3.0 PART ONE: ANALYSIS OF DIFFICULT QUESTIONS

3.1 MATHEMATICS ALT A (121)

In the year 2012 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 2012 KCSE Mathematics Alt A.

3.1.1 CANDIDATES' GENERAL PERFORMANCE

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

Table 8: Candidates' Performance in Mathematics Alt A for the last five years 2008 – 2012

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
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**
2011	1		100	21.36	21.66
	2	**409887**	100	28.22	23.57
	Overall		**200**	**49.57**	**44.30**
2012	**1**		100	29.46	23.98
	2	**433017**	100	27.86	23.18
	Overall		**200**	**57.31**	**46.20**

From the table the following observations can be made:

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

3.1.2 There is a notable improvement in the performance of Paper 1 (121/1) from a mean of 21.36 in the year 2011 to a mean of 29.46 in the year 2012. However, Paper 2 (121/2) recorded a slight decline.

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 in the questions. The analysis was done using scripts that were purposively sampled.

3.1.2 Mathematics Paper 1 (121/1)

In this paper question one in section I was the best performed as seen from the analysis of a sample of scripts. In section II, questions 17 and 18 were very popular among the candidates whereas questions 20 and 22 were unpopular.
Questions 2, 5, 7, 16, 21, 22 and 23 were performed poorly, these question are discussed below.

Question 2

Find the reciprocal of 0.216 correct to 3 decimal places, hence evaluate

$$\frac{\sqrt[3]{0.512}}{0.216}$$

(3 marks)

Weaknesses

Most candidates were able to obtain the reciprocal but were unable to use it in evaluation of the given problem. They divided $\sqrt[3]{0.512}$ with the reciprocal of 0.216, instead of multiplying.

Expected response

$$\frac{1}{0.216} = 4.630$$

$$\frac{\sqrt[3]{0.512}}{0.216} = 0.8 \times 4.630$$

$$= 3.704$$

Advice to teachers

Explanation on the use of hence and meaning of reciprocal should be emphasized.

Question 5

Given that $9^{2y} \times 2^{x} = 72$, find the values of x and y. (3 marks)

Weaknesses

Candidates were unable to express 72 into powers of its prime factors and inability to compare the powers of these factors.

Expected response

$$9^{2y} \times 2^x = 9 \times 8$$

$$(3^2)^{2y} \times 2^x = 3^2 \times 2^3$$

$$(3^2)^{2y} = 3 \text{ and } 2^x = 2^3$$

$$4y = 2 \text{ and } x = 3$$

$$y = \frac{1}{2} \text{ and } x = 3$$

Advice to teachers

There is need to teach factorization of numbers expansively.

Question 7

Koech left home to a shopping centre 12 km away, running at 8 km/h. Fifteen minutes later, Mutua left the same home and cycled to the shopping centre at 20 km/h. Calculate the distance to the shopping centre at which Mutua caught up with Koech. (3 marks)

Weaknesses

Most candidates could not form linear equations from the given situation.

Expected response

$$\frac{x}{8} = \frac{x}{20} + \frac{1}{4}$$

$$\frac{x}{8} - \frac{x}{20} = \frac{1}{4}$$

$$\Rightarrow \frac{3x}{40} = \frac{1}{4}$$

$$x = 3\frac{1}{3}$$

Distance to shopping centre

$$12 - 3\frac{1}{3} = 8\frac{2}{3} \text{ km}$$

Advice to teachers

Formation and solution of linear equations should be emphasized.

Question 16

Bukra had two bags A and B, containing sugar. If he removed 2 kg of sugar from bag A and added it to bag B, the mass of sugar in bag B would be four times the mass of the sugar in bag A. If he added 10 kg of sugar to the original amount of sugar in each bag, the mass of sugar in bag B would be twice the mass of the sugar in bag A. Calculate the original mass of sugar in each bag. (3 marks)

Weaknesses

Most candidates could not form equations from the given situation.

Expected response

$$4(A-2)=B+2$$
$$2(A+10)=B+10$$

$$4A-B=10....(i)$$
$$\mp 2A \pm B = \pm 10...(ii)$$
$$2A=20$$
$$\Longrightarrow A=10$$

Substitute A = 10 in (i)

$$4\times 10-B=10$$
$$\Longrightarrow B=30$$

Advice to teachers

Emphasize more on application of simultaneous equations to real life situations.

Question 21

The vertices of quadrilateral OPQR are O(0, 0), P(2, 0), Q(4, 2) and R(0, 3). The vertices of its image under a rotation are O'(1, −1), P'(1, −3), Q'(3, −5) and R'(4, −1).

(a) (i) On the grid provided, draw OPQR and its image O'P'Q'R'. (2 marks)

(ii) By construction, determine the centre and angle of rotation. (3 marks)

(b) On the same grid as (a)(i) above, draw O"P"Q"R", the image of O'P'Q'R' under a reflection in the line $y=x$. (2 marks)

(c) From the quadrilaterals drawn, state the pairs that are:

(i) directly congruent; (1 mark)

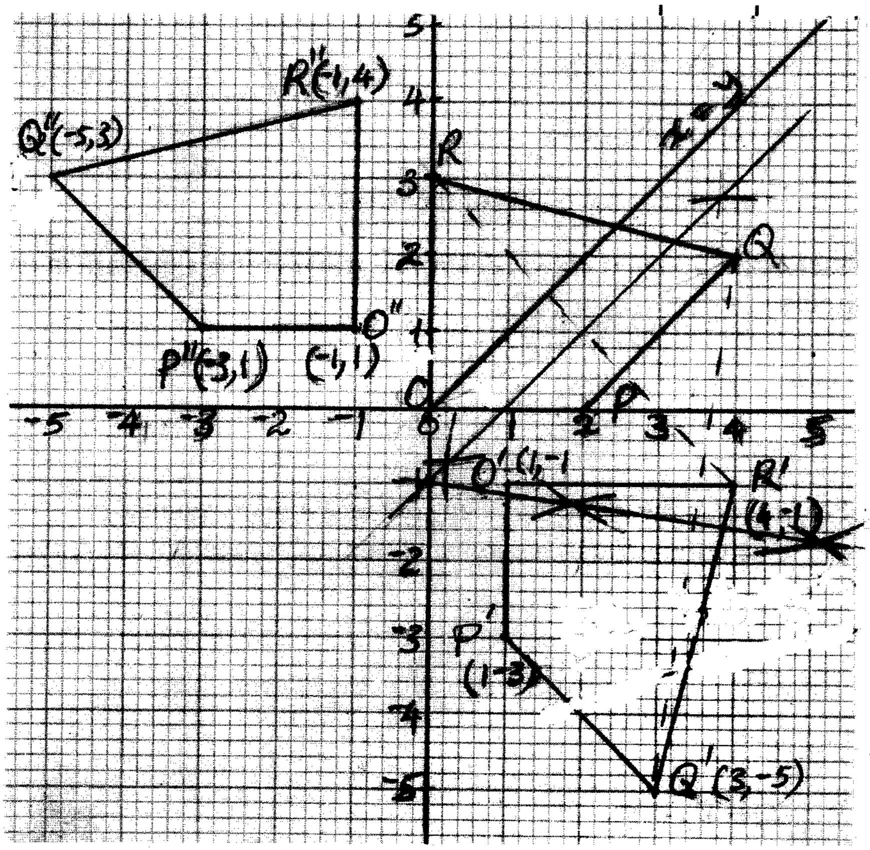
(ii) oppositely congruent. (2 marks)

Weaknesses

Candidates were not able to locate the centre and angle of rotation. Not able to identify the congruency.

Expected response

(a)(i)



(a)(ii)

centre of rotation (0, -1)

angle of rotation - 90^0

c) (i) directly congruent quads:

OPQR and O'P'Q'R'

(ii) Oppositely congruent quads.:

OPQR and O"P"Q"R"

O'P'Q'R' and O"P"Q"R"

Advice to teachers

Teach thoroughly on location of centre, angle of rotation and on congruency.

Question 22

The equation of a curve is $y = 2x^3 + 3x^2$.

(a) Find:

(i) the x - intercept of the curve; (2 marks)

(ii) the y - intercept of the curve. (1 mark)

(b) (i) Determine the stationery points of the curve. (3 marks)

(ii) For each point in (b) (i) above, determine whether it is a maximum or a minimum. (2 marks)

(c) Sketch the curve. (2 marks)

Weaknesses

Candidates were unable to sketch the curve and identify the stationary points.
They were also not able to determine the maximum and minimum points of the curve.

Expected response

(a) (i) x - intercepts

when y= 0

$x^2(2x+3) = 0$

$x = 0 \text{ and } x = -\frac{3}{2}$

(ii) y - intercept

when x = 0, y = 0

(b) (i) stationary points of curve

$\frac{dy}{dx} = 6x^2 + 6x$

stationery points when $\frac{dy}{dx} = 0$

i.e. $6x^2 + 6x = 0$

$6x(x+1) = 0$

$x = 0 \text{ or } x = -1$

∴ stationary points are:

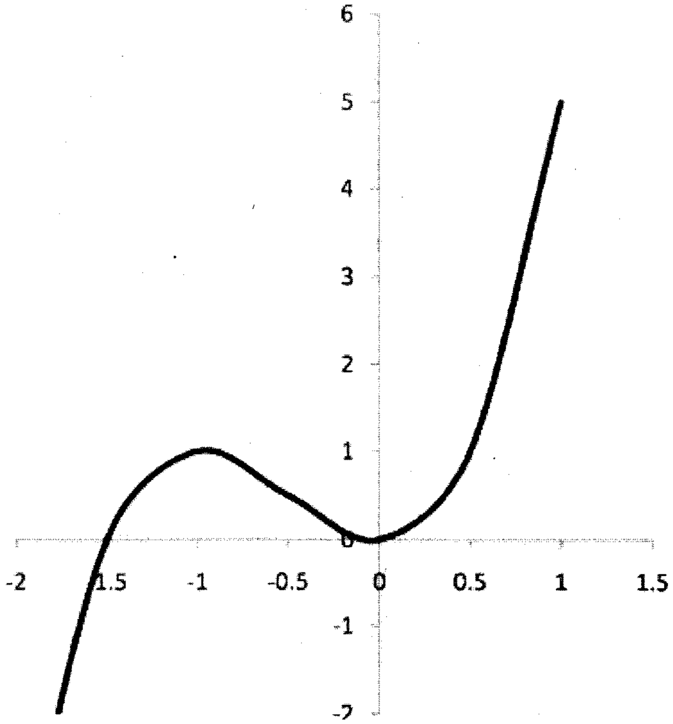
$(0,0)$ and $(-1,1)$

(ii)

x	-2	$-1\frac{1}{2}$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1
$\frac{dy}{dx}$	12	$4\frac{1}{2}$	0	$-1\frac{1}{2}$	0	$4\frac{1}{2}$	12

minimum point (0,0)
maximum point (-1,1)

(c)



Advice to teachers

There is need to teach calculus and its applications thoroughly.

Question 23

Three pegs R, S and T are on the vertices of a triangular plain field. R is 300 m from S on a bearing of 300° and T is 450 m directly south of R.

(a) Using a scale of 1 cm to represent 60 m, draw a diagram to show the positions of the pegs. (3 marks)

(b) Use the scale drawing to determine:

(i) the distance between T and S in metres; (2 marks)

(ii) the bearing of T from S. (1 mark)

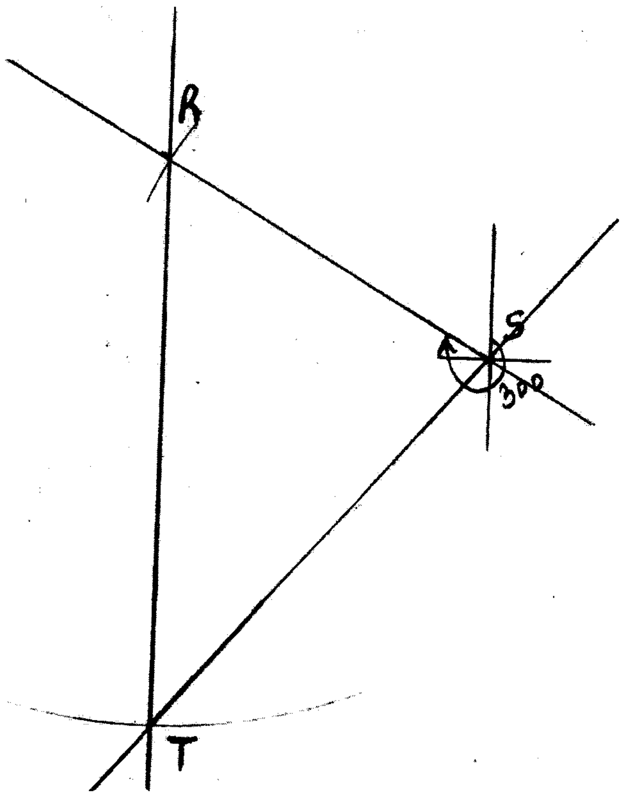
(c) Find the area of the field, in hectares, correct to one decimal place. (4 marks)

Weaknesses

Many candidates were unable to draw the scale drawing accurately. Some candidates were unable to convert the metres squared to hectares.

Expected response

(a)



(b) (i) Distance TS = 6.6cm (±0.1cm)

= 396m

(ii) Bearing of T from S = 221^0

(c) Area of field

$\angle TRS = 60°$

$area = \frac{1}{2} \times 300 \times 450 \sin 60°$

$= \frac{58456.71476}{10000}$

=5.8 ha

Advice to teachers

Emphasize on how to make accurate scale drawing and bearings and conversion of metres squared to hectares.

3.1.3 Mathematics Paper 2 (121/2)

In this paper question 2 in section I was the best performed as seen from the analysis of a sample of scripts. In section II, questions 18, 19 and 20 were very popular among the candidates whereas questions 17 and 21 were unpopular.

Questions 1, 7, 8, 12, 17 and 21 were performed poorly, these question are discussed below.

Question 1

Evaluate $\dfrac{\log 4^5 - \log 5^4}{\log 4^{\frac{1}{5}} + \log 5^{\frac{1}{4}}}$, giving the answer to 4 significant figures. (2 marks)

Weaknesses

Many candidates were unable to use the laws of logarithm to evaluate.

Expected response

$$\frac{5\log 4 - 4\log 5}{\frac{1}{5}\log 4 + \frac{1}{4}\log 5}$$

$$= \frac{3.010299957 - 2.795880017}{0.120411998 + 0.174742501}$$

$$= 0.726466785$$

$$\simeq 07265 \qquad \text{(4 s.f.)}$$

Advice to teachers

Give more practice on use of laws of logarithms.

Question 7

Kago deposited Ksh 30 000 in a financial institution that paid simple interest at the rate of 12% per annum. Nekesa deposited the same amount of money as Kago in another financial institution that paid compound interest. After 5 years, they had equal amounts of money in the financial institutions.
Determine the compound interest rate per annum, to 1 decimal place, for Nekesa's deposit.
(4 marks)

Weaknesses

Relating the accumulated amounts in simple interest and the one in compound interest was a problem to most candidates. Some could also not obtain the fifth root.

Expected response

Amount for Kago

$$= 30000 + \frac{12}{100} \times 30000 \times 5$$

$$= 48000$$

Compound interest rate for Nekesa

$$30000\left(1 + \frac{r}{100}\right)^5 = 48000$$

$$\left(1 + \frac{r}{100}\right)^5 = \frac{48000}{30000} = 1.6$$

$$1 + \frac{r}{100} = \sqrt[5]{1.6}$$

$$r = 100(1.098560543 - 1)$$

$$= 9.9\%$$

Advice to teachers

Give more questions in application of commercial arithmetic.

Question 8

The masses in kilograms of 20 bags of maize were; 90, 94, 96, 98, 99, 102, 105, 91, 102, 99, 105, 94, 99, 90, 94, 99, 98, 96, 102 and 105.
Using an assumed mean of 96 kg, calculate the mean mass, per bag, of the maize. (3 marks)

Weaknesses

Most candidates could not compute the mean deviations hence unable to do the question.

Expected response

Differences from assumed mean

$$-6 - 2 + 0 + 2 + 3 + 6 + 9 - 5 + 6 + 3 + 9$$
$$-2 + 3 - 6 - 2 + 3 + 2 + 0 + 6 + 9 = 38$$

$$\therefore mean = 96 + \frac{38}{20}$$

$$= 97.9$$

Advice to teachers

Give more practice in statistical questions.

Question 12

(a) Expand $(1 + x)^7$ up to the 4th term. (1 mark)

(b) Use the expansion in part (a) above to find the approximate value of $(0.94)^7$. (2 marks)

Weaknesses

Most candidates could not obtain the coefficients of the expansion.

Expected response

(a)

$$(1 + x)^7 = 1^7 + 7 \times 1^6 \times x + 21 \times 1^5 \times x^2 + 35 \times 1^4 \times x^3 + \ldots$$

$$= 1 + 7x + 21x^2 + 35x^3$$

(b)

$$(0.94)^7 = [1 + (-0.06)]^7$$

$$= 1 + 7 \times (-0.06) + 21 \times (-0.06)^2 + 35 \times (-0.06)^3$$

$$= 1 - 0.42 + 0.0756 - 0.00756$$

$$= 0.64804$$

Advice to teachers

Teach binomial expansion and its applications thoroughly.

Question 17

Amaya was paid an initial salary of Ksh 180 000 per annum with a fixed annual increment. Bundi was paid an initial salary of Ksh 150 000 per annum with a 10% increment compounded annually.

(a) Given that Amaya's annual salary in the 11th year was Ksh 288 000, determine:

(i) his annual increment; (2 marks)

(ii) the total amount of money Amaya earned during the 11 years. (2 marks)

(b) Determine Bundi's monthly earnings, correct to the nearest shilling, during the eleventh year. (2 marks)

(c) Determine, correct to the nearest shilling:

(i) the total amount of money Bundi earned during the 11 years. (2 marks)

(ii) The difference between Bundi's and Amaya's average monthly earnings during the 11 years. (2 marks)

Weaknesses

The question was unpopular and those who attempted it could not solve correctly.

Expected response

(a) (i)

$$180000 + (11 - 1)x = 288000$$
$$10x = 108000$$
$$x = 10800$$

(a) (ii)

$$S_{11} = \frac{11}{2}(180000 + 288000)$$

$$= 2574000$$

(b)

$$\frac{150000 \times 1.1^{10}}{12}$$

$$= 32422$$

(c) (i)

$$\frac{[150000 \times (1.1^{11} - 1)]}{(1.1 - 1)}$$

$$= 2779675$$

(c) (ii) Difference between monthly averages for the 11 years

$$\frac{2779675 - 2574000}{11 \times 12}$$

$$= 1558$$

Advice to teachers

Give more exercises on application of A.P and G.P.

Question 21

(a) On the same diagram construct:

(i) triangle ABC such that AB = 9 cm, AC = 7 cm and angle CAB = 60°; (2 marks)

(ii) the locus of a point P such that P is equidistant from A and B; (1 mark)

(iii) the locus of a point Q such that CQ ≤ 3.5 cm. (1 mark)

(b) On the diagram in part (a):

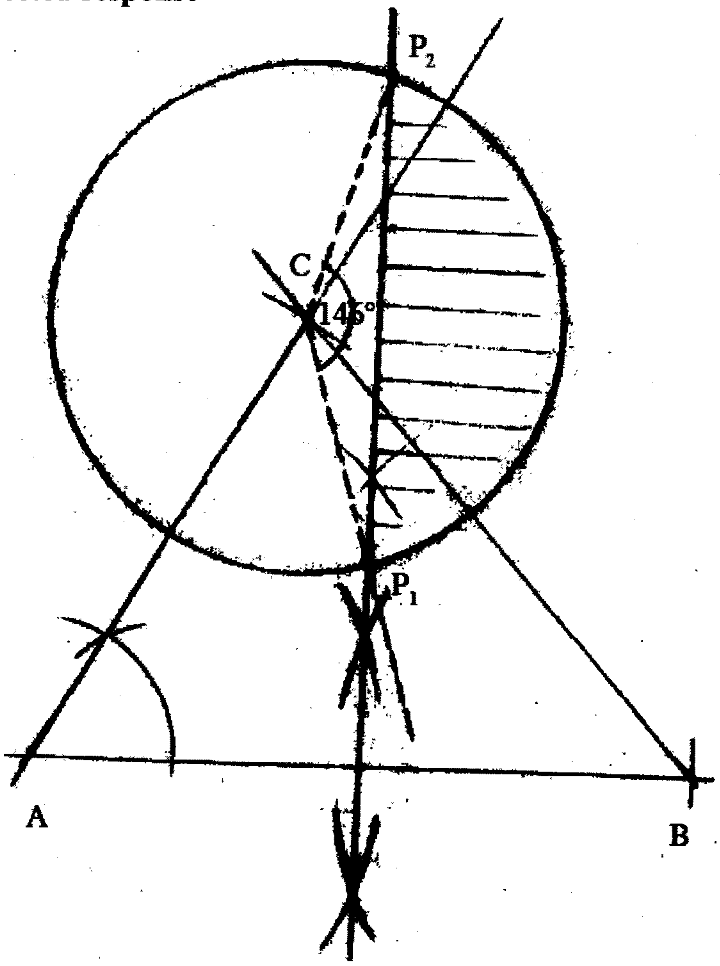
(i) shade the region R, containing all the points enclosed by the locus of P and the locus of Q, such that AP ≥ BP; (2 marks)

(ii) find the area of the region shaded in part (b)(i) above. (4 marks)

Weaknesses

Most candidates could not represent the required loci.

Expected response



(ii) area of shaded region

area of minor sector P_1CP_2

$= \frac{146}{360} \times \pi \times 3.5^2$

$\simeq 15.6\ cm^2$

area of ΔP_1CP_2

$\frac{1}{2} \times 3.5^2 \sin 146^\circ$

$\simeq 3.4\ cm^2$

∴ shaded area

15.6 - 3.4

=12.2 cm²

Advice to teachers

Give more practice and exercises on loci.