3.0 PART ONE: ANALYSIS OF DIFFICULT QUESTIONS

3.1 MATHEMATICS ALT A (121)

In the year 2018 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) consisting of 16 compulsory short answer questions of not more than four marks each and Section II (50 marks), with eight questions of 10 marks cach 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 2018 KCSE Mathematics Alt A.

3.1.1 CANDIDATES' GENERAL PERFORMANCE

Thc tablc below shows the performance of both papers in the last five years.

Table 9: Candidates' Performance in Mathematics Alt A for the last five years, 2014– 2018

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
2014	**1**	**481286**	100	24.54	20.77
	2		100	23.50	23.16
	Overall		**200**	**48.04**	**42.94**
2015	**1**	**520274**	100	25.53	20.39
	2		100	28.23	22.81
	Overall		**200**	**53.76**	**40.87**
2016	**1**	**570398**	100	23.74	21.24
	2		100	17.84	21.09
	Overall		**200**	**41.56**	**41.20**
2017	**1**	**609525**	100	24.49	22.03
	2		100	26.47	22.43
	Overall		**200**	**50.95**	**43.46**
2018	**1**	**658904**	100	24.07	21.16
	2		100	28.82	20.85
	Overall		200	**52.88**	**41.1**

From the table the following observations can be made:

i) There was a marginal drop in paper 121/1 compared to the previous year 2017. In paper 121/2 there was an improvement in the mean as compared to the previous year 2017.

ii) There was a 1.93 marks improvement in the overall mean.

3.1.2 INDIVIDUAL QUESTION ANALYSIS

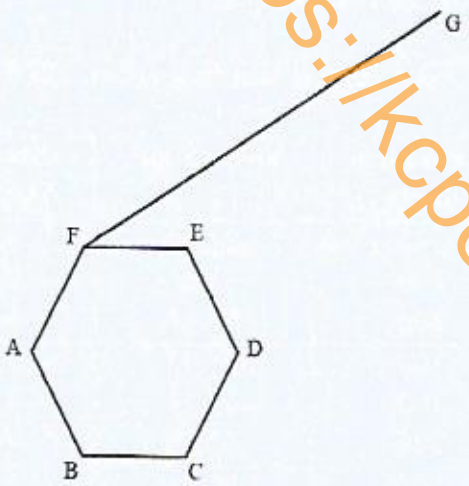
The following is a discussion of some of the questions in which the candidates had major weakness in, as a result of which these questions were poorly performed. The discussion is based on comments from the chief examiners reports and an analysis the students' responses and scores from sampled scripts.

3.1.3 Mathematics Paper 1 (121/1)

In section 1 of 121/1, questions 1, 2 and 15 were performed well by most of the candidates. In Section II, questions 19 and 23 were performed well by the candidates who choose them.
In section II, questions 17 and 19 were the most popular among the candidates.

Question 4

In the figure below ABCDEF is a uniform cross section of a solid. Given that FG is one of the visible edges of the solid, complete the sketch showing the hidden edges with broken lines.

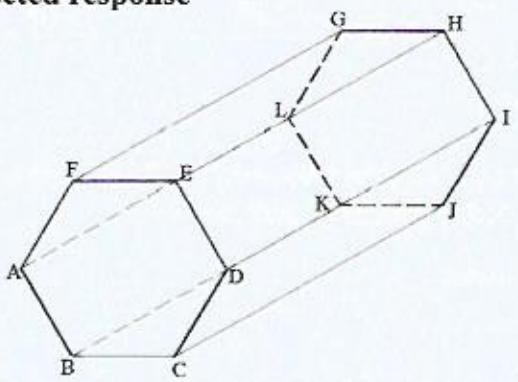


The question tested on sketching of common solids. (Hexagonal Prism).

Weaknesses

- Inability to draw parallel lines
- Not sure of where to use continuous and broken lines

Expected response



Advice to teachers

Practically teach nets of solids and drawing of common solids.

Question 5

The lengths of three wires were 30 m, 36 m and 84 m. Pieces of wire of equal length were cut from the three wires. Calculate the least number of pieces obtained. (4 marks)

The question tested on the application of GCD in real life.

Weaknesses

The word least was interpreted to require the application of LCM and this lead to many candidates calculating LCM instead of GCD/HCF.

Expected response

$$\left.\begin{aligned} 30 &= 3\times 2\times 5 \\ 36 &= 2\times 2\times 3\times 3 \\ 84 &= 2\times 2\times 3\times 7 \end{aligned}\right\}$$

$G.C.D. = 2\times 3$

$= 6$

No of pieces obtained

$= \frac{30}{6} + \frac{36}{6} + \frac{84}{6}$

$= 25$

Advice to teachers

Teach understanding of LCM and GCD especially the application.

Question 6

A two digit number is such that, the sum of its digits is 13. When the digits are interchanged, the original number is increased by 9. Find the original number. (4 marks)

The question tested on forming and solving linear equations with two unknowns.

Weaknesses

Candidates were unable to form an expression involving a two digit number. ie $xy = 10x + y$

Expected response

Let the number be xy

$$\left.\begin{array}{l} x+y=13 \\ (10y+x)-(10x+y)=9 \ \ or \ \ -x+y=1 \end{array}\right\}$$

$$x+y=13$$

$$\underline{y-x=1}$$

$$2y=14$$

$$y=7$$

$$x=6$$

Number is 67.

Advice to teachers

Teach and relate the concept of place value
Formation of equations involving two and three digit numbers.

Question 16

A photograph print measuring 24 cm by 15 cm is enclosed in a frame. A uniform space of width x cm is left in between the edges of the photograph and the frame. If the area of the space is 270 cm², find the value of x. (3 marks)

The question tested on the formation and solving of quadratic equations.

Weaknesses

Most students could not visualize how the photograph is fixed in a frame. Some even had the frame being smaller than the photograph.

Expected response

Area of space $= 2\times(15+2x)x+2\times24\times x$

$$30x+4x^2+48x=270$$

$$4x^2+78x-270=0$$

$$4x^2-12x+90x-270=0$$

$$4x(x-3)+90(x-3)=0$$

$$4x(x-3)+90(x-3=0$$

$$(4x+90)(x-3)=0$$

$$x=-22.5 \ \ or \ \ x=3$$

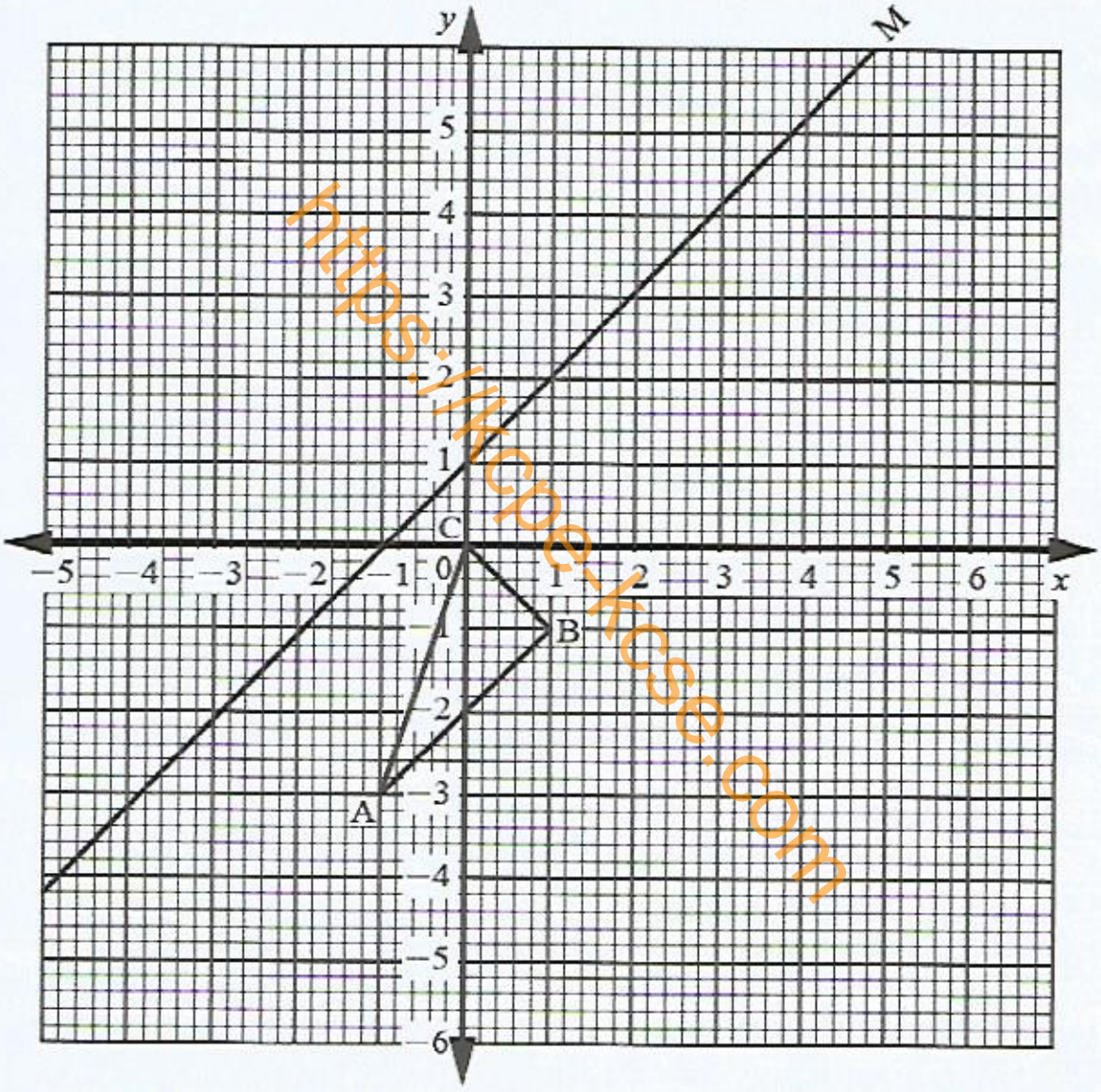
$$x=3cm$$

Advice to teachers

Use real life photographs or other scenarios to visualize the concept of frame and the width left after fixing the photograph.

Question 20

The diagram below shows triangle ABC with vertices A(−1, −3), B(1, −1) and C(0,0), and line M.



(a) Draw triangle A′B′C′ the image of triangle ABC under a reflection in the line M. (2 marks)

(b) Triangle A″B″C″ is the image of triangle A′B′C′ under a transformation represented by the matrix $\mathbf{T} = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$

(i) Draw triangle A″B″C″ (3 marks)

(ii) Describe fully the transformation represented by matrix **T**. (3 marks)

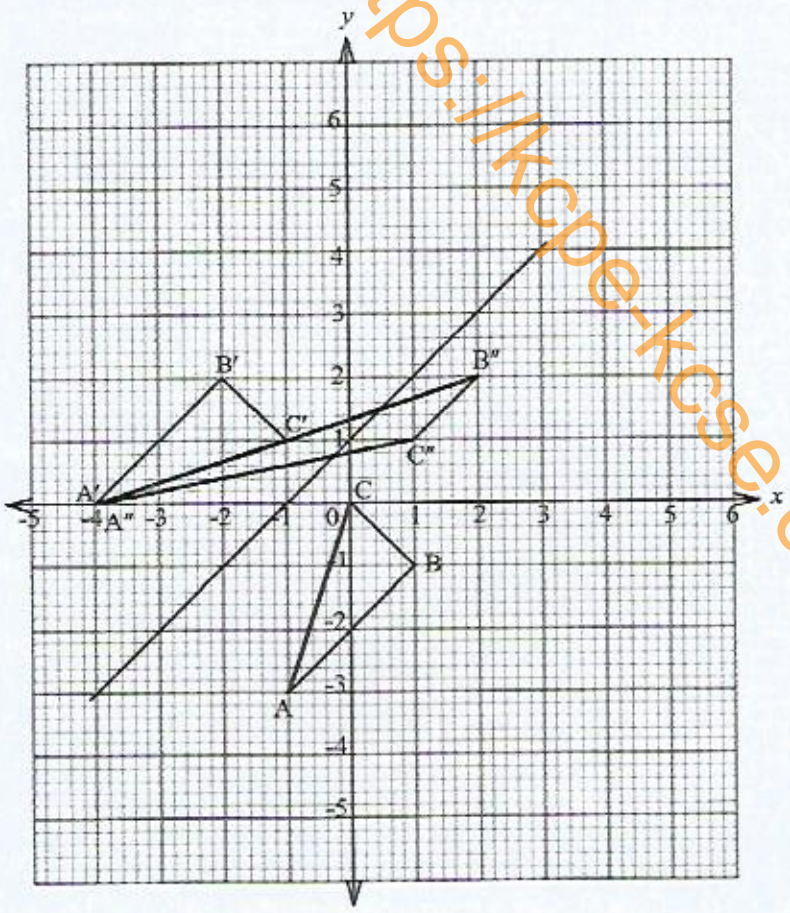
(iii) Find the area of triangle A′B′C′ hence find area of triangle A″B″C″. (2 marks)

The question tested on application of reflection on the cartesian plane, relating image and object under a given transformation, use of the relationship between Area Scale factor and determinant of a transformation matrix and describing a transformation.

Weaknesses

The mirror line was not well used by the candidates.
Some candidates post multiplied with the transformation matrix rather than pre multiply

Expected Response



(a) Correct position of the vertices of $A'B'C'$

Correctly complete triangle $A'B'C'$ drawn

(b) (i)
$$\begin{matrix} & A' & B' & C' \end{matrix}$$
$$\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} -4 & -2 & -1 \\ 0 & 2 & 1 \end{pmatrix} = \begin{matrix} A'' & B'' & C'' \end{matrix}$$
$$= \begin{pmatrix} -4 & 2 & 1 \\ 0 & 2 & 1 \end{pmatrix}$$

Triangle A″B″C″ correctly drawn

(ii) It's a shear,
The x axis invariant
point $B'(-2, 2)$ is mapped onto $B''(2, 2)$

(iii) Area of triangle $A'B'C' = \frac{1}{2} \times (3+1) \times 2 - 1.5 - 0.5$

$= 4 - 2$

$= 2$ sq units

Area of $A''B''C'' =$ *Area of* $A'B'C'$

= 2 square units

Advice to teachers

Before using matrices to map objects, a thorough revision of reflection, rotation, stretch, shear, enlargement from first principals needs to be done.

3.1.4 Mathematics Paper 2 (121/2)

In section 1 of 121/1, questions 2 and 6 were performed well by most candidates while in section II, questions 21 and 22 were performed well.

Question 18 was the most popular question among the candidates in Section II.

Question 1

Given that $2 \log x^2 + \log \sqrt{x} = k \log x$, find the value of k. (2 marks)

The question tested on use of logarithmic laws to simplify logarithmic expressions and solving of logarithmic equations.

Weaknesses

- Combining of logs to single log.
- Interpretation of the root.
- Interpretation of coefficients and powers.

Expected response

$2\log x^2 + \log \sqrt{x} = k \log x$

$\log (x^4 x^{\frac{1}{2}}) = \log x^k$

$k = 4\frac{1}{2}$

Advice to teachers

Practice more on related questions.

Question 3

Asia invested some money in a financial institution. The financial institution offered 6% per annum compound interest in the first year and 7% per annum in the second year. At the end of the second year, Asia had Ksh 170130 in the financial institution. Determine the amount of money Asia invested. (3 marks)

The question tested on calculation of compound interest.

Weaknesses

Failure to calculate principal amount from given accrued amount with different rates at a specified period.
Calculating principal as if the rate was the same in the two years.

Expected response

$P_2(1.07) = 170130$

$P_2 = \frac{170130}{1.07}$

$= 159000$

$P_1 = \frac{159000}{1.06}$

$= Ksh\ 150000$

Advice to teachers

Teachers should expose students to more questions of this reversed nature.

Question 5

Simplify $\frac{\sqrt{54}+3\sqrt{3}}{\sqrt{3}}$. (2 marks)

The question tested on rationalization of denominators with surds.

Weaknesses

- Misinterpretation of conjugate of $\sqrt{3}$ as most are used to finding more complex conjugates with two terms.
- Failure by some students to simplify $\sqrt{54}$ as $3\sqrt{3}\times\sqrt{2}$.

Expected response

$$\frac{\sqrt{54}+3\sqrt{3}}{\sqrt{3}} = \left(\frac{\sqrt{54}+3\sqrt{3}}{\sqrt{3}}\right)\times\frac{\sqrt{3}}{\sqrt{3}}$$

$$= \frac{\sqrt{162}+9}{3}$$

$$= \frac{9\sqrt{2}+9}{3}$$

$$= 3\sqrt{2}+3$$

Question 7

Use completing the square method to solve $3x^2 + 8x - 6 = 0$, correct to 3 significant figures. (3 marks)

The question tested on solving quadratic equations by completing the square.

Weaknesses

- Students used the positive value only suggesting too much reliance on calculator.
- Quite a number of students failed to give their answers to 3SF as the question required.

Expected response

$$3x^2 + 8x = 6$$

$$x^2 + \frac{8}{3}x + \left(\frac{4}{3}\right)^2 = \frac{6}{3} + \left(\frac{4}{3}\right)^2$$

$$\left(x+\frac{4}{3}\right)^2 = \frac{34}{9}$$

$$x+\frac{4}{3} = \pm\sqrt{\frac{34}{9}}$$

$$x = \frac{-4 \pm \sqrt{34}}{3}$$

$$x = -3.28 \text{ or } x = 0.610$$

Advice to teachers

Teachers need to give students more questions on rounding off of numbers to a given number of significant figures.
They also need to emphasize that the root of a number is either positive or negative.

Question 11

The mass, in kilograms, of 9 sheep in a pen were:
13, 8, 16, 17, 19, 20, 15, 14 and 11.
Determine the quartile deviation of the data. (3 marks)

The question tested on estimation of quartiles by calculation.

Weaknesses
Candidates had difficulty in determining the position of the lower quartile (Q_1) and the upper quartile (Q_3).
Candidates had problems with the definition and calculation of quartile deviation.

Expected response

8, 11, 13, 14, 15, 16, 17, 19, 20

$$\left.\begin{aligned} Q_1 &= \frac{11+13}{2} = 12 \\ Q_3 &= \frac{17+19}{2} = 18 \end{aligned}\right\}$$

$$\text{Quartile deviation} = \frac{1}{2}(18-12)$$

$$= 3$$

Advice to teachers

Emphasize on odd and even number of scores in identifying the quartiles.
Familiarize learners with the formula for calculating quartile deviation.

Question 15

Under a transformation $\mathbf{T} = \begin{pmatrix} 4 & -3 \\ 2 & 3 \end{pmatrix}$, triangle OAB is mapped onto triangle OA′B′ with vertices O(0,0), A′(18,0) and B′(18, 6). Find the area of triangle OAB. (3 marks)

The question tested on use of relationship between Area Scale Factor and determinant of a matrix.

Weaknesses

Most candidates could not calculate the area of triangle OAB.

Expected response

Det (T) = 18

$$\text{Area of object OAB} = \frac{\text{Area of image}}{\text{Det(T)}}$$

$$= \frac{\frac{1}{2} \times 18 \times 6}{18}$$

$$= 3 \text{ units}$$

Advice to teachers

Teacher should teach on length of lines on a Cartesian plane.

Conclusion

Major weaknesses have been observed in some areas of the syllabus for Mathematics Alt A. These areas include **Linear equations with two unknowns, Quadratic Equations 1 and 2, Further logarithms, Statistics 2, Geometry** and **Transformations.**

Application of learned concepts to real life situations was observed to be a challenge to many candidates. To help learners understand the concepts, it is necessary to have more applications relating to real life situations in the course of the teaching and learning..