

5.0 MATHEMATICS ALT A (121)

In the year 2011 Mathematics Alternative A was tested in two papers. **Paper 1 (121/1)** and **Paper 2 (121/2)**. Each paper consisted of two sections: Section 1 (50 marks) compulsory short answer questions of not more than four marks each and Section II (50 marks), a choice of eight questions of 10 marks each where candidates answer any five.

Paper 1 (121/1) tests mainly Forms 1 and 2 work while Paper 2 (121/2) tests mainly forms 3 and 4 work of the syllabus.

This report is based on an analysis of performance of candidates who sat the year 2011 KCSE Mathematics Alt A.

5.1 CANDIDATES' GENERAL PERFORMANCE

The table below shows the performance of both papers in the last five years.

Table 18: Candidates' Performance in Mathematics Alt A for the last five years

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
2007	1	273504	100	19.55	19.09
	2		100	19.91	20.74
	Overall		200	39.46	39.83
2008	1	304908	100	22.76	22.76
	2		100	19.82	19.56
	Overall		200	42.59	41.53
2009	1	335615	100	22.37	19.71
	2		100	19.89	18.78
	Overall		200	42.26	37.65
2010	1	356072	100	26.21	20.63
	2		100	19.92	20.35
	Overall		200	46.07	40.02
2011	1	409887	100	21.36	21.66
	2		100	28.22	23.57
	Overall		200	49.57	44.30

From the table the following observations can be made:

5.1.1 The overall performance shows an increasing trend in the mean. This is an improvement compared to the previous years.

5.1.2 There is a notable improvement in the performance of Paper 2 (121/2) from a mean of 19.92 in the year 2010 to a mean of 28.22 in the year 2011. However, Paper 1 (121/1) recorded a decline.

5.2.1.3 There has been a significant increase in the candidature over the years.

1.2 INDIVIDUAL QUESTION ANALYSIS

The following is a discussion of some of the questions in which the candidates had weakness.

1.2.1 PAPER 1 (121/1)

Question 4

A square room is covered by a number of whole rectangular slabs of sides 60 cm by 42 cm. Calculate the least possible area of the room in square metres. (3 marks)

The candidates were required to use the knowledge of L.C.M and apply it in solving the problem.

Weaknesses

The candidates had problems relating LCM to real life situations.

Expected response

$$60 = 2^2 \times 3 \times 5$$

$$42 = 2 \times 3 \times 7$$

$$\text{Side of room} = 2^2 \times 3 \times 5 \times 7 = 420\text{cm}$$

$$\text{Least area} = 4.2\text{m} \times 4.2\text{m} = 17.64 \text{ m}^2$$

Advice to teachers

Most books lack applications questions in this area, and thus teachers are asked to research in the area and expose students more to application questions.

Question 7

The external length, width and height of an open rectangular container are 41 cm, 21 cm and 15.5 cm respectively. The thickness of the material making the container is 5 mm. If the container has 8 litres of water, calculate the internal height above the water level. (4 marks)

The question tested on volume and Capacity. The candidates were required to use the knowledge of finding the volume of a cube and capacity to answer the question.

Weaknesses

Candidates were unable to visualize the aspect of the thickness of the container. Some could not convert the litres to cm^3 .

Expected response

Internal Dimensions: 40, 20 and 15

$$\begin{aligned} \text{Volume unoccupied} &= 40 \times 20 \times 15 - 8000 \\ &= 4000 \end{aligned}$$

$$\text{Height above water level} = \frac{4000}{40 \times 20} = 5\text{cm}$$

Advice to teachers

Give more application questions.

Question 12

Three vertices of a parallelogram PQRS are P (-1, 2), Q (8, -5) and R (5, 0).

(a) On the grid provided below draw the parallelogram PQRS. (1 mark)

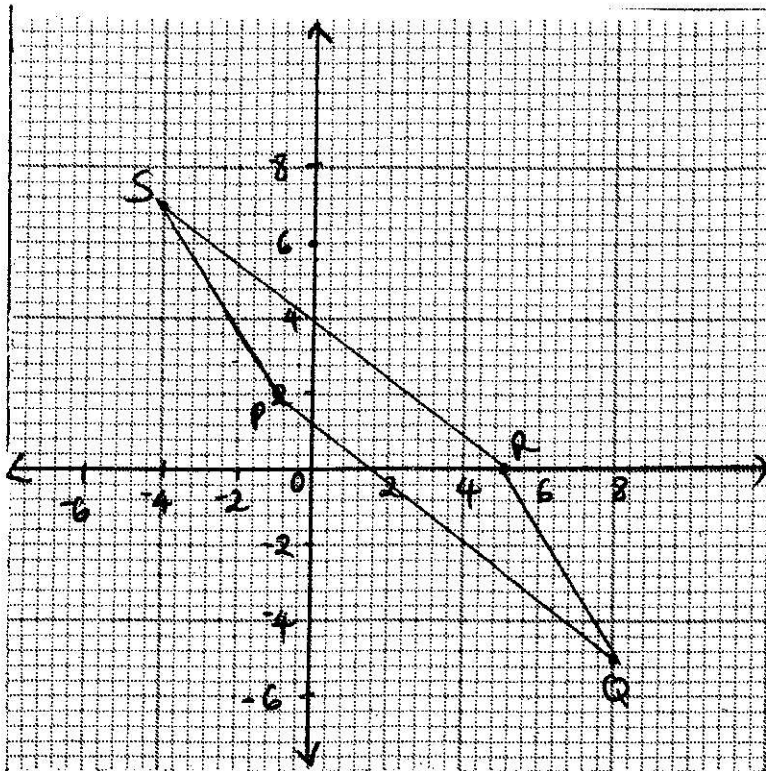
(b) Determine the length of the diagonal QS. (2 marks)

The question tested on coordinates and plane figures. Candidates were required to locate a point on the Cartesian plane to complete the parallelogram. Knowledge on the properties of the parallelogram was required.

Weaknesses

Inability to locate the point needed to complete the parallelogram.

Expected response



$$QS = \sqrt{12^2 + 12^2} = 16.97$$

Advice to teachers

Concept on Coordinate geometry and properties of plane figures need to be reemphasized.

Question 13

In January, Mambo donated $\frac{1}{6}$ th of his salary to a children's home while Simba donated $\frac{1}{5}$ th of his salary to the same children's home. Their total donation for January was

Ksh 14 820. In February, Mambo donated $\frac{1}{8}$ th of his salary to the children's home while Simba donated $\frac{1}{12}$ th of his salary to the children's home. Their total donation for February was Ksh 8 675. Calculate Mambo's monthly salary. (4 marks)

Question tested on forming and solving simultaneous equations.

Weaknesses

Most candidates were unable to manipulate the fractional coefficients.

Expected response

Let Mambo's salary be x and Simba's salary be y

$$\frac{1}{6}x + \frac{1}{5}y = 14820$$

$$\frac{1}{8}x + \frac{1}{12}y = 8675$$

$$5x + 6y = 444600$$

$$3x + 2y = 208200$$

$$5x + 6y = 444600$$

$$9x + 6y = 624600$$

$$4x = 180000$$

$$x = 45000$$

Advice to teachers

Give more exercises involving solving simultaneous equations having different types of coefficients.

Question 21

(a) Using the trapezium rule with seven ordinates, estimate the area of the region bounded by the curve $y = -x^2 + 6x + 1$, the lines $x = 0$, $y = 0$ and $x = 6$. (5 marks)

(b) Calculate:

(i) the area of the region in (a) above by integration; (3 marks)

(ii) the percentage error of the estimated area to the actual area of the region, correct to two decimal places. (2 marks)

The question tested on area estimation using trapezium rule.

Weaknesses

Candidates were unable to find the ordinates and thus could not determine the area.

Expected response

a) *Ordinates*

$$x = 0 \quad y_1 = 1$$

$$x = 1 \quad y_2 = 6$$

$$x = 2 \quad y_3 = 9$$

$$x = 3 \quad y_4 = 10$$

$$x = 4 \quad y_5 = 9$$

$$x = 5 \quad y_6 = 6$$

$$x = 6 \quad y_7 = 1$$

$$\text{Area} = \frac{1}{2} \times 1 \times \{1 + 2(6 + 9 + 10 + 9 + 6)\} = \frac{1}{2}(82) = 41$$

$$(b) \quad (i) \quad \int_0^6 -x^2 + 6x + 1 = \left[-\frac{1}{3}x^3 + \frac{6}{2}x^2 + x \right]_0^6 = -72 + 108 + 6 = 42$$

$$(ii) \quad \frac{42 - 41}{42} \times 100\% = 2.38\%$$

Advice to teachers

Teach the area thoroughly.

Question 24

The frequency table below shows the daily wages paid to casual workers by certain company.

Wages in shillings	100-150	150-200	200-300	300-400	400-600
No. of workers	160	120	380	240	100

(a) Draw a histogram to represent the above information.

(5 marks)

(b) (i) State the class in which the median wage lies.

(1 mark)

(ii) Draw a vertical line, in the histogram, showing where the median wage lies.

(1 mark)

(c) Using the histogram, determine the number of workers who earn sh 450 or less per day.

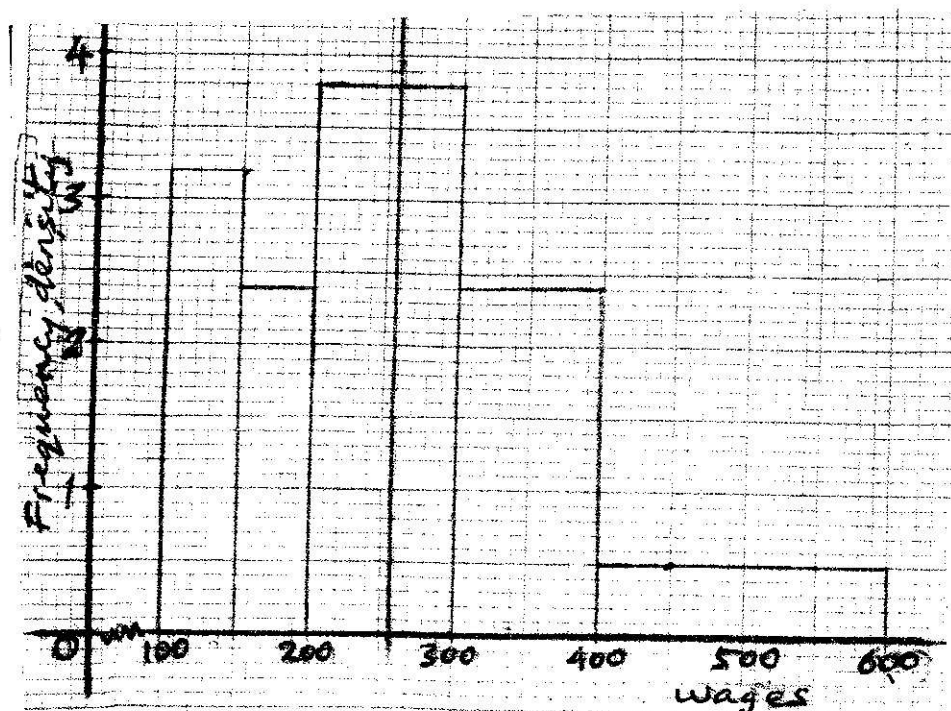
(3 marks)

The question tested on drawing of the histograms using the frequency density.

Weaknesses

The candidates were unable to draw the histogram.

Expected response



(a)

(b) (i) median class: 200 – 300

(c) Number of workers who earn Sh. 450 or less per day = $900 + 50 \times 0.5 = 925$

Advice to teachers

Teach expansively on how to draw and interpret histograms.

1.2.2 PAPER 2 (121/2)

Question 4

(a) Solve the inequalities $2x - 5 > -11$ and $3 + 2x \leq 13$, giving the answer as a combined inequality. (3 marks)

(b) List the integral values of x that satisfy the combined inequality in (a) above. (1 mark)

The question tested on solving of inequalities.

Weaknesses

Failure to give the solution as a combined inequality.

Expected response

(a)

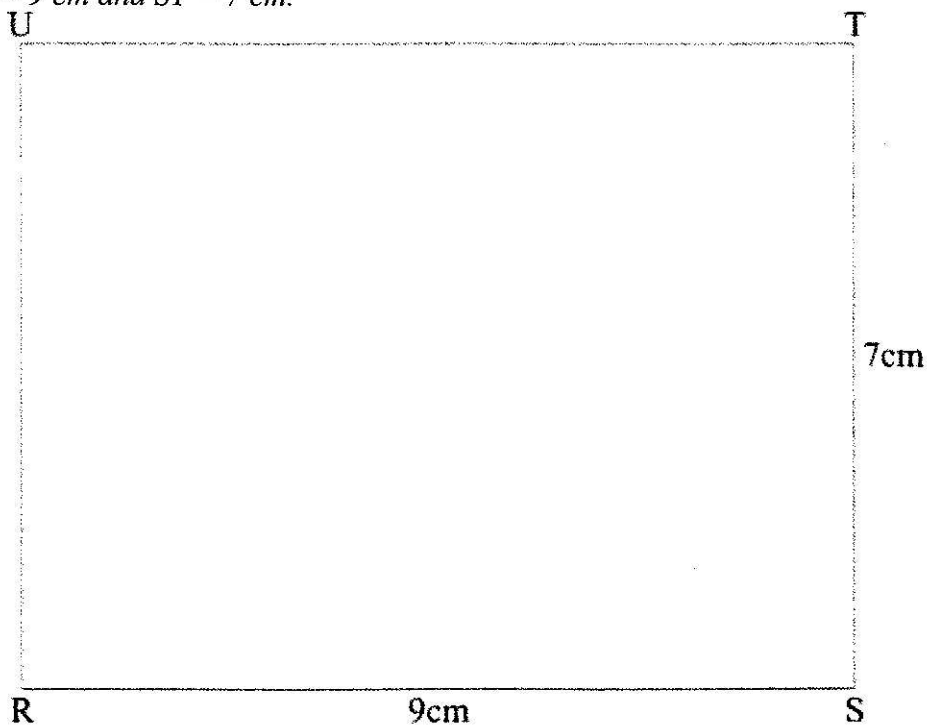
$$2x - 5 > -11 \Rightarrow 2x > -6 \Rightarrow x > -3$$

$$3 + 2x \leq 13 \Rightarrow 2x \leq 10 \Rightarrow x \leq 5$$

$$\therefore -3 < x \leq 5$$

(b) *Integral values: -2, -1, 0, 1, 2, 3, 4, 5.***Advice to teachers**

Guide students more on the solving of inequalities.

Question 12*The figure below represents a scale drawing of a rectangular piece of land, RSTU.**RS = 9 cm and ST = 7 cm.*

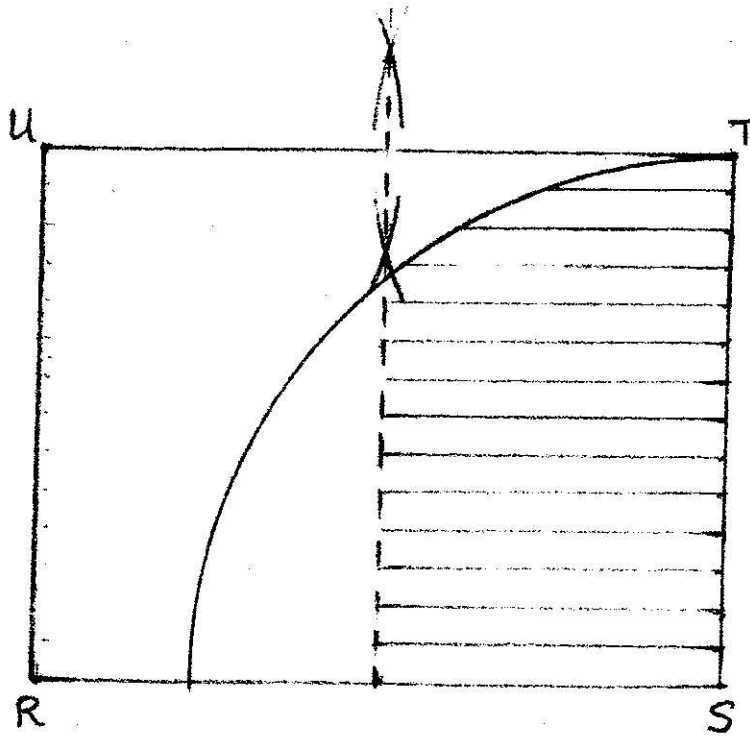
An electric post P, is to be erected inside the piece of land. On the scale drawing, shade the possible region in which P would lie such that $PU > PT$ and $PS \leq 7$ cm. (3 marks)

The question tested on locus. The candidates were expected to represent the inequality of locus in the figure.

Weaknesses

Unable to construct the loci

Expected response



Advice to teachers

Give more examples and exercises in this area.

Question 18

The first, fifth and seventh terms of an Arithmetic Progression (AP) correspond to the first three consecutive terms of a decreasing Geometric Progression (G.P). The first term of each progression is 64, the common difference of the AP is d and the common ratio of the G.P is r .

- (a) (i) Write two equations involving d and r . (2 marks)
(ii) Find the values of d and r . (4 marks)
- (b) Find the sum of the first 10 terms of:
(i) the Arithmetic Progression (A.P); (2 marks)
(ii) the Geometric Progression (G.P). (2 marks)

The question tested on Arithmetic Progression (AP) and Geometric Progression (GP). The candidates were required to find the common ratio for the GP, common difference for the AP and the sums of the AP and GP

Weaknesses

Application of the knowledge of AP and GP was a challenge to many candidates.

Expected response

$$(a) (i) \begin{aligned} 64 + 4d &= 64r \\ 64 + 6d &= 64r^2 \end{aligned}$$

(ii) From (i)

$$d = 16r - 16$$

$$64r^2 = 64 + 6(16r - 16)$$

$$64r^2 = 64 + 96r - 96$$

$$2r^2 - 3r + 1 = 0$$

$$(2r - 1)(r - 1) = 0$$

$$r = \frac{1}{2} \text{ or } r = 1$$

For decreasing GP, $r = \frac{1}{2}$

Substituting $r = \frac{1}{2}$ in (i)

$$64 \times \frac{1}{2} = 64 + 4d$$

$$d = -8$$

(b) (i) A.P

$$S_{10} = \frac{10}{2} \{ 2 \times 64 + 9 \times -8 \} = 280$$

(ii) G.P

$$S_{10} = \frac{64 \left(1 - \frac{1}{2^{10}} \right)}{1 - \frac{1}{2}} = \frac{64 \left(\frac{1023}{1024} \right)}{\frac{1}{2}} = 127.875$$

Advice to teachers

Involve students more in situations involving application of AP and GP.

Question 23

The cost C , of producing n items varies partly as n and partly as the inverse of n . To produce two items it costs Ksh 135 and to produce three items it costs Ksh 140.

Find:

(a) the constants of proportionality and hence write the equation connecting C and n ; (5 marks)

(b) the cost of producing 10 items; (2 marks)

(c) the number of items produced at a cost of Ksh 756. (3 marks)

The question tested on partial variation. The candidates were required to form equation from the given situation then solve

Weaknesses

Understanding of partial variation.

Formation of the equations

Expected response

1. (a) $c = an + \frac{b}{n}$

$$135 = 2a + \frac{b}{2}$$

$$140 = 2a + \frac{b}{3}$$

$$270 = 4a + b$$

$$420 = 9a + b$$

$$150 = 5a \Rightarrow a = 30$$

$$270 = 120 + b \Rightarrow b = 150$$

$$c = 30n + \frac{150}{n}$$

(b)

$$\begin{aligned} c &= 30 \times 10 + \frac{150}{10} \\ &= 315 \end{aligned}$$

(c) $756 = 30n + \frac{150}{n}$

$$756n = 30n^2 + 150$$

$$5n^2 - 126n + 25 = 0$$

$$(5n - 1)(n - 25) = 0$$

$$n = \frac{1}{5} \text{ or } n = 25$$

$$\text{number of items} = 25$$

Advice to teachers

Explain different forms of variation, how to form the equations and how to solve.

Question 24

A building contractor has two Lorries, P and Q, used to transport at least 42 tonnes of sand to a building site. Lorry P carries 4 tonnes of sand per trip while lorry Q carries 6 tonnes of sand per trip. Lorry P uses 2 litres of fuel per trip while lorry Q uses 4 litres of fuel per trip. The two Lorries are to use less than 32 litres of fuel. The number of trips made by lorry P should be less than 3 times the number of trips made by lorry Q. Lorry P should make more than 4 trips.

- (a) Taking x to represent the number of trips made by lorry P and y to represent the number of trips made by lorry Q, write the inequalities that represent the above information. (4 marks)
- (b) On the grid provided, draw the inequalities and shade the unwanted regions. (4 marks)
- (c) Use the graph drawn in (b) above to determine the number of trips made by lorry P and by lorry Q to deliver the greatest amount of sand. (2 marks)

Question tested on linear programming. The candidates were required to form inequalities and then graph them.

Weaknesses

Unable to form the inequalities

Expected response

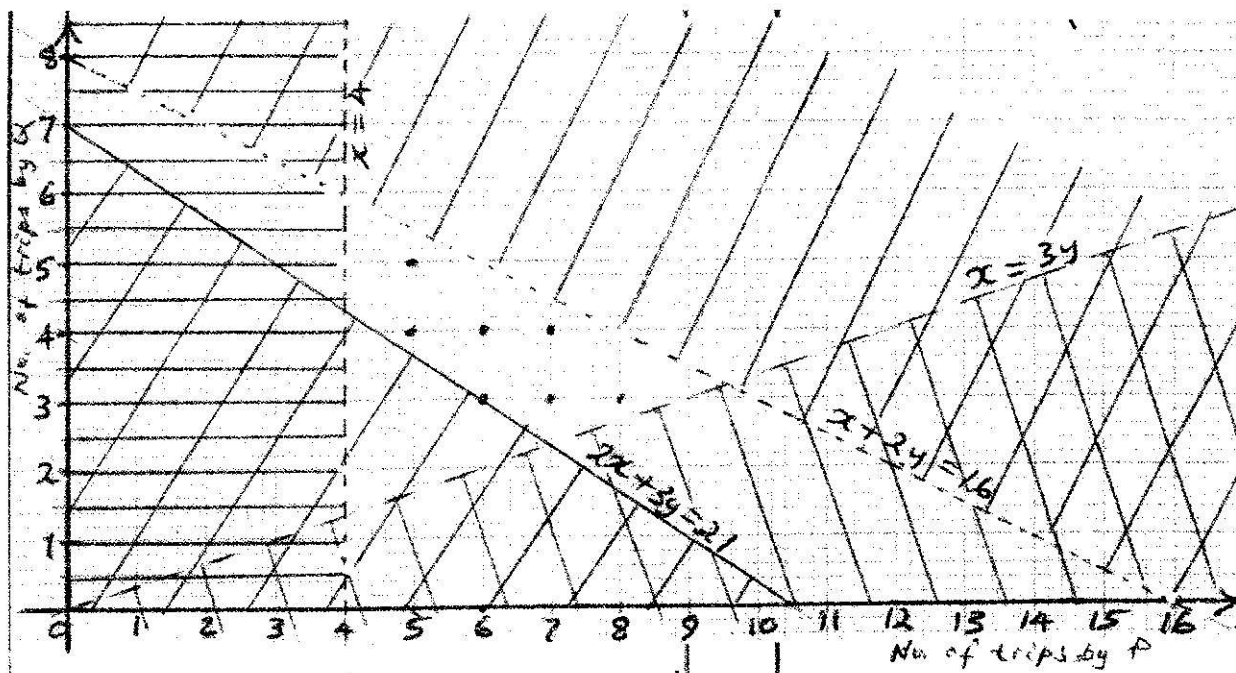
(a)

$$4x + 6y \geq 42 \Leftrightarrow 2x + 3y \geq 21$$

$$2x + 4y < 32 \Leftrightarrow x + y < 16$$

$$x < 3y$$

$$x > 4$$



- (c) $x = 5, y = 5 \Rightarrow 5 \times 4 + 5 \times 6 = 50$ tons
 $x = 6, y = 4 \Rightarrow 6 \times 4 + 4 \times 6 = 48$ tons
 $x = 7, y = 4 \Rightarrow 7 \times 4 + 4 \times 6 = 52$ tons

Advice to teachers

Expose the students to various situations involving formation of inequalities and their graphs.