3.2 MATHEMATICS ALT B (122)

In the year 2014 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 2014 KCSE Mathematics Alt B.

3.2.1 CANDIDATES' GENERAL PERFORMANCE

Table 10: Candidates' Performance in Mathematics Alt B for the last five years 2010 - 2014

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**
2012	1	**1281**	100	9.27	12.48
	2		100	9.77	13.48
	Overall		**200**	**18.99**	**25.19**
2013	1	**1104**	100	9.89	12.98
	2		100	7.44	9.94
	Overall		**200**	**17.29**	**21.96**
2014	1	**1293**	100	13.71	12.68
	2		100	11.16	13.28
	Overall		**200**	**24.76**	**24.71**

From the table the following observations can be made:

(i) The subject registered an improvement in the mean performance when compared to the previous year's performance.

(ii) The mean scores of the various papers are however, still quite low.

3.2.2 INDIVIDUAL QUESTION ANALYSIS

The following is a discussion of some of the questions in which the candidates had major weakness in. This discussion is based on analysis of some question papers and chief examiners report.

3.2.3 Mathematics Alt. B Paper 1 (122/1)

Question 7

An acute angle α is such that $\sin(4\alpha)^\circ = \cos(\alpha+10)^\circ$. Find:

(a) the value of α; (2 marks)

(b) $\sin \alpha$, correct to 3 decimal places. (1 mark)

The question tested on complementary angles.

Weaknesses

Candidates lacked knowledge on the relationship between the sine and cosine of complimentary angles.

Expected response

$$\begin{aligned} 4\alpha + \alpha + 10 &= 90^\circ \\ 5\alpha &= 80^\circ \\ \alpha &= 16^\circ \end{aligned}$$

$$\sin\alpha = 0.276$$

Advice to teachers

More activities involving trigonometric relationship of complimentary angles are necessary.

Question 8

Without using a calculator or mathematical tables, evaluate:

$$\frac{0.375 \div 0.06 - 4.2}{3.96 + 2.8 \times 0.05}$$ (3 marks)

The question tested on simplification and evaluating decimals.

Weaknesses

Most candidates were unable to use BODMAS in the operations.

Expected response

$$\begin{aligned} \frac{0.375 \div 0.06 - 4.2}{3.96 + 2.8 \times 0.05} &= \frac{6.25 - 4.2}{3.96 + 0.14} \\ &= \frac{2.05}{4.1} \\ &= 0.5 \end{aligned}$$

Advice to teachers

Give more activities to students involving BODMAS in the operations of decimals.

Question 9

Three children Awino, Buko and Chebet had two types of fruits each. Awino had twice as many mangoes as Buko while Buko had three times as many mangoes as Chebet. Also, Buko had three times as many oranges as Awino while Chebet had twice as many oranges as Awino. If Buko had x mangoes and y oranges, write a simplified expression to represent the total number of fruits the three children had.
(3 marks)

The question required formation of algebraic expressions.

Weaknesses
Interpretation of the question was a problem and thus candidates had challenges in formulating the expressions.

Expected response

Mangoes: $2x + x + \frac{1}{3}x$

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

Oranges: $\frac{1}{3}y + y + \frac{2}{3}y = 2y$

Total Fruits $= 3\frac{1}{3}x + 2y$

Advice to teachers
Give more practice exercises on formation of algebraic expressions from real life situations.

Question 11

The tip of the minute hand of a clock moves through a distance of 17.6 cm between 3.00 pm and 3.12 pm. Find the length of the minute hand.
(4 marks)

The question tested on arc length.

Weaknesses
Candidates failed to connect the clock to a circle and the distance moved by the minute hand to the length of an arc.

Expected response

Fraction of circumference made $= \frac{12}{60}$

$\frac{22}{7} \times 2r \times \frac{12}{60} = 17.6$

$r = \frac{7}{22} \times \frac{60}{12} \times \frac{17.6}{2}$

$= 14$

Advice to teachers
Give more application to real life situations activities when teaching the arc length.

Question 13

Factorise $2x^2 + 6y - 3x - 4xy$. (2 marks)

The question required factorization of a quadratic expression.

Weaknesses
Grouping of terms that can be factorised was a challenge especially were negative numbers are involved.

Expected response

$$2x^2 + 6y - 3x - 4xy$$

$$= 2x^2 - 4xy - 3x + 6y$$

$$= 2x(x - 2y) - 3(x - 2y)$$

$$= (2x - 3)(x - 2y)$$

Advice to teachers
More practice on factorization is required.

Question 14

The area of a rhombus is 34 cm². One of the interior angles is 30°. Calculate the length of a side of the rhombus to the nearest centimetre. (3 marks)

The question tested on area of a rhombus.

Weaknesses
Many candidates lacked knowledge of the required formula to calculate the area of the rhombus.

Expected response

$$x^2 \sin 30^0 = 34$$

$$x = \sqrt{\frac{34}{\sin 30}}$$

$$\simeq 8 \text{ cm}$$

Advice to teachers
Revise on various formulae for finding area of a triangle and of plane figures.

Question 16

A tumbler is in the shape of a frustum of a cone. The radii of the circular ends are 2.1 cm and 3.5 cm. The slant height of the tumbler is 5 cm. Calculate the area of the curved surface. (4 marks)

The question required the candidates to find the area of a frustum.

Weaknesses
Use of similar figures to obtain the length was a challenge to a majority of the candidates.

Expected response

$$\frac{L}{2.1} = \frac{L+5}{3.5}$$

$$3.5L - 2.1L = 10.5$$
$$L = 7.5$$
$$L = 5 + 7.5 = 12.5$$

Curved area

$$= \frac{22}{7} \times (3.5 \times 12.5 - 2.1 \times 7.5)$$

$$= 88 \text{ cm}^2$$

Advice to teachers
Give more examples involving the calculating area of similar figures.

Question 18

The capacity of a cylindrical container is 1.54 litres. The height of the container is 10 cm. (Take $\pi = \frac{22}{7}$)

(a) Calculate the diameter of the container. (3 marks)

(b) Along each end of the curved surface, a ribbon of width 1.5 cm is fixed with an overlap of 2 cm.

Calculate:

(i) the total length of the ribbon used; (3 marks)

(ii) the surface area of the part of container covered by the ribbon. (1 mark)

(c) Given that the container is open at one end, calculate the outer surface area of the container. (3 marks)

The question tested on capacity and surface area of a cylindrical container.

Weaknesses

Most candidates had challenges in calculating the surface area in part (b). The application part using the ribbon was a challenge to many.

Expected response

(a) $1.54l = 1540 \text{ cm}^3$

$$\text{Volume} = \frac{22}{7} \times r^2 \times 10 = 1540$$

$$r = \sqrt{\frac{1540 \times 7}{22 \times 10}}$$

$$= 7$$

$$\therefore \text{Diameter} = 2 \times 7 = 14 \text{ cm}$$

(b) (i) Length of ribbon

$$= 2 \times \frac{22}{7} \times 14 + 2 \times 2$$

$$= 88 + 4 = 92$$

(ii) Surface area covered by ribbon

$$= 88 \times 1.5 = 132 \text{ cm}^2$$

(c) Surface area

$$= \frac{22}{7} \times 49 + \frac{22}{7} \times 14 \times 10$$

$$= 154 + 440$$

$$= 594 \text{ cm}^2$$

Advice to teachers

Emphasis on application questions to real life situations.

PAPER 2 (122/2)

Question 1

Use a calculator to evaluate $\dfrac{(0.214)^{\frac{1}{2}} - (0.38)^3}{(0.817)^{\frac{1}{4}}}$ giving the answer correct to 4 significant figures. (2 marks)

The question tested on use of a calculator to find the cube and roots of numbers.

Weaknesses
Most candidates had challenges in finding the fourth root

Expected response

$$\frac{(0.214)^{\frac{1}{2}} - (0.38)^3}{(0.817)^{\frac{1}{4}}} = \frac{0.40772934}{0.950726313}$$

$$= 0.4289$$

Advice to teachers
Much guidance is needed on use and operations of the calculator.

Question 2

The third term of a geometric progression is $1\frac{1}{4}$ and the sixth term is $\frac{5}{32}$. Determine:

(a) the common ratio; (2 marks)

(b) the first term. (2 marks)

The question tested on the 1st term and common ratio of a Geometric progression.

Weaknesses
Some candidates used formula for Arithmetic progression instead of the formula for geometric progression. Working with fractional terms was also a challenge to others.

Expected response

(a) $\dfrac{ar^5}{ar^2} = \dfrac{5}{32} \times \dfrac{4}{5}$

$r^3 = \dfrac{1}{8} \Rightarrow r = \dfrac{1}{2}$

(b) $ar^2 = \dfrac{5}{4}$

$a \times \left(\dfrac{1}{2}\right)^2 = \dfrac{5}{4} \Rightarrow a = \dfrac{5}{4} \times \dfrac{4}{1}$

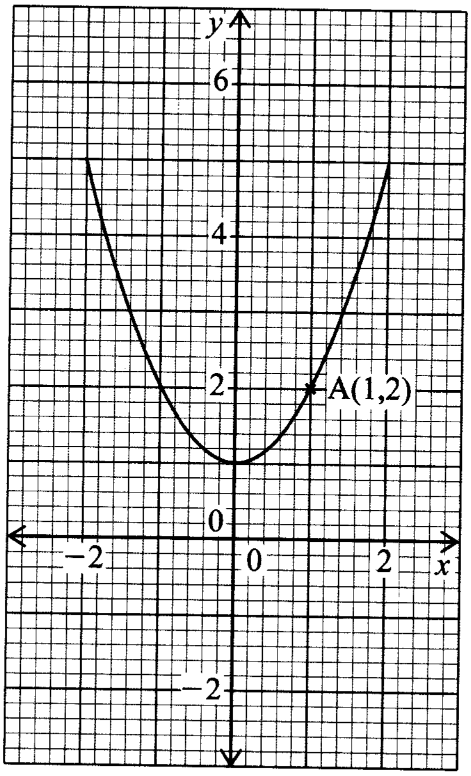
$a = 5$

Advice to teachers

More practice activities is necessary for better understanding of the concept and to be able to differentiate between an arithmetic progression and a geometric progression

Question 8

The figure below shows a curve which passes through point A(1,2).



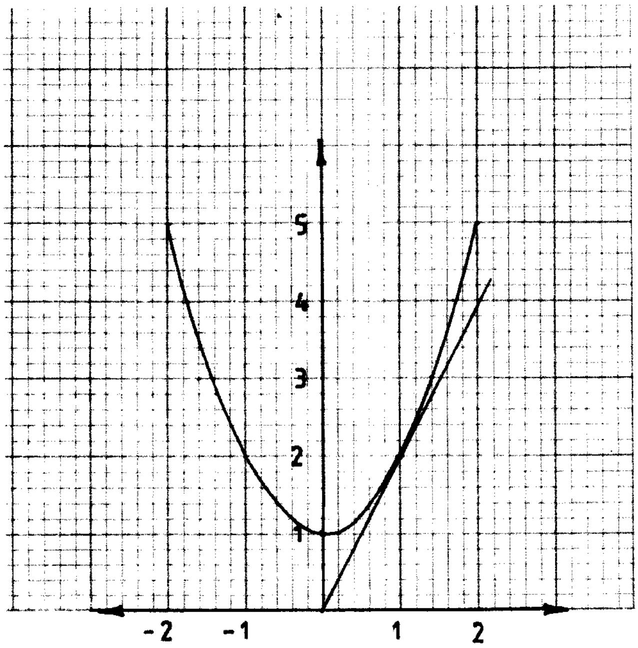
Determine the instantaneous rate of change at A. (3 marks)

The question tested on finding the gradient at a point on a curve.

Weaknesses

Most candidates were non starters, others had challenges in drawing the tangent at a point.

Expected response



tangent at A

$$\text{gradient} = \frac{4-0}{2-0}$$

$$= 2$$

Advice to teachers
Give more activities on rates of change and gradient at a point on a curve.

Question 9

Solve the equation, $\tan(2\theta - 30)^\circ = \sqrt{3}$ for $0^\circ \leq \theta \leq 360^\circ$. (3 marks)

Question tested on trigonometric ratios.

Weaknesses
Failure to find the angle in the given range, could only find the acute angle.

Expected response

$\tan^{-1}\sqrt{3} = 60$

$2\theta - 30 = 60^\circ, 240^\circ, 420^\circ, 600^\circ$

$2\theta = 90^\circ, 270^\circ, 450^\circ, 630^\circ$

$\theta = 45^\circ, 135^\circ, 225^\circ, 315^\circ$

Advice to teachers
Revise thoroughly on trigonometric ratios of angles greater than 90°.

Question 11

Two matrices **M** and **N** are such that **MN** = $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$. Given that **M** = $\begin{pmatrix} 8 & 3 \\ 4 & 2 \end{pmatrix}$, find **N**.
(3 marks)

Question tested on the inverse of a matrix.

Weaknesses
Failure to recognize that matrix **N** was the inverse of matrix **M**.

Expected response

$$\det\begin{pmatrix} 8 & 3 \\ 4 & 2 \end{pmatrix} = 16 - 12 = 4$$

$$\text{Matrix N} = \frac{1}{4}\begin{pmatrix} 2 & -3 \\ -4 & 8 \end{pmatrix}$$

$$= \begin{pmatrix} \frac{1}{2} & -\frac{3}{4} \\ -1 & 2 \end{pmatrix}$$

Advice to teachers
Teach thoroughly on the properties of inverses of a matrix.

Question 23

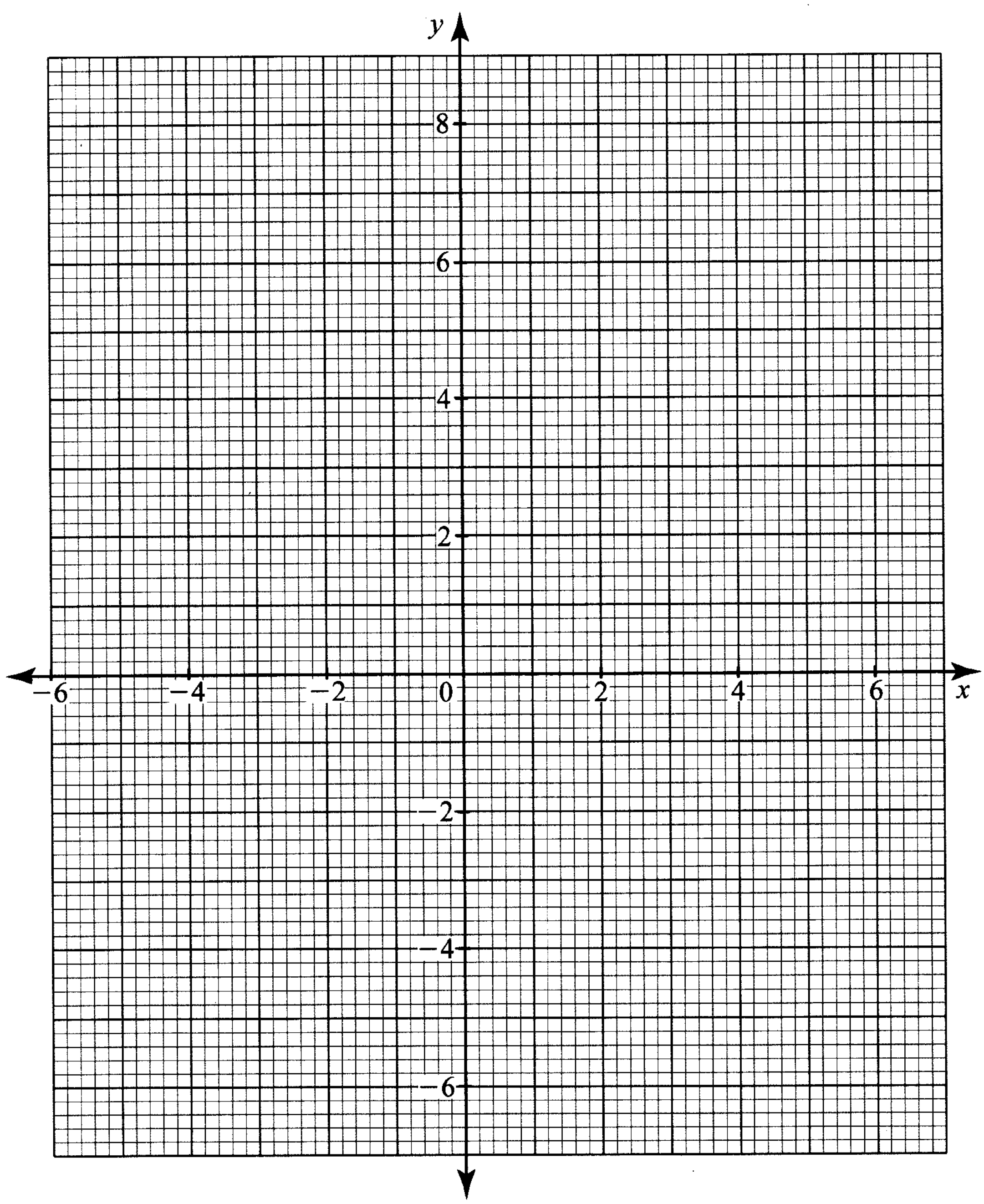
The vertices of a triangle ABC are A(2, 4), B(2, 9) and C(6, 2).

(a) On the grid provided:

(i) draw triangle ABC; (1 mark)

(ii) draw triangle A′B′C′, the image of triangle ABC under a transformation

$$\mathbf{T} = \begin{pmatrix} -\frac{3}{5} & \frac{4}{5} \\ \frac{4}{5} & \frac{3}{5} \end{pmatrix}.$$ (3 marks)



(b) Describe transformation **T** fully. (2 marks)

(c) The images of the vertices of triangle A′B′C′ under a transformation **H** are A″(−2,−4), B″(−6,−7) and C″(2,−6).

(i) On the same grid as in (a), draw triangle A″B″C″; (1 mark)

(ii) determine the matrix of transformation **H**. (1 mark)

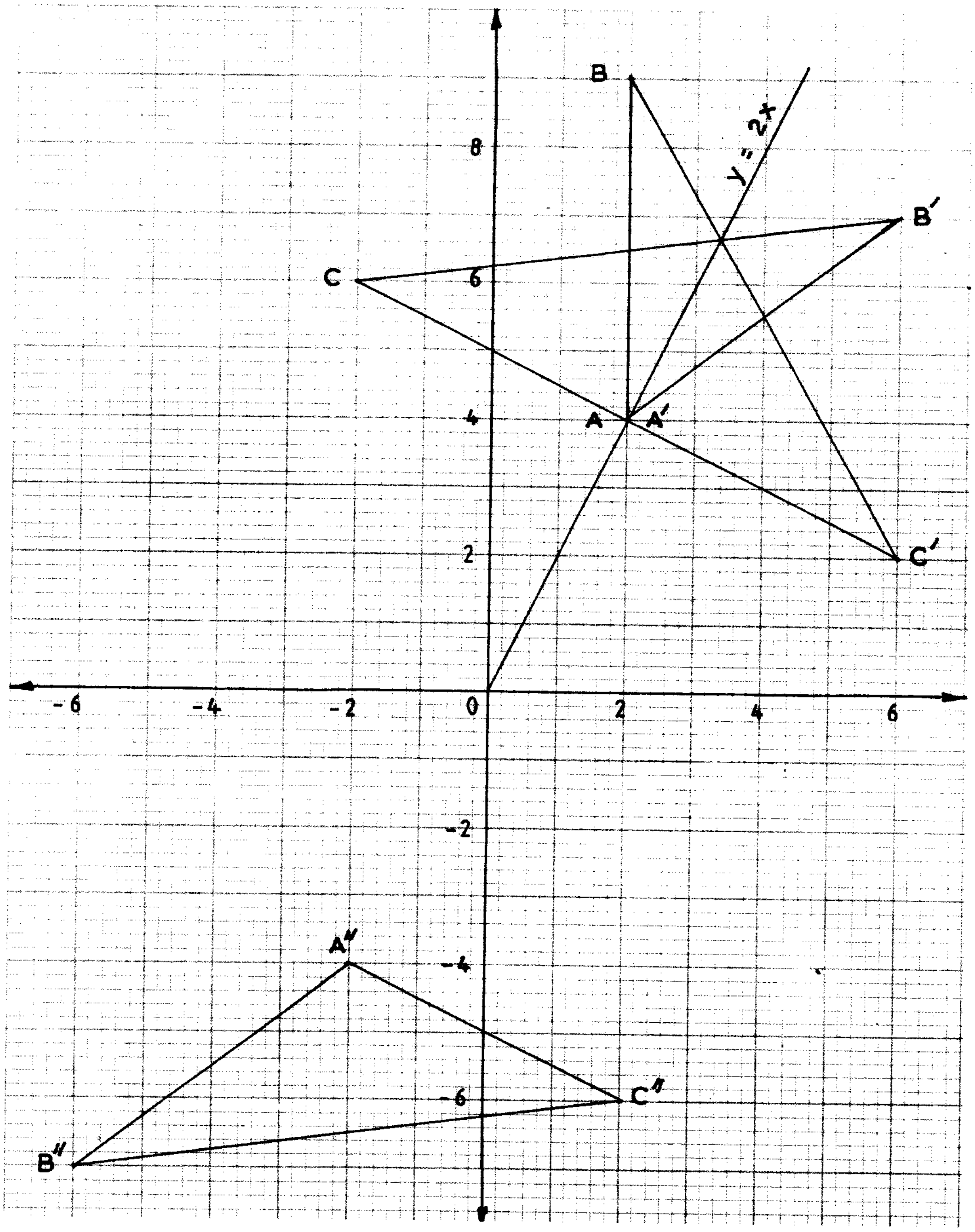
(d) Find a single matrix of transformation that maps A″B″C″ onto ABC. (2 marks)

The question tested on transformation- reflection.

Weaknesses

Most candidates had challenges in describing the transformation and getting the matrix of the transformation.

Expected response



(a) (i)

(ii) $\begin{pmatrix} -\frac{3}{5} & \frac{4}{5} \\ \frac{4}{5} & \frac{3}{5} \end{pmatrix}\begin{pmatrix} 2 & 2 & 6 \\ 4 & 9 & 2 \end{pmatrix} = \begin{pmatrix} 2 & 6 & -2 \\ 4 & 7 & 6 \end{pmatrix}$

(b) Reflection in line y = 2x

(c) (i)

(ii) matrix of H = $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

(d) $HT = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} -\frac{3}{5} & \frac{4}{5} \\ \frac{4}{5} & \frac{3}{5} \end{pmatrix} = \begin{pmatrix} \frac{3}{5} & -\frac{4}{5} \\ -\frac{4}{5} & -\frac{3}{5} \end{pmatrix}$

Advice to teachers
Give more practice on different types of transformations.

Conclusion

Major weaknesses have been observed in some areas of the syllabus for both Mathematics Alt A and Mathematics Alt B. These areas include **Natural numbers, Trigonometry, Geometry** and **Transformations.** Application of learned concepts to real life situations was also observed to be a challenge to many candidates.

Teachers are therefore advice to put more emphasis when teaching the above areas to help the students achieve the stated objectives in the syllabus. Teachers should also help the students in relating the learned concepts to real life situations.