5.0 MATHEMATICS ALT A (121)

The 2010 KCSE Mathematics Alternative A was tested in two papers. **Paper 1 (121/1)** and **Paper 2 (121/2)**. The papers are equally weighted with each having two sections; Section 1 (50 marks) 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. 2

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

It is hoped that this report will be helpful to teachers in the teaching/learning process as well as in preparing candidates for future examinations.

5.1 CANDIDATES' GENERAL PERFORMANCE

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

Table 10: ***Candidates' Performance in Mathematics for the last four years***

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

From the table the following observations can be made:

5.1.1 The overall performance in Mathematics Alt A shown a slightly improvement compared to the previous years.

5.1.2 There is a notable improvement in the performance of Paper 1 (121/1) from a mean of 22.27 in the year 2009 to a mean of 26.21 in the year 2010.

5.1.3 Paper 2 (121/2) shown a slight improvement from a mean of 19.89 in the year 2009 to a mean of 19.92 in the year 2010

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

5.2 INDIVIDUAL QUESTION ANALYSIS

The following is a discussion of the questions in which the candidates performed poorly.

5.2.1 PAPER 1 (121/1)

Question 4

A bus left a petrol station at 9.20 a.m. and travelled at an average speed of 75 km/h to a town N. At 9.40 a.m. a taxi, travelling at an average speed of 95 km/h, left the same petrol station and followed the route of the bus.

Determine the distance, from the petrol station, covered by the taxi at the time it caught up with the bus. (3 marks)

The question tested on relative speed in the topic of linear motion.

Weaknesses

Calculation of the distance covered.

Expected response

Let the distance be d km

$$\frac{d}{75} \text{ or } \frac{d}{95}$$

$$\frac{d}{75} - \frac{d}{95} = \frac{20}{60}$$

$$d = 118.75km$$

Advice to teachers

Give more practical examples in relative motion.

Question 10

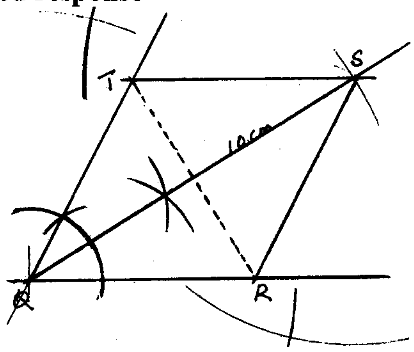
Using a ruler and a pair of compasses only, construct a rhombus QRST in which angle TQR = 60° and QS = 10 cm. (3 marks)

The question tested on basic construction of a rhombus. The candidates were required to have knowledge of the properties of a rhombus.

Weaknesses

The location of point S. Candidates who did not score in this question took the length of the diagonal as equal to the length of one of the sides.

Expected response

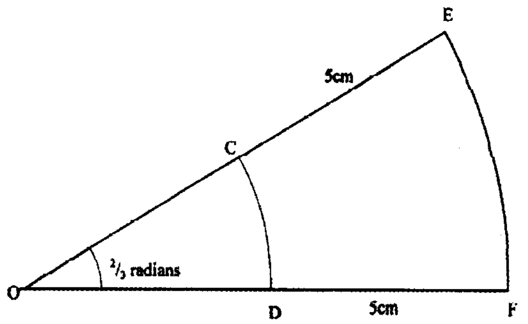


Advice to teachers

Emphasis on construction of basic plane figures is essential. Give guidance on the correct labeling of plane figures.

Question 15

The figure below shows two sectors in which CD and EF are arcs of concentric circles, centre O. Angle COD = radians and CE = DF = 5 cm.



If the perimeter of the shape CDFE is 24 cm, calculate the length of OC. (3 marks)

The question tested on arc length of a circle. Use of the relationship $s = r\theta$ where s is the arc length and θ is the angle at the centre measured in radians was required.

Weaknesses

Use of the radian measure in calculating the arc length. i.e. $s = r\theta$, where θ is in radians

Expected response

Let OC = r

$$\therefore CD = \frac{2}{3}r \quad \text{and} \quad EF = \frac{2}{3}((r+5)$$

$$\frac{2}{3}r + \frac{2}{3}(r+5) + 5 + 5 = 24$$

$$\frac{4}{3}r = 10\frac{2}{3}$$

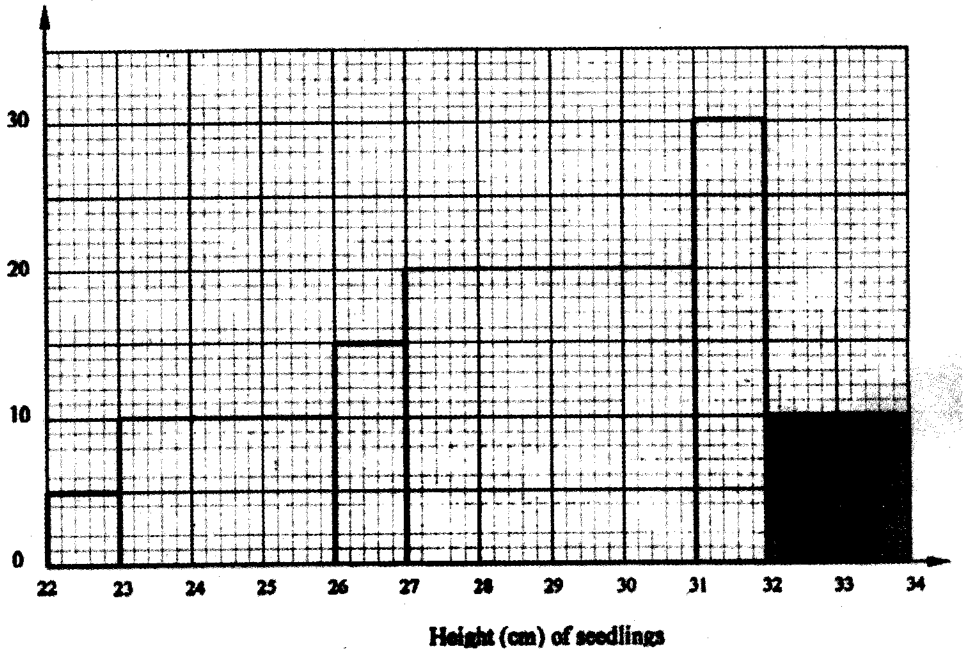
$$r = 8$$

Advice to teachers

Emphasis on the radian measure and on conversion from degrees to radians and vice versa

Question 16

The histogram shown below represents the distribution of heights of seedlings of a certain plant.



The shaded area in the histogram represents 20 seedlings. Calculate the percentage number of seedlings with heights of at least 23 cm but less than 27 cm.

(3 marks)

The question is on representation of data with unequal width using a histogram. The students were required to calculate the frequency density of each class in order to answer the question.

Weaknesses

Most candidates could not interpret the histogram properly and thus unable to answer question.

Expected response

Total No. Of seedlings

$= 5 \times 1 + 10 \times 3 + 15 \times 1 + 20 \times 4 + 30 \times 1 + 10 \times 2$

$= 5 + 30 + 15 + 80 + 30 + 20$

$= 180$

% height (h) : $23 \leq h \angle 27$

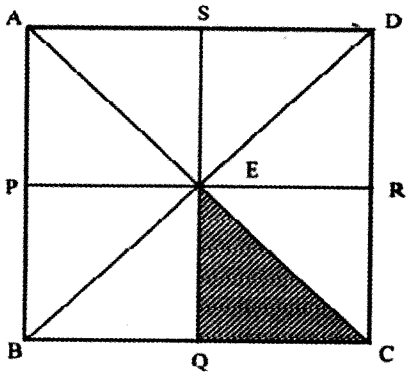
$= \left(\frac{30 + 15}{180} \right) \times 100\%$

$= 25\%$

Advice to teachers

This is an area which been performed poorly whenever it's tested. Teachers are advised to teach this area thoroughly and give more practice in the area for the concept to be understood clearly.

Question 22
In the figure below, ABCD is a square. Points P, Q, R and S are the midpoints of AB, BC, CD and DA respectively.



(a) Describe fully:
(i) a reflection that maps triangle QCE onto triangle SDE; (1 mark)

(ii) an enlargement that maps triangle QCE onto triangle SAE; (2 marks)

(iii) a rotation that maps triangle QCE onto triangle SED. (3 marks)

(b) The triangle ERC is reflected on the line BD. The image of ERC under the reflection is rotated clockwise through an angle of 90o about P.

Determine the images of R and C:
(i) under the reflection; (2 marks)

(ii) after the two successive transformations. (2 marks)

The question tested on transformations. Candidates were required to know the general properties of transformations, i.e. reflection, rotation and enlargement.

Weaknesses
This question was unpopular with most of the candidates. Some of those who attempted the question had weaknesses in the description of the transformation .

Expected responses

(a) (i) Reflection in the line PR or ER

(ii) Enlargement centre E
Scale factor = -1

(iii) Rotation about point R through 90^0 clockwise

(b) (i) R ⟶ S
C ⟶ A

(ii) R ⟶ Q
C ⟶ E

Advice to teachers
The question was unpopular to most of the candidates. Thus there is need for more emphasis on transformations and use of more practical situations other than the ones in the text books only.

5.2.2 PAPER 2 (121/2)

Question10

The points O, A and B have the coordinates (0, 0), (4, 0) and (3, 2) respectively. Under a shear represented by the matrix $\begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix}$, triangle OAB maps onto triangle OAB'.

(a) Determine in terms of k, the x coordinate of point B'. (2 marks)

(b) If OAB' is a right angled triangle in which angle $OB'A$ is acute, find two possible values of k. (2 marks)

The question was on matrix transformation. Knowledge of the shear and stretch was important in answering this question

Weaknesses

The question was unfamiliar to both students and teachers especially in part (b). There was wrong interpretation of x and y coordinates with the students. Correct understanding of the shear was also a problem.

Expected responses

(a) $\begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 3+2k \\ 2 \end{pmatrix}$

x ordinate = 3+2k

(b) $3+2k=4 \Rightarrow k=\frac{1}{2}$

$3+2k=0 \Rightarrow k=-\frac{3}{2}$

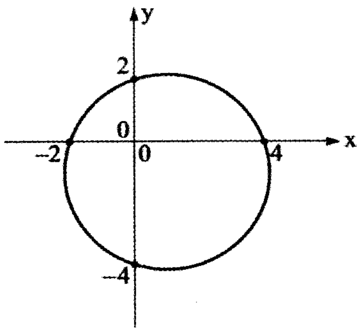
(4 marks)

Advice to teachers

Emphasis on transformation is important and also use of different approaches to teach the topic.

Question16

The circle shown below cuts the x-axis at (–2, 0) and (4, 0). It also cuts y-axis at (0, 2) and (0,–4).



Determine the:

(a) (i) coordinates of the centre; (1 mark)

(ii) radius of the circle. (1 mark)

(b) equation of the circle in the form $x^2 + y^2 + ax + by = c$ where a, b and c are constants. (2 marks)

The question tested on equation of a circle. The candidates were required to use knowledge of chords in answering the question. Point of intersection of the perpendicular bisector of the chords gives the center on the circle

Weaknesses
Use of the chords to find the coordinates of the centre of the circle was a problem due to failure to relate the perpendicular bisectors of the chords and the centre of the circle.

Expected responses

(a) Coordinates of centre (1, -1)

Radius: $r^2 = 1^2 + 3^3 = 10 \Rightarrow r = \sqrt{10}$

(b) Equation

$(x-1)^2 + (y+1)^2 = 10$

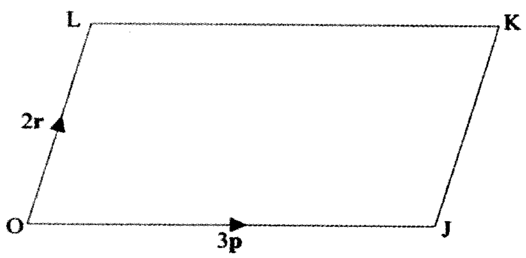
$x^2 - 2x + 1 + y^2 2y + 1 = 10$

$x \ + y^2 - 2x + 2y = 8$

(4 marks)

Advice to teachers
Revise on chord of a circle and their perpendicular bisectors .

Question18
In the figure below OJKL is a parallelogram in which **OJ** = 3**p** and **OL** = 2**r**.



(a) If A is a point on LK such that LA = AK and a point B divides the line JK externally in the ratio 3:1, express **OB** and **AJ** in terms of **p** and **r**. (2 marks)

(b) Line OB intersects AJ at X such that **OX** = m**OB** and **AX** = n**AJ**.

(i) Express **OX** in terms of **p**, **r** and m. (1 mark)

(ii) Express **OX** in terms of **p**, **r** and n. (1 mark)

The question tested on vectors and ration theorem.

Weaknesses

Interpretation of a ratio for external division.

Expected responses

(a) $\boldsymbol{OB} = 3\boldsymbol{p} + 3\boldsymbol{r}$

$\boldsymbol{AJ} = 2\boldsymbol{p} + 2\boldsymbol{r}$

(b) $\boldsymbol{OX} = m(\boldsymbol{OB}) = m(3\boldsymbol{p} + 3\boldsymbol{r})$

$\boldsymbol{OX} = 2\boldsymbol{r} + \boldsymbol{p} + n(2\boldsymbol{p} - 2\boldsymbol{r})$

(iii) $m(3\boldsymbol{p}+3\boldsymbol{r}) = 2\boldsymbol{r}-2n\boldsymbol{r}+\boldsymbol{p}+2n\boldsymbol{p}$

$3m\boldsymbol{p}+3m\boldsymbol{r} = \boldsymbol{r}(2-2n)+\boldsymbol{p}(1+2n)$

$3m\boldsymbol{p} = (1+2n)\boldsymbol{p}$

$3m = 1+2n$.............. (i)

$3m\boldsymbol{r} = \boldsymbol{r}(2-2n)$

$3m = 2-2n$.............. (ii)

$1-2n = 2-2n$

$4n = 1 \Rightarrow n = \frac{1}{4}$

Subst. for $n = \frac{1}{4}$ in (i)

$3m = 1+2\times\frac{1}{4}$

$3m = 1\frac{1}{4} \Rightarrow m = \frac{3}{2\times 3} = \frac{1}{2}$

The ratio in which x divides $\boldsymbol{AJ}$

$\boldsymbol{AX} = n\boldsymbol{AJ} = \frac{1}{4}\boldsymbol{AJ}$

Ratio 1: 3

(10 marks)

Advice to teachers

Emphasize on different situations in external division.

Question 22

The first term of an Arithmetic Progression (A.P.) with six terms is p and its common difference is c. Another A.P. with five terms has also its first term as p and a common difference of d. The last terms of the two Arithmetic Progressions are equal.

(a) Express d in terms of c. (3 marks)

(b) Given that the 4th term of the second A.P. exceeds the 4th term of the first one by $1\frac{1}{2}$, find the values of c and d. (3 marks)

(c) Calculate the value of p if the sum of the terms of the first A.P. is 10 more than the sum of the terms of the second A.P. (4 marks)

The question tested on Arithmetic progression (A.P). Candidates were required to calculate the common differences of the two APs and the first term.

Weaknesses

Relating the terms in the two progressions.

Expected responses

(a)

$$T_6 = p + 5c$$

$$T_5 = p + 4d$$

$$p + 4d = p + 5c$$

$$4d = 5c$$

$$d = \frac{5}{4}c$$

(b)

$$p + 3d - (p + 3c) = 1\frac{1}{2}$$

$$3d - 3c = 1\frac{1}{2}$$

$$\frac{15}{4}c - 3c = 1\frac{1}{2}$$

$$\frac{3}{4}c = \frac{3}{2} \Rightarrow c = 2$$

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

(c)

$$S_6 = \frac{1}{2}n(a + \ell) = \frac{1}{2}n(2p + 10)$$

$$= 3(2p + 10) = 6p + 30$$

$$S_5 = \frac{1}{2}n(2p + 10) = 2.5(2p + 10) = 5p + 25$$

$$(6p + 30) - (5p + 25) = 10$$

$$p + 5 = 10$$

$$p = 5$$

(10 marks)

Advice to teachers
Give more practical examples on the topic of sequence and series.