3.2 MATHEMATICS ALT B (122)

In the year 2013 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 2013 KCSE Mathematics Alt B.

3.2.1 CANDIDATES' GENERAL PERFORMANCE

Table 9: Candidates' Performance in Mathematics Alt B for the last four years 2010 - 2013

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**

From the table the following observations can be made:

(i) The subject continuously registered a decline in performance when compared to the previous year's performance.

(ii) The mean score of the papers was quite low.

INDIVIDUAL QUESTION ANALYSIS

Mathematics Alt B has continued to have a dismal performance since its inception in 2010. With this kind of performance, most questions were poorly performed.

The following is a discussion of some of the questions in which the candidates had major weakness in.

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

Question 2

The first four prime numbers are written in descending order to form a number.

(a) Write down the number. (1 mark)

(b) Find the total value of the hundreds digit in the number. (1 mark)

The candidates were required to identify prime numbers and find the total value of a number.

Weaknesses
Most candidates assumed 1(one) to be a prime number whereas it's not. The term descending order was not understood and some wrote the number in ascending order.

Expected response

(a) Number is 7532

(b) Total value of hundreds digit = 500

Advice to teachers
Teach learners to differentiate between various types of numbers. The terms descending and ascending should be well understood by learners.

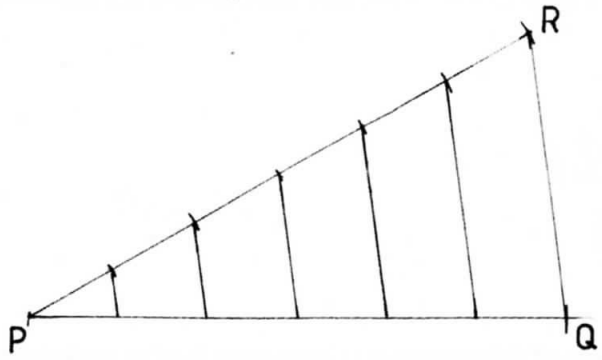
Question 7

By construction, divide the line PQ below into six equal parts. (3 marks)

The question tested on geometry, the candidates were required to divide the given line proportionally into six equal parts.

Weaknesses
Most candidates lacked understanding of the concept

Expected response



Advice to teachers
Teach constructions in geometry thoroughly. This is an area that has continuously posed challenges to students.

Question 9

A box contains five shillings coins and ten shillings coins. The number of ten shillings coins are 6 times as many as the five shillings coins. The total value of all the coins in the box is Ksh 2600. Determine the total number of coins in the box. (4 marks)

The question required the candidates to form and solve linear equations.

Weaknesses
Many candidates could not form the required equation.

Expected response

$5x + 6x(10) = 2600$

$5x + 60x = 2600$

$x = \frac{2600}{65}$

$= 40$

Total number of coins:
$= 40 + 6 \times 40 = 280$

Advice to teachers
Teach and give more practice to students on forming and solving linear equations.

Question 12

Factorise $9a^2 - \frac{16}{b^2c^2}$ (2 marks)

The question required the use of quadratic identities to factorize the given quadratic expression.

Weaknesses
Most candidates didn't realize it was an identity hence could not factorize.

Expected response

$9a^2 - \frac{16}{b^2c^2} = (3a)^2 - \frac{4^2}{(bc)^2}$

$= \left(3a + \frac{4}{bc}\right)\left(3a - \frac{4}{bc}\right)$

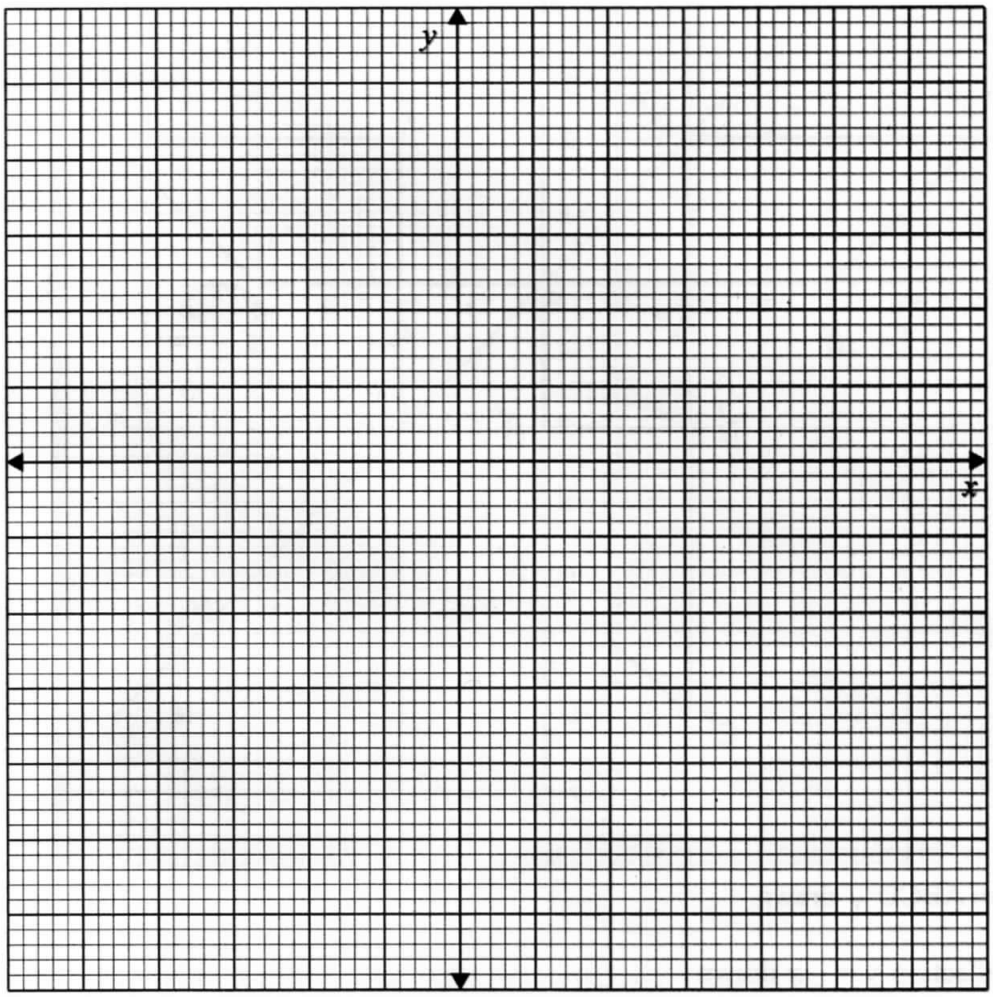
Advice to teachers
Emphasis on various ways of factorization is important for the students to understand.

Question 23

The vertices of a trapezium ABCD are A(2, 0), B(4, 0), C(6, 2) and D(2, 2).

(a) On the grid provided below, draw:

(i) the trapezium ABCD; **(1 mark)**



(ii) A′B′C′D′ the image of ABCD under a reflection in the line $y = -x$; **(2 marks)**

(iii) A″B″C″D″ the image of A′B′C′D′ under a rotation of $-90°$, centre (0, 0). **(2 marks)**

(b) Describe a transformation that maps A″B″C″D″ onto ABCD. **(2 marks)**

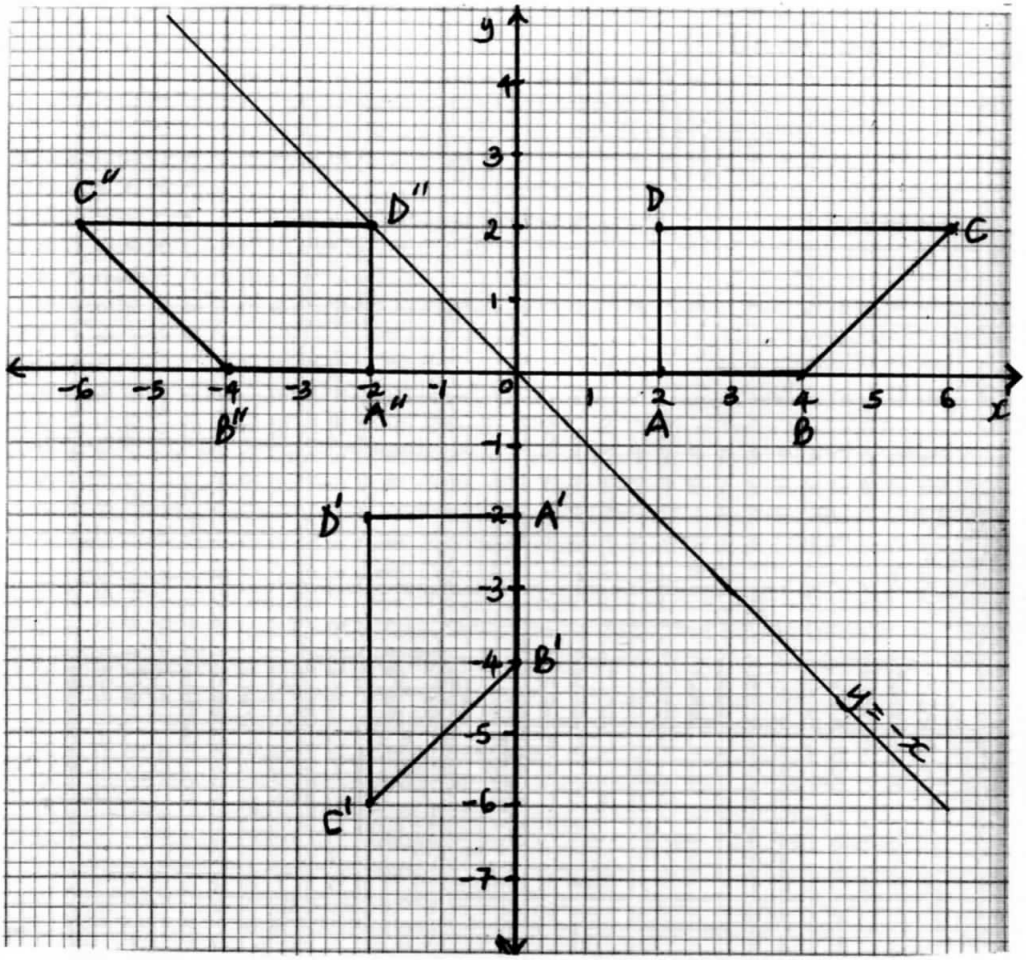
(c) State pairs of trapezia that are directly congruent and those that are oppositely congruent. **(3 marks)**

The question required the candidates to apply reflection and rotation in Cartesian plane and identify congruent triangles.

Weaknesses

Most candidates could not apply reflection and rotation in the Cartesian plane. Others could not differentiate between direct and opposite congruence.

Expected response



(a) (i) trapezium ABCD √ drawn

(ii) line of reflection $y = -x$ drawn
trapezium A'B'C'D' √ drawn

(iii) points A"B"C"D" plotted
trapezium A"B"C"D" drawn

(b) transformation which maps
A"B"C"D" onto ABCD
reflection
on line $x = 0$

(c) directly congruent pair
A'B'C'D' and A"B"C"D"
oppositely congruent pairs
ABCD and A'B'C'D'
ABCD and A"B"C"D"

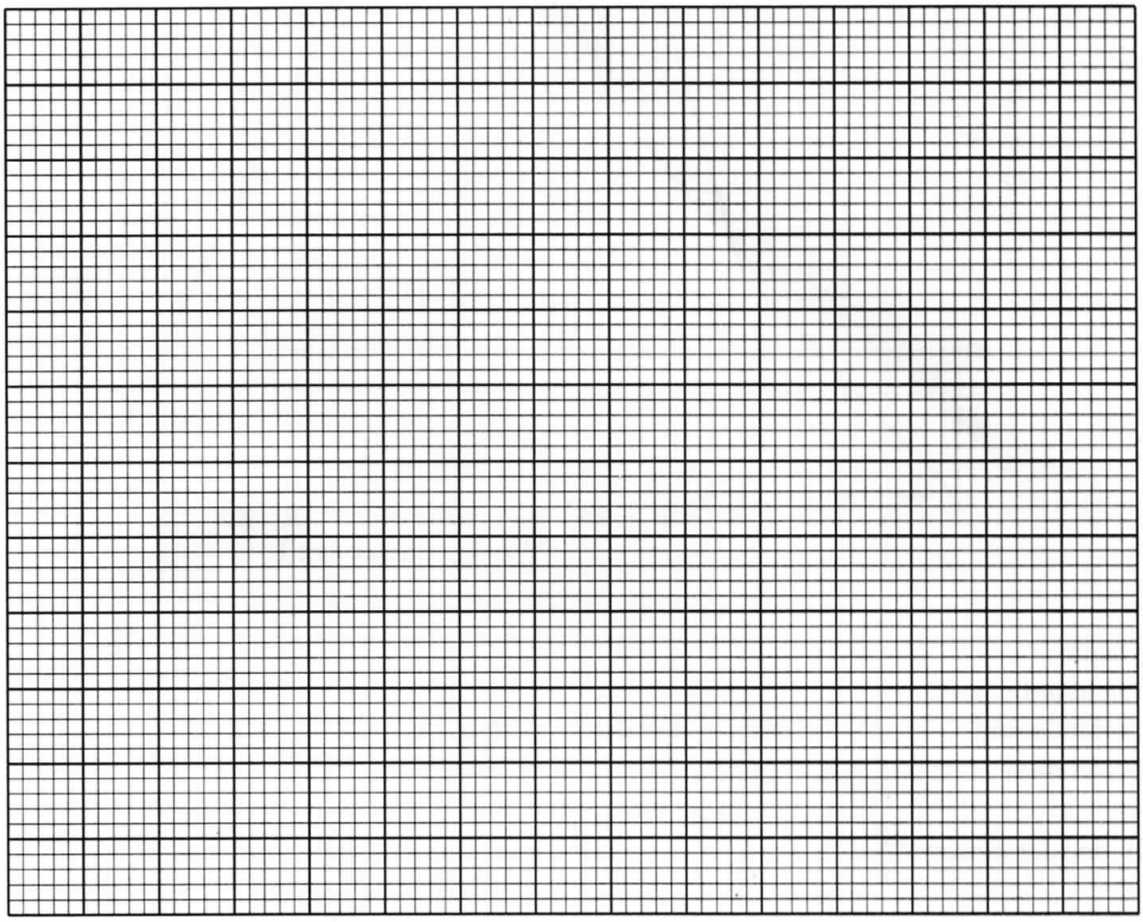
Advice to teachers

Emphasis on the various types of transformations is important for students to fully understand the concept.

Question 24

A racing motorcycle started from rest and moved with a constant acceleration of 1 m/s^2 for 15 seconds. It then accelerated at 3.5 m/s^2 for the next 10 seconds and maintained a constant speed for the next 10 seconds. It decelerated constantly and came to rest after 25 seconds.

(a) On the grid provided, draw the velocity–time graph for the motorcycle. (4 marks)



(b) Use the graph to determine:

(i) the deceleration of the motorcycle; (2 marks)

(ii) the total distance travelled; (2 marks)

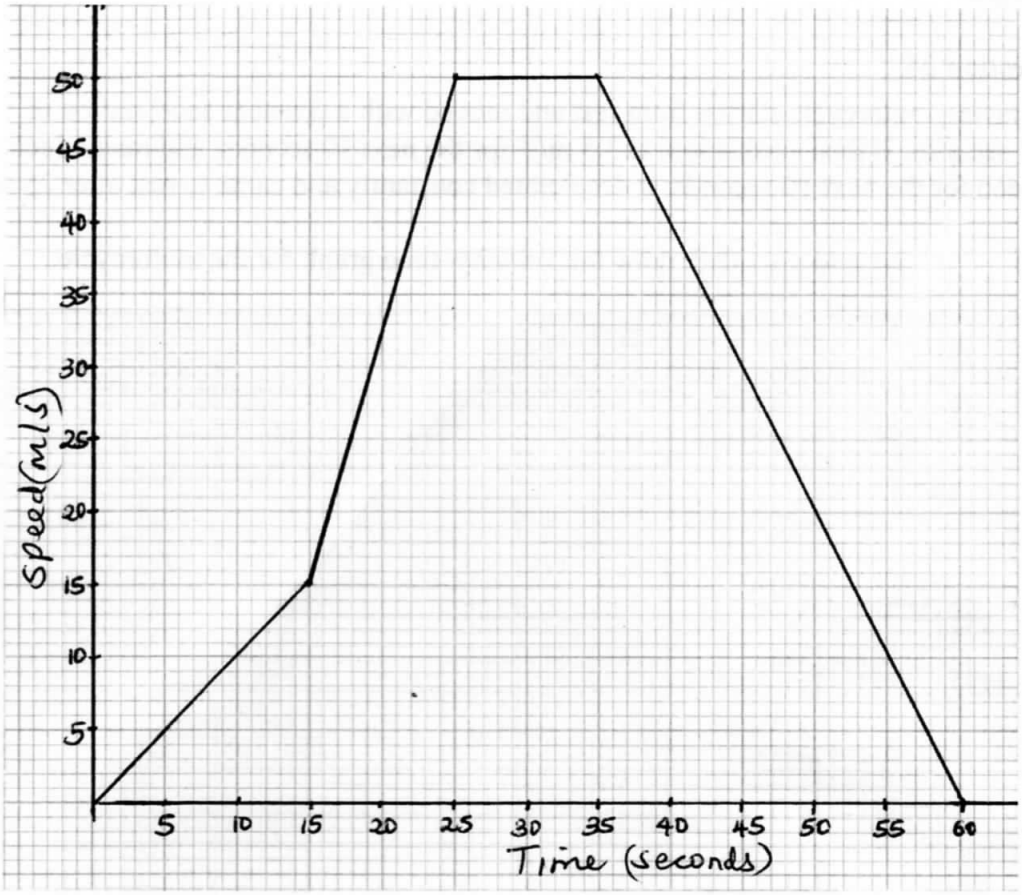
(iii) the average speed for the motorcycle, correct to 3 significant figures. (2 marks)

The question required the drawing and interpretation of a velocity - time graph in linear motion.

Weaknesses

Majority of the candidates could not interpret the given information in order to represent it on the graph.

Expected response



(a) √ scale
acceleration parts
constant speed
deceleration

(b) (i) deceleration $= \frac{50}{25}$

$= 2 \text{ m/s}^2$

(ii) Total distance

$$= \frac{1}{2}(15 \times 15) + \frac{1}{2}(15 + 50) \times 10 + 10 \times 50 + \frac{1}{2}(25 \times 50)$$

$$= 112.5 + 325 + 500 + 625 = 1562.5$$

(iii) Average speed

$$= \frac{1562.5}{60}$$

$$= 26.0416 = 26.0\ m/s$$

Advice to teachers
Plotting, drawing and interpretation of graphs of linear motion should be emphasized more during teaching.

3.2.3 Mathematics Alt. B Paper 2 (122/2)

Question 5

Two fair dice are rolled together and the sum of the numbers showing on the top faces noted.

(a) Represent all the possible outcomes in a probability space. (2 marks)

(b) Determine the probability that the sum is greater than 6 but less than 10. (1 mark)

The question tested on probability, on construction of a probability space and using it to determine probabilities.

Weaknesses
Most students were unable to come up with the probability space.

Expected response

(a)

+	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

(b) $P(6 < x < 10)$

$$= \frac{15}{36} = \frac{5}{12}$$

Advice to teachers
Emphasize more on the drawing of the probability space for various events to the students.

Question 8

Given that $2\cos(x - 30)^\circ = -0.9$, determine the value of x for $0^\circ \leq x \leq 180^\circ$ correct to 2 decimal places. (3 marks)

The question tested on the solution of trigonometric equations using the unit circle.

Weaknesses
Most candidates found the acute angle and failed to relate it to the 2nd quadrant of the unit circle.

Expected response

$$2\cos(x-30)^\circ = -0.9$$
$$\cos(x-30)^\circ = -0.45$$
$$(x-30)^\circ = \cos^{-1} - 0.45$$
$$= 116.74^\circ$$
$$x = 146.74^\circ$$

Advice to teachers
Give students more practice questions on use of unit circle to solve equations relating to trigonometric ratios.

Question 12

In a camp, there was enough food to feed 2000 people on equal rations for 90 days. After 20 days 500 more people joined the camp. Calculate the number of days that the remaining food would be used to feed the people. (4 marks)

The question tested in proportions.

Weaknesses
Most candidates appeared not to understand the proportions.

Expected response

Fraction of food per person per day $\frac{1}{2000 \times 90}$

Fraction for 2000 persons for 20 days

$$= 2000 \times \frac{20}{2000 \times 90}$$

$$= \frac{2}{9}$$

Remaining fraction of food $= \frac{7}{9}$

No of days to feed 2000 + 500 persons

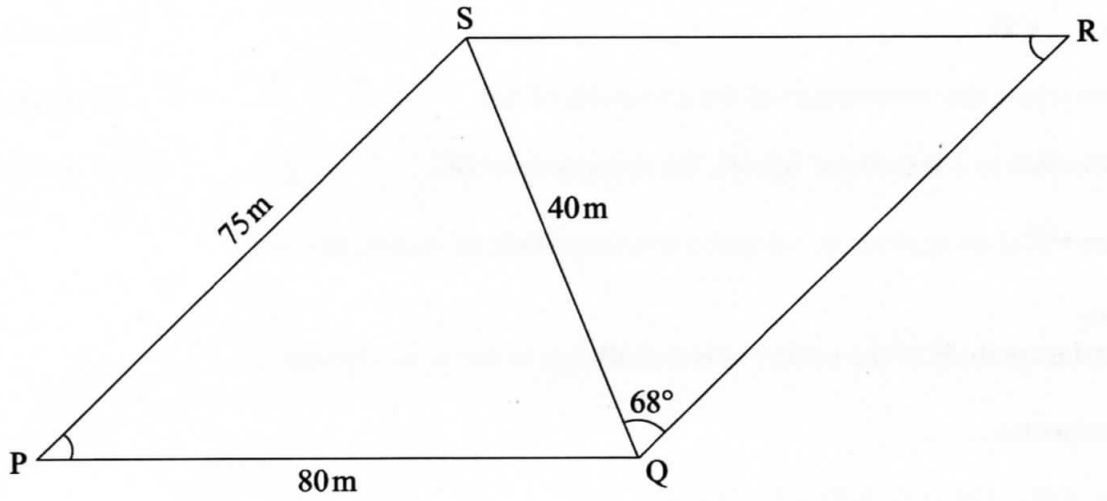
$$= \frac{7}{9} \div \frac{1 \times 2500}{180000}$$

$$\frac{7}{9} \times \frac{72}{1} = 56$$

Advice to teachers
Give more practice questions on the topic of proportions when teaching it to help students understand.

Question 13

Figure PQRS below represents a garden in which,
PQ = 80 m, PS = 75 m, SQ = 40 m, ∠SQR = 68° and ∠SPQ = ∠SRQ.



Calculate, to 2 significant figures, the length of SR. (3 marks)

The question tested on use of cosine rule and sine rule in solution of triangles.

Weaknesses
Most candidates had problems in the manipulation of the cosine rule and sine rule.

Expected response

$$\cos P = \frac{75^2 + 80^2 - 40^2}{2 \times 75 \times 80}$$

$$= \frac{10425}{12000} = 0.86875$$

$$P \simeq 30^\circ$$

$$\frac{SR}{\sin 68} = \frac{40}{\sin 30} \Longrightarrow SR = \frac{40 \sin 68}{\sin 30^\circ}$$

$$= 74 \text{ m}$$

Advice to teachers
Give more practice exercise on the use of the cosine rule and sine rule and help students to make judgment on which of the two to use at any given time in solution of triangles.

Question 21

Four vectors are such that **OA** $= -2i + j$, **OB** $= 3i + 5j$, **OC** $= -8i - 12j$ and **OD** $= 2i - 4j$.

(a) Express in terms of i and j, the vectors:

(i) **AB**; (2 marks)

(ii) **CD**. (2 marks)

(b) Determine the co-ordinates of the mid-point of **AD**. (3 marks)

(c) Calculate to 3 significant figures, the magnitude of **BC**. (3 marks)

The question tested on operations, midpoint and magnitude of vectors in i and j.

Weaknesses

Midpoint and magnitude of the vectors was a challenge to many candidates.

Expected response

(a) (i) $\underset{\sim}{AB} = \underset{\sim}{OB} - \underset{\sim}{OA} = 3i + 5j - (-2i + j)$

$= 3i + 5j + 2i - j$

$= 5i + 4j$

(ii) $\underset{\sim}{CD} = \underset{\sim}{OD} - \underset{\sim}{OC} = 2i - 4j - (-8i - 12j)$

$= 2i - 4j + 8i + 12j$

$= 10i + 8j$

(b) mid point of vector AD

$= \frac{1}{2}\left\{\begin{pmatrix} -2i \\ j \end{pmatrix} + \begin{pmatrix} 2i \\ -4j \end{pmatrix}\right\} = \frac{1}{2}\begin{pmatrix} 0 \\ -3j \end{pmatrix}$

$= \begin{pmatrix} 0 \\ -1.5j \end{pmatrix}$

$\therefore$ coordinates of mid point is

(0, -1.5)

(c) $\underset{\sim}{BC} = \underset{\sim}{OC} - \underset{\sim}{OB} = -8i - 12j - (3i + 5j)$

$= 11i - 17j$

$\therefore |\underset{\sim}{BC}| = \sqrt{11^2 + 17^2}$

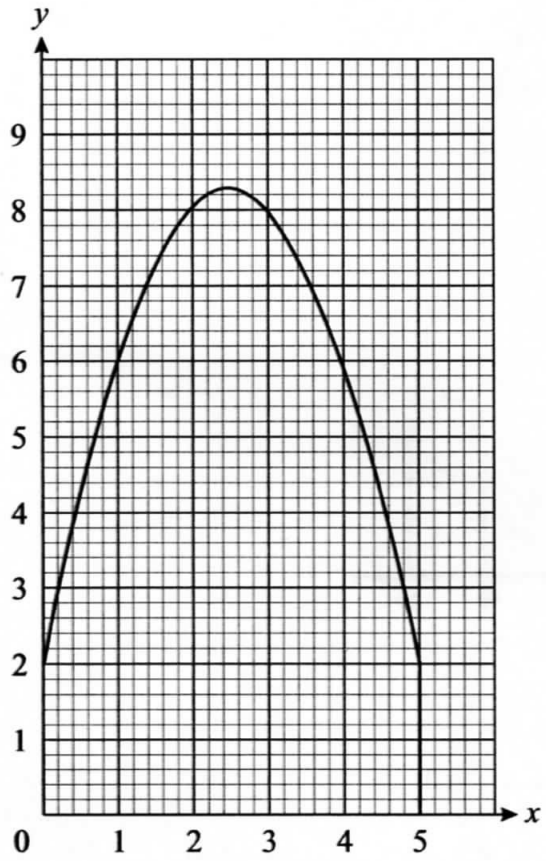
$= \sqrt{121 + 289} \simeq 20.2$

Advice to teachers

Emphasize more on the midpoint and magnitude of the vectors.

Question 24

In the figure below the area bounded by the curve, the y-axis, the x-axis and the line $x = 5$ represents a map of a piece of land.



(a) Estimate the area of the map in cm^2 by:

(i) the counting technique; (2 marks)

(ii) using the trapezium rule with 5 strips of equal width. (3 marks)

(b) Given that the actual area of the map is $30\frac{5}{6}$ cm^2, calculate:

(i) the percentage error, correct to 2 significant figures, when the trapezium rule is used to estimate the area of the map; (2 marks)

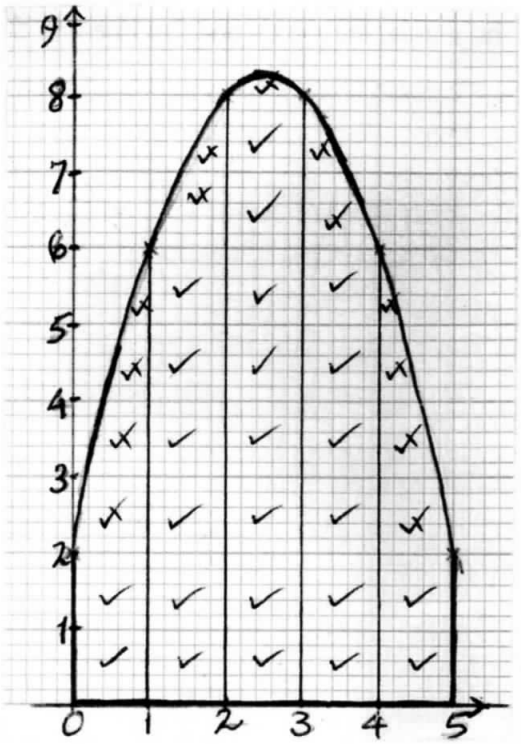
(ii) the actual area in hectares of the piece of land if the scale used was 1:12000. (3 marks)

The question tested on area approximations using the counting technique and trapezoidal rule.

Weaknesses

Identification of the first and last ordinates from the graph was a challenge to many candidates.

Expected response



(a) (i) $24 + \frac{1}{2}(13) = 30\frac{1}{2}$

(ii) $\frac{1}{2} \times 1\{2 + 2 + 2(6 + 8 + 8 + 6)\}$

$= \frac{1}{2}(60)$

$= 30 \text{ cm}^2$

(b) (i) $\% \text{ error} = \dfrac{30\frac{5}{6} - 30}{30\frac{5}{6}} \times 100$

$= 2\dfrac{26}{37}$

$= 2.7$

(ii) $1 \text{ cm} \equiv 120 \text{ m}$
$1 \text{ cm}^2 \equiv 14400 \text{ m}^2$

$\therefore 30\frac{5}{6} \text{ cm}^2 \equiv \dfrac{144000}{10000} \times \dfrac{185}{6}$

$=44.4 \text{ ha}$

Advice to teachers

Give more practice to students on different methods of area approximations.

3.3 BIOLOGY (231)

This was the eighth time the revised KCSE Biology syllabus was tested.

3.3.1 CANDIDATES' GENERAL PERFORMANCE

The performance of the 2013 candidates in the three Biology papers is given in the table below. The performance of the candidates in the years 2009, 2010, 2011 and 2012 is also given for comparison.

Table 10: Candidates' Overall Performance in Biology In the years 2009, 2010, 2011, 2012 and 2013

Year	Paper	Candidature	Maximum score	Mean score	Standard Deviation
2009	1		80	20.14	12.31
	2		80	18.41	10.30
	3		40	15.86	8.43
	Overall	**299,302**	**200**	**54.29**	**28.80**
2010	1		80	21.39	13.76
	2		80	18.67	10.82
	3		40	18.42	8.31
	Overall	**317,135**	**200**	**58.39**	**30.44**
2011	1		80	22.74	12.41
	2		80	23.31	13.04
	3		40	18.84	8.10
	Overall	**363,817**	**200**	**64.87**	**31.05**
2012	1		80	19.77	12.84
	2		80	20.70	12.09
	3		40	11.97	6.59
	Overall	**389,523**	**200**	**52.41**	**29.43**
2013	1		80	28.03	14.49
	2		80	22.36	12.70
	3		40	12.88	7.64
	Overall	**397,319**	**200**	**63.26**	**32.06**

From the table it can be observed that:

(i) There has been an increase in candidature for the past five years.

(ii) There was an improvement in performance in the year 2013 compared to 2012 as indicated by the mean scores of the papers.

(iii) The standard deviation values indicate that the papers adequately discriminated learners of different abilities.

Conclusion

From the analysis of the Mathematics papers in both Mathematics Alt A (121) and Mathematics Alt B (122) it has been noted that candidates had major weaknesses in some areas of the syllabus. These areas include **Natural numbers, Trigonometry, Geometry** and **Transformations.** Teachers are therefore advice to put more emphasis when teaching these topics to help the students achieve the stated objectives in the syllabus.