2.0 MATHEMATICS ALT B (122)

In the year 2011 Mathematics Alt B was tested in two papers. **Paper 1 (122/1)** and **Paper 2 (122/2)**. Each paper consisted of 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.

Paper 1 (122/1) tested mainly Forms 1 and 2 work while Paper 2 (121/2) tested 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 B.

2.1 CANDIDATES' GENERAL PERFORMANCE

Table 2: Candidates' Performance in Mathematics Alternative B

Year	Paper	Candidature	Maximum score	Mean Score	Standard Deviation
2010	1	**1221**	100	20.40	16.85
	2		100	17.96	15.91
2011	1	**1247**	100	12.11	12.75
	2		100	14.65	15.43
	Overall		**200**	**26.64**	**26.89**

From the table the following observations can be made:

2.1.1 There was a slight increase in the candidature.
2.1.2 The subject registered a decline in performance when compared to year 2010 performance.
2.1.3 The mean score of the papers was quite low.

2.2 INDIVIDUAL QUESTION ANALYSIS

The following is a discussion of some questions in which the candidates showed weaknesses.

2.2.1 PAPER 1 (122/1)

Question 6

Find the integral values of x which satisfy the inequality $3x \leq 2x + 3 < 4x + 5$ *(3 marks)*

The question tested on solution of inequalities.

Weaknesses
Separating the inequalities into two to solve and finding the integral values satisfying the inequalities.

Expected response

$3x \leq 2x + 3$
$x \leq 3$
$2x + 3 < 4x + 5$
$-x < 1$
$x > -1$
Integral values: 0, 1, 2, 3.

Advice to teachers

Emphasize on solving various forms of inequalities. Use the number line in teaching/ learning of inequalities.

Question 7

Three metal rods of lengths 234 cm, 270 cm and 324 cm were cut into shorter pieces, all of the same length, to make window grills.
Calculate the length of the longest piece that can be cut from each of the rods and hence the total number of pieces that can be obtained from the rods. *(4 marks)*

The question tested on application of GCD.

Weaknesses

Candidates unable to understand the question

Expected response

$234 = 2 \times 3^2 \times 13$
$270 = 2 \times 3^2 \times 5$
$324 = 2^2 \times 3^4$
$\therefore HCF \text{ of } 234, 270 \ \& \ 324 = 2 \times 3^2 = 18$
Number of pieces
$$\frac{234}{18} + \frac{270}{18} + \frac{324}{18} = 46$$

Advice to teachers

There is need to give emphasis to the concept on GCD especially their applications to real life situations.

Question 12

The areas of the lids of two similar cylinders are 16 cm² and 25 cm². If the volume of the bigger cylinder is 800 cm3, find the volume of the smaller cylinder. *(4 marks)*

The question tested on area scale factor and volume scale factor.

Weaknesses

Challenges relating the linear scale factor, area scale factor and volume scale factor.

Expected response

$$\text{Linear scale factor} = \sqrt{\frac{16}{25}} = \frac{4}{5}$$

$$\text{Volume scale factor} = \left(\frac{4}{5}\right)^3$$

$$\therefore \text{Volume of smaller cylinder} = \frac{64}{125} \times 800 = 409.6\ cm^3$$

Advice to teachers

Emphasize on the relationship between the linear scale factor, area scale factor and volume scale factor.

Question 15

Solve the simultaneous equations:

$p - q = 3$

$p^2 - q^2 = 21$ *(4 marks)*

The question tested on solution of simultaneous equations involving one linear equation and one quadratic.

Weaknesses

Unable to express one unknown in terms of the other in the linear equation and substituting it in the quadratic equation.

Expected response

$p = 3 + q$

$(3+q)^2 - q^2 = 21$

$9 + 6q + q^2 - q^2 = 21$

$q = 2$

$p = 5$

Advice to teachers

Give more practice in solution of simultaneous equations.

Question 18

Three straight lines L_1, L_2 and L_3 are such that:
L_1 cuts the y-axis at $y = 5$ and has a gradient of 2;
L_2 is perpendicular to L_1 at the point where L_1 cuts the x-axis;
L_3 is parallel to L_2 and passes through point (1, 2).
(a) Find the equations, in the form $y = mx + c$, of:
(i) L_1; *(2 marks)*
(ii) L_2; *(3 marks)*
(iii) L_3. *(2 marks)*
(b) Determine the coordinates of the point at which L_3 is perpendicular to L_1. *(3 marks)*

The question tested on gradient and equations of straight lines.

Weaknesses

Confusion between gradient of parallel and perpendicular lines and presentation of equation in the form y= mx + c

Expected response

(a) *(i)* $\frac{y-5}{x-0} = 2$

$y = 2x + 5$

(ii) *Gradient of L_2*

$m_1 \times m_2 = -1$

$2 \times m_2 = -1$

$m_2 = -\frac{1}{2}$

Equation of L_2

$\frac{y}{x+2.5} = -\frac{1}{2}$

$y = -\frac{1}{2}x - \frac{5}{4}$

(iii) *Equation of L_3*

$\frac{y-2}{x-1} = -\frac{1}{2}$

$y = -\frac{1}{2}x + 2\frac{1}{2}$

b) *At intersection of L_1 and L_3*

$$2x + 5 = -\frac{1}{2}x + 2\frac{1}{2}$$

$$2\frac{1}{2}x = -2\frac{1}{2}$$

$$x = -1$$

$$y = 2(-1) + 5 = 3$$

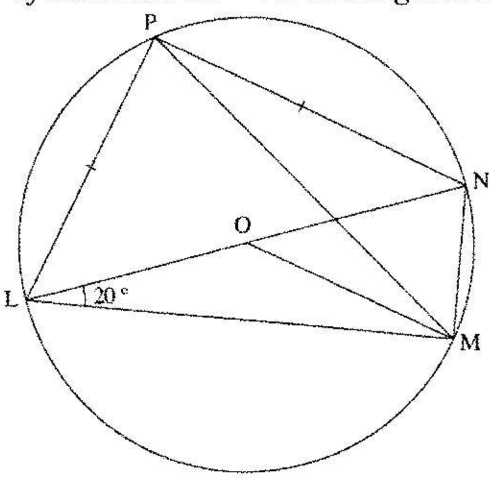
Coordinates of point of intersection = (-1,3)

Advice to teachers

Emphasize on the relationship between gradients of parallel and perpendicular lines.

Question 21

In the figure below, points L, M, N and P are on the circumference of a circle centre O. Line LON is a diameter of the circle. PL = PN and angle NLM = 20°.



Find, giving a reason in each case, the size of each of the following angles.

(a) ∠ MPN; (2 marks)
(b) ∠ PLN; (2 marks)
(c) ∠ LPM; (2 marks)
(d) ∠ MNP; (2 marks)
(e) ∠ PMO. (2 marks)

The question tested on angle properties of a circle.

Weaknesses

Failure to give the reasons for the answer as required in the question.

Expected response

(a) $\angle MPN = \angle MLN = 20^o$

Angles subtended at the circumference by chord MN

(b) $\angle PLN = \frac{1}{2}(180^0 - 90^0) = 45^0$

Angle in semicircle equals 90^o and base angles of isosceles triangle are equal.

(c) *$\angle LPM = \angle LNM = 90^o - 20^o = 70^o$*
Complementary angles in a right angled triangle, angles subtended by chord LM equal to 70^o

(d) *$\angle MNP = 180^0 - (45^0 + 20^0) = 115^o$*
Opposite angles of cyclic quadrilateral add up to 180^o

(e) *$\angle PMO = 90^o - (45^0 + 20^0) = 25^o$*
Base $\angle$s of isosceles triangle OLM = 20^o
(i.e. $\angle NMP = \angle PLM$)
and $\angle$s subtended by chord PN at circumference equal.

Advice to teachers
Always emphasize on the reason(s) for angles calculated or stated.

6.2.2 PAPER 2 (122/2)

Question7

Given that $\mathbf{P} = \begin{pmatrix} 1 & -2 \\ -1 & 3 \end{pmatrix}$, $\mathbf{Q} = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ *and* $\mathbf{R} = \mathbf{P}^2\mathbf{Q}$, *determine* **R**. *(3marks)*

The question tested on operation of matrices.
Weaknesses
Combination of rows and columns in multiplication.
Expected response

$$P^2 = \begin{pmatrix} 1 & -2 \\ -1 & 3 \end{pmatrix}\begin{pmatrix} 1 & -2 \\ -1 & 3 \end{pmatrix} = \begin{pmatrix} 3 & -8 \\ -4 & 11 \end{pmatrix}$$

$$R = \begin{pmatrix} 3 & -8 \\ -4 & 11 \end{pmatrix}\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix} = \begin{pmatrix} 6 & -16 \\ -8 & 22 \end{pmatrix}$$

Advice to teachers
Multiplication of matrices should be properly explained

Question 14
The first term of an arithmetic progression (A.P) is 7 and the 17th term is 81. There are 15 other terms between them.
Calculate:
(a) the sum of the 17 terms; *(2 marks)*
(b) the sum of the 15 middle terms of the A.P. *(2 marks)*

The question tested on finding the sum of an AP.

Weaknesses

Finding the common difference was a problem to most candidates.

Expected response

(a) $S_{17} = \frac{17}{2}(17 + 81) = 748$

(b) *Sum of 15 middle terms* = $748 - (7 + 81) = 660$

Advice to teachers

Give more practice on finding the sum of AP.

Question 16

Corresponding value of x and y in a given relation are as shown in the table below.

x	15	18	23	30	35	40	45	53
y	0.10	0.18	0.23	0.34	0.40	0.50	0.55	0.74

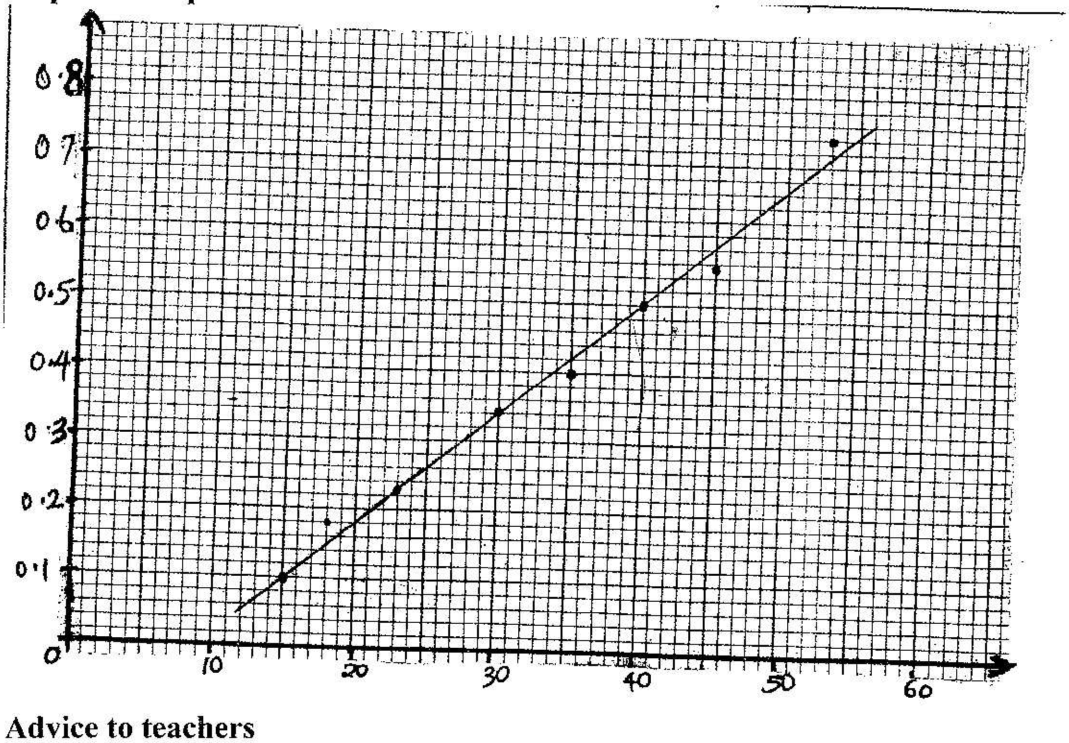
On the grid provided, plot all the points and draw the line of best fit. *(3 marks)*

The question tested on drawing the line of best fit.

Weaknesses

Most students drew lines which didn't accommodate the points

Expected response



Advice to teachers

Emphasize more on drawing the line of best fit. It should be close to the scatter points.

Question18

The third and the sixth terms of a geometric progression are 18 and 486 respectively.
Calculate:

(a) the common ratio; *(3 marks)*
(b) the first term; *(2 marks)*
(c) the sum of the ninth and tenth terms; *(3 marks)*
(d) the sum of the first sixteen terms. *(2 marks)*

The question tested on Geometric Progression (GP),finding the common ratio and the terms.

Weaknesses

Calculation of the common ratio and the first term was a challenging to many candidates.

Expected response

(a) $\frac{ar^5}{ar^2} = \frac{486}{18}$

$r = \sqrt[3]{27} = 3$

(b) $a \times 3^2 = 18$

$a = 2$

(c) $T_9 = 2 \times 3^8$ and $T_{10} = 2 \times 3^9$

$T_9 + T_{10} = 2 \times 3^8 + 2 \times 3^9 = 52488$

(d) $S_{16} = \frac{2(3^{16} - 1)}{3 - 1} = 43046720$

Advice to teachers

Give more examples to students.

Question 22

(a) (i) Complete the table below for $y = 2\sin x^o$. *(2 marks)*

x°	0	30	60	90	120	150	180	210	240	270	300	330	360
$y = 2\sin x^\circ$	0	1			1.73		0	−1				−1	0

(ii) On the grid below draw the graph of $y = 2\sin x^o$ for $0^o \leq x \leq 3600$. Use 1 cm for 30^o on the x-axis and 2 cm for 1 unit on the y-axis. *(4 marks)*

(b) Use the graph to find:

(i) the values of x for which $y = 1.5$; *(2 marks)*
(ii) the range of values of x for which $2\sin x^o > 1$. *(2 marks)*

The question tested on drawing of trigonometric function

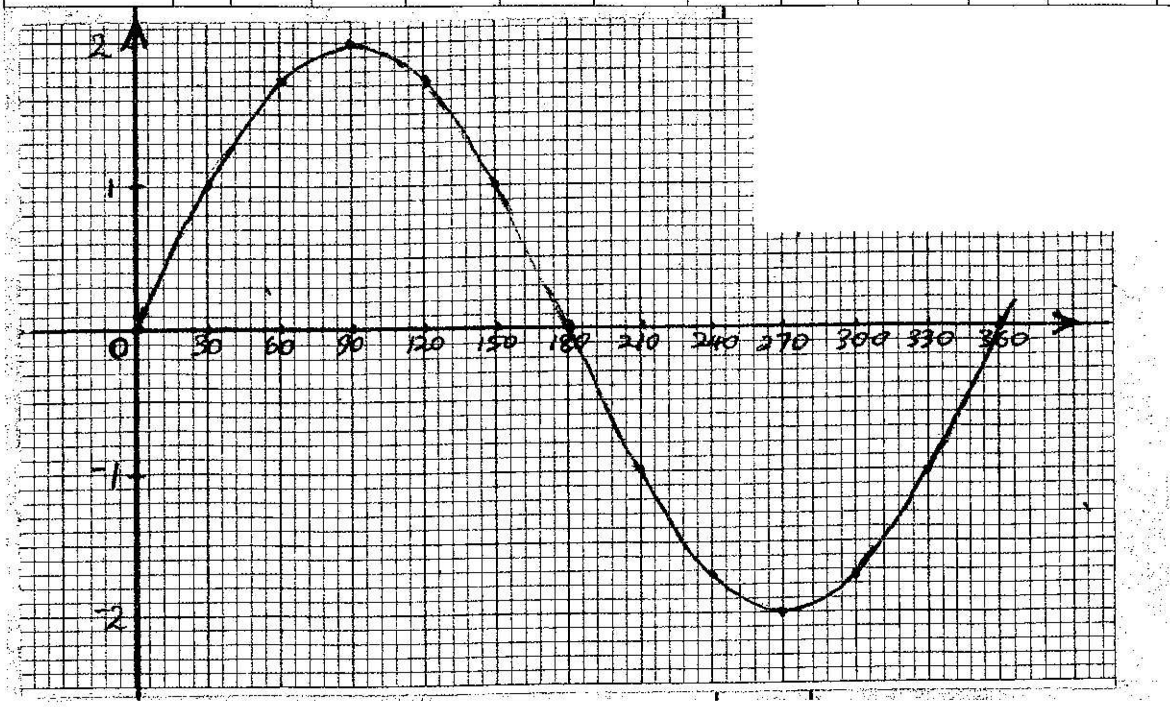
Weaknesses

Potting of points and drawing of smooth curves.

Expected response

(i)

x°	0	30	60	90	120	150	180	210	240	270	300	330	360
y = 2sin x	0	1	1.73	2	1.73	1	0	- 1	- 1.73	- 2	- 1.73	- 1	0



(b) (i) $x = 48^0$ and $x = 132^0$

(ii) $30° < x < 150°$

Advice to teachers

Give more practice on drawing of graphs.