids A, B and C to make it.

Josephine has to find the volumes of A, B and C.
She makes the table below.
The table is not complete.



a) Complete the table for Josephine:

	Answer
Volume of Cuboid **A**	1000 cm^3
Volume of Cuboid **B**	1000 cm^3
Volume of Cuboid **C**	1500 cm^3
Total Volume	3500 cm^3

~~20×10~~
50×30
1500
5 × 10
50 × 20
~~2000~~
1000

20×5
100 ×10
1000

20×5
1000

20×10
200

b) i) Underline the correct answer.
The length of cuboid C is:

25 cm   <u>30 cm</u>   35 cm

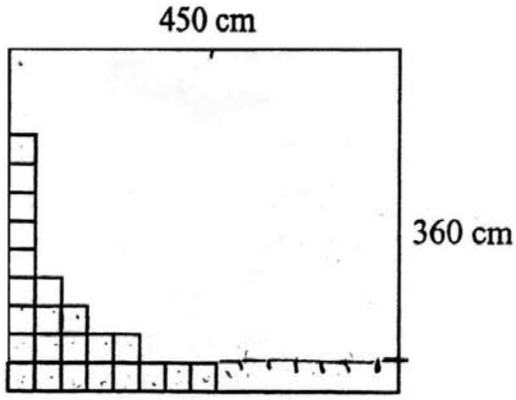
ii) Write down a reason for your answer:

Becaus its lenght is 10 cm more than hight of A. 20×50 1000

~~Because its lenght is~~

Below is one strategy that makes use of the fact that it is a scale drawing.
Notice the 12, the 8 and the 7 are obtained by counting the number of tiles and by estimating from the empty space. Then multiplying 12 by 8 and 7 and adding the result would give the correct answer.
The answer for the last part was obtained by dividing the square in the diagram into four parts. 90 divided by two, following the method of the first part, gives the correct answer of 45cm.

20. The **scale diagram** shows the floor of a room partly covered with tiles.

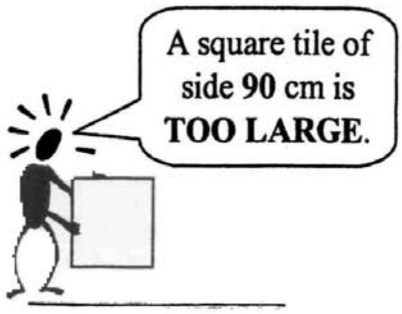


a) The floor is to be completely covered with **square tiles.** Each tile is of **side 30 cm.**
How many tiles are needed to cover the whole floor?

12x8 12x7 96+
96 84 84
180

180 tiles.

b) A **different** tile size can be used to cover the same floor.
Only **whole square** tiles can be used.
The size of each square tile must be **more** than 30 cm but **less** than 90 cm.
Find the **size** of the tile.



Each tile is of side 45 cm.

Markers' Comments

The following remarks were made by the markers and refer to the strengths and weakness demonstrated by the candidates in each question.

Question 1
Many children worked the multiplication but did not add in part (b). In part (c) the question on numbers in words presented a great difficulty. The traditional long multiplication method of putting the numbers one below the other and moving one column to the left to write the answer is unfortunately still very widespread.

Question 2
Difficulty was shown in manipulating equivalent fractions. Most students worked well throughout this question.

Question 3
The children found difficulty in drawing the pattern in part (b) i. It was an easy question

Question 4
Converting to decimals the fraction 7/1000 created some difficulty with the number of zeros after the decimal point. In part (b) many missed the multiplication of the 2c by 3 coins. Children should read the question carefully to avoid such errors.

Question 5
In this question the main difficulty was the drawing of the line starting from A. Many simply stopped at number 8 and many started from 0 notwithstanding the instructions.

Question 6
In this question part (c) proved to be the most difficult. Many committed the mistake that 100ml instead of 50ml were filled in half an hour.

Question 7
Many worked out this through measurement. As the diagram was a rough sketch many got a wrong answer.

Question 8
The children confused perimeter with area, the squares of the faces of the cube and the squares of the grid. Shading in one more face on the grid does not determine whether the question has been properly understood.

Question 9
Most errors were committed while converting the hours to minutes, using 100 minutes for one hour or writing five and a quarter hours as 5.25 instead of 5:15.

Question 10
Again converting kilometres to metres was a problem. The last part of the problem was left by the children in the wrong units or worked incorrectly. Conversion of units should be given more attention.

Question 11
Many markers commented about the poor language used by the children to describe the square and that many children said it was a diamond when they were told that it was a square. There was uncertainty on the understanding of the words vertical and horizontal as many drew all four lines of symmetry (which was not what they were told to do).

Question 12
Estimating area and capacity needs more attention. The most difficult part of this question was estimating the area of a copybook's front page. In finding the weight of one apple many worked wrongly the division by 60. Dividing by factors is preferable to long division in this case, as one of the factors is 10. Emphasis should be made on choosing an efficient strategy.

Question 13
Diagrams helped the children. But children need to read the questions carefully. Many left out multiplying by 10 the number of bunches. "Bunches of ten" was written six times in the question!

Question 14
Clockwise and anti-clockwise rotations were the dominant difficulties in this question. The association of 180° with the straight line and the triangle should be emphasised.

Question 15
The questions on bearings and data handling were answered correctly by many. Emphasis should be made on the language to describe mathematical ideas.

Question 16
Prime numbers and factors presented some difficulty. More work on factors is required as factors form the basis for algebra later on.

Question 17
This was an easy question although there was some difficulty with the meaning of key words such as "highest" and "lowest" and the calculation of the average value.

Question 18
Many students did not give proper attention to the diagram. The last part of the question could have been worked easily by multiplying Lm38 by 2. Many children failed to do this opting for equally valid different strategies or completely missing the method.

Question 19
The first part of this question was within the deductive ability of many children. The second part of the question required some trial and error in that the answer was given and it was required to find how it was obtained. This proved to be difficult. Many obtained the correct answer but gave a wrong description.

Question 20
This was a hard nut to crack. Some used the scale diagram while others did it by calculation. But the last part of the question was left out by many or it was worked out wrongly. Again the diagram of the small dummy with a 90cm by 90cm tile was apparently ignored.

Implications for Teaching and Learning

- Children should be encouraged to adopt methods that are based on reasoning and understanding. These methods are described in the Year 4, 5 and 6 Syllabus. Children will thus learn Mathematics in a meaningful way.

- Children should check their answers to ensure that they are reasonable. This should start from an early age, as soon as children are taught to solve the first problem. In this way good problem solving skills can develop.

- The concepts of number and place value need to be stressed. Large numbers should be read out carefully stressing the value of each digit. One should never say " one, two, five, seven" instead of "one thousand two hundred and fifty-seven" making meaningful numbers sound like telephone numbers! Many mistakes were committed on the questions related to this topic because children did not grasp the place value of a digit.

- Children need to read carefully the question and to spot the key words and data in the question. In this way mistakes will be avoided.

- Proportional relationships should not be taught without proper understanding. The questions in the paper related to proportional relationships could have been worked very neatly through reasoning as is shown in the exemplars of question number 6, in both methods.

- Answers should be in proper units where this is indicated. The number in the blank space for the answer before the units must be properly written. For instance 1.5 instead of 150 before cm is wrong if the answer should be 150cm, even though 1.5m is equivalent.

- Estimation needs to be emphasised. The units of area and volume, time and angular measure are all to be taught through estimation first and accuracy of measurement or calculation after. Practical work is important and needs to be emphasised.

- It is of utmost importance that children do not associate the name of a shape with its orientation. Shapes should not be presented always in the same way. For instance the square should not always be presented or drawn with one side horizontal and one side vertical! The solution of certain problems requires measurement but unless it is a scale diagram it is not permissible to solve by direct measurement.

- Emphasis should be made on the technique of dividing by factors.

- In solving problems it is important to adopt a technique which gives a correct solution. For this reason emphasis should be made on various strategies leading to a solution. Never present a one and only solution to a problem unless this is the case. Consider and appreciate all attempts even if sometimes the attempt falls short of the solution. This encourages a child to think.