3.2 MATHEMATICS ALT. B (122)

Mathematics Alt B for the year 2022 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.

3.2.1 Candidates' general performance

Table 11: Candidates' performance in Mathematics Alt B for the last five years 2018 - 202

Year	Paper	Candidature	Maximum score	Mean Score	Standard Deviation
2018	1 2 **Overall**	**1161**	100 100 **200**	9.13 8.38 **17.44**	10.61 11.14 **20.36**
2019	1 2 **Overall**	**1126**	100 100 **200**	5.9 7.3 **12.97**	8.79 9.75 **16.62**
2020	1 2 **Overall**	**1035**	100 100 **200**	10.83 11.62 **22.32**	12.81 12.66 **23.22**
2021	1 2 **Overall**	**844**	100 100 **200**	13.02 10.42 **23.29**	15.76 15.40 **28.99**
2022	1 2 **Overall**	**844**	100 100 **200**	15.29 14.07 **29.31**	18.08 17.78 **34.64**

From the table it is observable that the subject registered an improvement in performance compared to previous years. However, the mean score is still far below average.

3.2.2 Individual question analysis

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

3.2.3 Mathematics Paper 1 (122/1)

Question 5

Auma poured a litre of juice into 3 glasses. The first glass contained $\frac{3}{5}$ *of a litre and the second glass contained* $\frac{1}{4}$ *of a litre. Determine the fraction of the juice contained in the third glass.* *(3 marks)*

The question tested on application of fractions.

Weaknesses
The candidates were unable to calculate the L.C.M hence ended up with wrong operations of fractions.

Expected response

$\frac{3}{5}+\frac{1}{4}=\frac{12+5}{20}$	M1
$=\frac{17}{20}$	
Fraction in 3rd glass $= 1-\frac{17}{20}$	M1
$=\frac{3}{20}$	A1
	3

Advice to teachers
Emphasize on LCM and manipulation of fractions.

Question 6

Kaige was in a car travelling at 81 km/hr. The car took one second to go past a building on the side of a road. If the length of the car was 4.5 m, calculate the length of the building in metres. *(3 marks)*

The question tested on application of speed.

Weaknesses
Candidates were not able to convert speed from Km/h to m/s.

Expected response

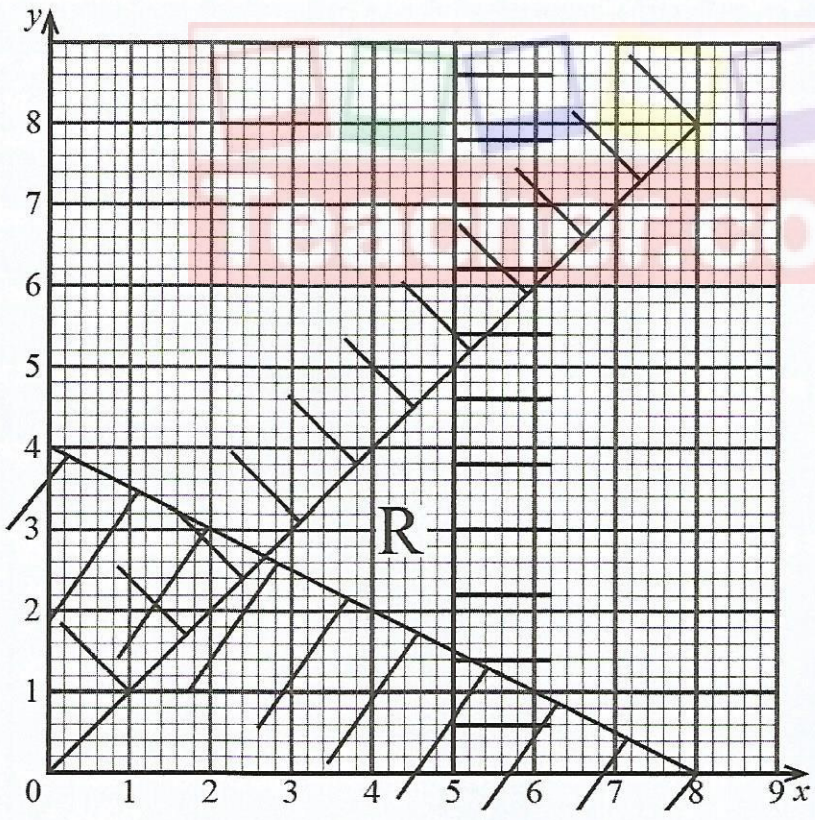
$81 \text{ km/h} = 81 \times \frac{1000 \text{ m}}{3600 \text{ s}}$	M1
$= 22.5 \text{ m/s}$	A1
Distance travelled in 1 s = 22.5 m	
Length of building = 22.5 – 4.5	
= 18 m	B1
	3

Advice to teachers

Emphasize more on conversion of Km/h to m/s and vice versa.

Question 10

In the diagram below, the region R is defined by three inequalities.



Write down the three inequalities. *(4 marks)*

The question tested on linear inequalities in two unknowns. It required the knowledge of equations of straight lines.

Weaknesses

The candidates lacked knowledge of equations of straight lines given the lines. They were also unable to get the inequalities represented.

Expected response

$x \leq 5$	B1
$y \leq x$	B1
(8, 0) (0, 4)	
$-\frac{4}{8} = -\frac{1}{2}$ $\quad y = -\frac{1}{2}x + 4$	B1
$y \geq -\frac{1}{2}x + 4$	B1
	4

Advice to teachers

Emphasis more on coordinates and graphs and equations of a straight line as they provide the prerequisite knowledge required in graphical representations of linear inequalities.

Question 13

Without using a calculator, evaluate

$$\frac{3(4^2+2^2)-5\times 6\div 2}{3\times 5}$$

(3 marks)

The question tested on a working out combined operations of integers in the correct order .

Weaknesses

Most learners were unable to execute the multiplication and division and follow the correct order of operations.

Expected response

$\frac{3(16+4)-5\times3}{3\times5}$ $=\frac{3\times20-15}{15}$ $=\frac{60-15}{15}$ $=3$	M1 M1 A1
	3

Advice to teachers

Avoid over use of calculators. Emphasize on the correct order of operations.

Question 15

An institution bought 2 bags of maize and a bag of beans from a store and paid a total of Ksh 7 600. Another institution bought 3 bags of maize and 2 bags of beans from the same store and paid Ksh 13 400. Find the cost of a bag of maize and a bag of beans. *(4 marks)*

The question tested on formation and solution of linear equations in two unknowns.

Weaknesses

Unable to form the correct equations.

Expected response

$2m + b = 7600$ $\underline{3m + 2b = 13400}$ $4m + 2b = 15200$ $\underline{3m + 2b = 13400}$ $m = 1800$ $b = 7600 - 2 \times 1800$ $= 4000$ Cost of a bag of maize = Ksh 1800 Cost of a bag of beans = Ksh 4000	M1 M1 A1 B1
	4

Advice to teachers

Emphasize on the formation of linear equations from different situations.

Question 20

During a soccer training session, 3 players (Peter, John and Ahmed) were positioned such that John was 10 metres away from Peter and Ahmed was 15 metres away from John.

(a) Peter passed the ball to John and the ball travelled at an average speed of x m/s. Write an expression in terms of x for the time taken, in seconds, for the ball to travel from Peter to John. *(1 mark)*

(b) John then passed the ball to Ahmed and the ball travelled at an average speed of 5 m/s faster than the ball's average speed from Peter to John. Write an expression in terms of x for the time taken, in seconds, for the ball to travel from John to Ahmed. *(2 marks)*

(c) The total time taken for the ball to travel from Peter to John then to Ahmed was 6 seconds.

(i) Form a quadratic equation in terms of x to show the total time taken by the ball to travel from Peter to John then to Ahmed. *(3 marks)*

(ii) Find the average speed of the ball as it travelled from John to Ahmed. *(4 marks)*

The question tested on formation and solution of quadratic equations.

Weaknesses

Inability to form the quadratic equations

Expected response

20. (a)	$\frac{10}{x}$	B1
(b)	Speed $= x + 5$ Time $= \frac{15}{x+5}$	B1 B1
(c) (i)	$\frac{10}{x} + \frac{15}{x+5} = 6$	M1
	$10(x+5)+15x = 6x(x+5)$ $10x + 50 + 15x = 6x^2 + 30x$ $6x^2 + 5x - 50 = 0$	M1 A1
(ii)	$6x^2 - 15x + 20x - 50 = 0$ $3x(2x-5)+10(2x-5)=0$ $(2x-5)(3x+10)=0$	M1
	$2x = 5$ or $3x + 10 = 0$ $x = 2.5$ or $-\frac{10}{3}$	M1
	$x = 2.5$ m/s	A1
	average speed of ball from John to Ahmed $= 2.5 + 5$ $= 7.5$ m/s	B1
		10

Advice to teachers

More practice is needed in the formation of quadratic equations from different situations.

Question 20

During a soccer training session, 3 players (Peter, John and Ahmed) were positioned such that John was 10 metres away from Peter and Ahmed was 15 metres away from John.

(a) Peter passed the ball to John and the ball travelled at an average speed of x m/s. Write an expression in terms of x for the time taken, in seconds, for the ball to travel from Peter to John. *(1 mark)*

(b) John then passed the ball to Ahmed and the ball travelled at an average speed of 5 m/s faster than the ball's average speed from Peter to John. Write an expression in terms of x for the time taken, in seconds, for the ball to travel from John to Ahmed. *(2 marks)*

(c) The total time taken for the ball to travel from Peter to John then to Ahmed was 6 seconds.

(i) Form a quadratic equation in terms of x to show the total time taken by the ball to travel from Peter to John then to Ahmed. *(3 marks)*

(ii) Find the average speed of the ball as it travelled from John to Ahmed. *(4 marks)*

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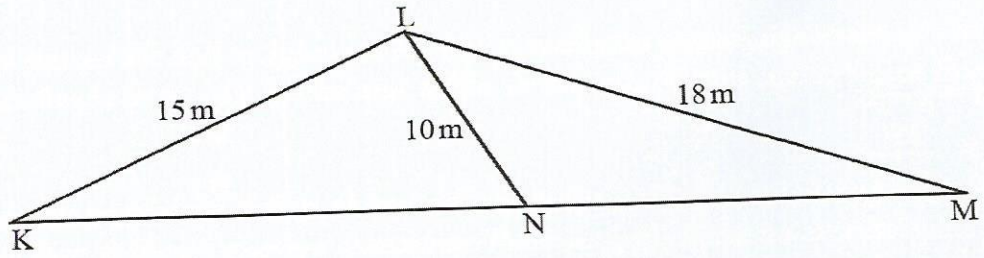
The question tested on formation and solution of quadratic equations.

Weaknesses

Inability to form the quadratic equations

Question 21

Figure KLMN below represent a vegetable garden divided into two triangles. KL=15 m, LM=18 m and LN=10 m. Triangle KLM is similar to triangle LNM.



(a) Write:

(i) two pairs of the corresponding sides of triangles KLM and LNM; *(2 marks)*

(ii) one pair of corresponding angles of triangles KLM and LNM. *(1 mark)*

(b) Calculate the length of:

(i) KM; *(2 marks)*

(ii) KN. *(3 marks)*

(c) Determine the area scale factor of triangle KLM to triangle LNM. *(2 marks)*

The question tested on similarity and enlargement, linear scale factor and area scale factor.

Weaknesses

Unable to identify the similar triangles.
Unable to compare ratios of corresponding sides.

Expected response

21		
(a)(i)	Corresponding sides	B1
	KL and LN LM and NM KM and LM	B1
(ii)	Corresponding angle	
	$\angle KML = \angle LMN$ $\angle LKM = \angle NLM$ $\angle KLM = \angle LNM$	B1
(b) (i)	$\frac{KM}{18} = \frac{15}{10}$	M1
	$KM = \frac{15 \times 18}{10}$ $= 27$ m	A1
(ii)	$KN = KM - NM$	
	$\frac{18}{NM} = \frac{15}{10}$	M1
	$NM = \frac{18 \times 10}{15}$	A1
	$= 12$	
	$KN = 27 - 12 = 15$	B1
(c)	A.s.f $= \left(\frac{3}{2}\right)^2$ *or* $\left(\frac{15}{10}\right)^2$	M1
	$= \frac{9}{4}$ or 2.25	A1
		10

Advice to teachers

Give more practice on similarity and enlargement from different situations.

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

Question 4

A quantity P is partly constant and partly varies as the cube root of a quantity Q. When Q = 8, P = 13 and when Q = 64, P = 23. Find the equation connecting P and Q. (3 marks)

The question tested on partial variation.

Weaknesses
Unable to differentiate the different type of variations.

Expected response

$P = C + k\sqrt[3]{Q}$	
$13 = C + 2k$	
$23 = C + 4k$	M1
$10 = 2k$	
$k = 5$	A1
$C = 3$	
$\therefore P = 3 + 5\sqrt[3]{Q}$	B1
	3

Advice to teachers

Give more exposure on different types of variations.

Question 12

In order to decide who of two boys Meso and Bwana starts to play a game, they toss a coin.

Meso starts if the two coins show a head. Bwana starts if the first coin shows a head and the second coin shows a tail.

(a) Draw a tree diagram to represent the possible outcomes. *(2 marks)*

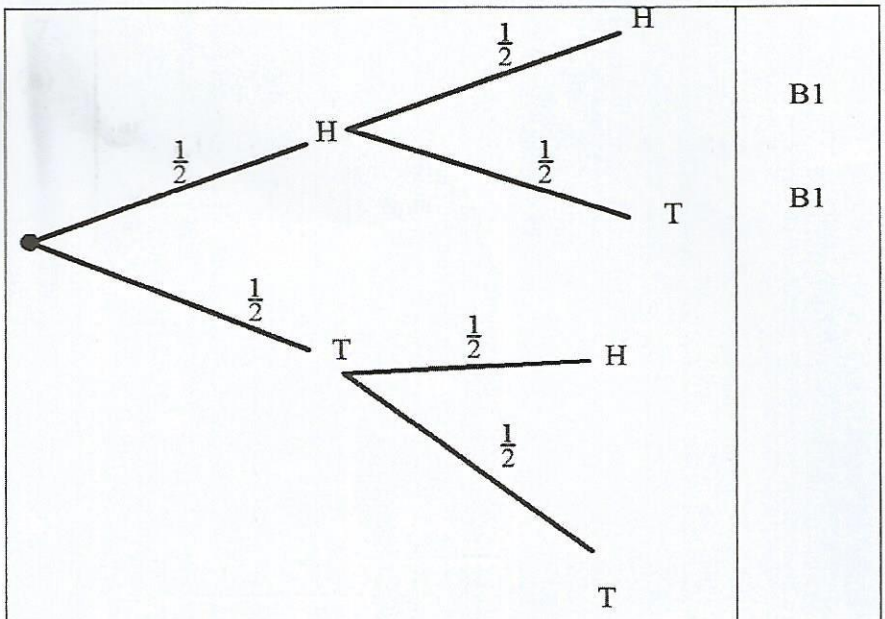
(b) Determine the probability that Bwana starts to play the game. *(2 marks)*

The question tested on probability.

Weaknesses

Most students could not draw the tree diagram, hence nonstarters.

Expected response



	B1
	B1
$P(HT) = \frac{1}{2} \times \frac{1}{2}$	M1
$= \frac{1}{4}$	A1
	4

Advice to teachers

Expose students more on probability spaces.

Question 13

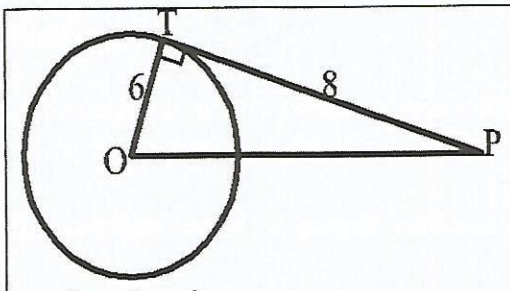
A line TP, 8 cm long, is a tangent to a circle at T. The radius of the circle is 6 cm. Calculate the distance of P from the centre of the circle. *(2 marks)*

The question tested on circles, tangents and chords.

Weaknesses

Unable to relate the radius and the tangent.

Expected response



$OP^2 = 6^2 + 8^2$

$OP = \sqrt{100}$

$= 10\text{ cm}$

M1

A1

2

Advice to teachers

Give more practice in- circles, tangents and chords

Question 17

The fifth and eighth terms of a Geometric Progression (GP) are $\frac{1}{2}$ *and* $\frac{1}{16}$ *respectively. Find:*

(a) the common ratio and the first term of the GP; *(4 marks)*

(b) the sum of the first 10 terms of the GP, correct to 2 decimal places; *(2 marks)*

(c) the least value of n such that the sum of the progression is 15. *(4 marks)*

The question tested on finding the nth term and sum of a Geometric Progression.

Weaknesses

Failure to link the sum and the number of terms.

Expected response

17. (a)	$ar^4 = \frac{1}{2}$	B1
	$ar^7 = \frac{1}{16}$	
	$\frac{ar^7}{ar^4} = \frac{1}{16} \times \frac{2}{1}$	M1
	$r^3 = \frac{1}{8}$	
	$r = \frac{1}{2}$	A1
	$a = 8$	B1
(b)	$S_{10} = \frac{8\left(1-\left(\frac{1}{2}\right)^{10}\right)}{1-\frac{1}{2}}$	M1
	$= \frac{1023 \times 16}{1024}$	
	$= \frac{1023}{64}$	A1
	$= 15.98$	
(c)	$\frac{8\left(1-\frac{1}{2}^{n}\right)}{1-\frac{1}{2}} = 15$	M1
	$\left(1-\frac{1}{2}^{n}\right) = \frac{15}{16}$	M1
	$\left(\frac{1}{2}\right)^n = \frac{1}{16}$	
	$2^{-n} = 2^{-4}$	M1
	$n = 4$	A1
		10

Advice to teachers

Give more practice on Geometric Progression in different situations.

Question 22

ABCD is a kite with vertices at A(3,6), B(2,3), C(3,1) and D(4,3).

(a) *On the grid provided, draw the kite.* *(1 mark)*

(b) *A'B'C'D' is the image of ABCD under a transformation matrix*

(i) *Find the coordinates of A'B'C'D'.* *(2 marks)*

(ii) *On the same grid, draw A'B'C'D'.* *(1 mark)*

(c) *A"B"C"D" is the image of A'B'C'D' under a reflection on the line y = x.*
Draw A"B"C"D". *(3 marks)*

(d) *Find a single transformation matrix, **T**, that maps ABCD onto A"B"C"D". (3 marks)*

The question tested on use of matrices in transformations.

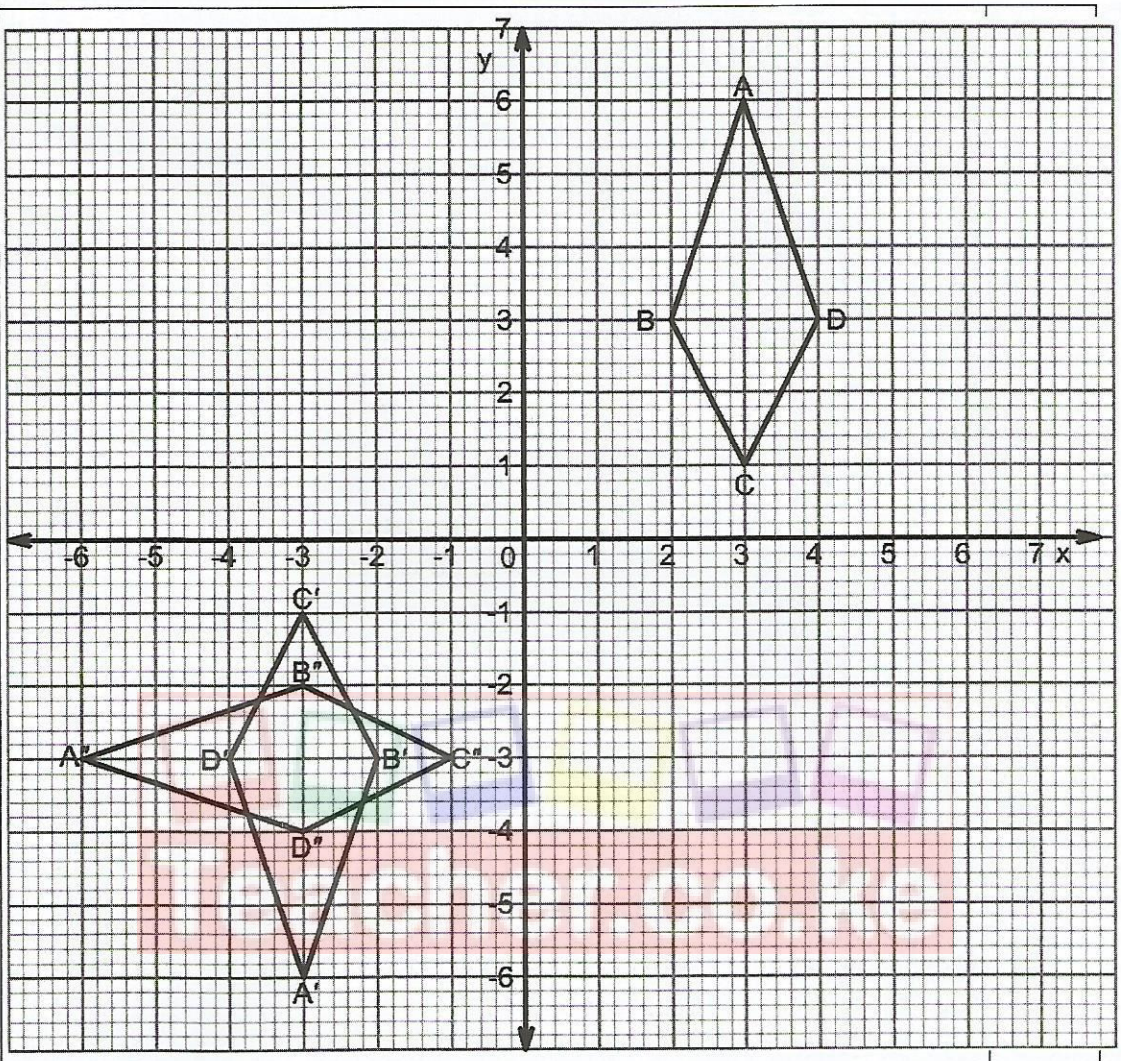
Weaknesses

Unable to obtain the image given the mirror line.

Expected response

22.

(a)



Kite A B C D drawn — B1

(b)

A B C D A′ B′ C′ D′

(i)

$$\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} 3 & 2 & 3 & 4 \\ 6 & 3 & 1 & 3 \end{pmatrix}=\begin{pmatrix} -3 & -2 & -3 & -4 \\ -6 & -3 & -1 & -3 \end{pmatrix}$$ — M1

A′(-3,-6) B′(-2,-3) C′(-3,-1) D′(-4, -3) — A1

(ii)

A′B′C′D′ correctly drawn — B1

(c)

Line y = x drawn — B1

	$A''B''C''D''$ plotted and drawn	B1B1
(d)	$\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} 3 & 2 & 3 & 4 \\ 6 & 3 & 1 & 3 \end{pmatrix}=\begin{pmatrix} -6 & -3 & -1 & -3 \\ -3 & -2 & -3 & -4 \end{pmatrix}$	M1
	$3a+6b=-6$ $3a+2b=-2$ $4b=-4$ $b=-1$ $a=0$ $3c+6d=-3$ $3c+2d=-3$ $4d=0$ $d=0$ $c=-1$	M1
	$\mathbf{T}=\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$	A1
		10

Advice to teachers

Give more practice on use of matrices in transformations.

Conclusion

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 contextualize the learning to different situations in the course of the teaching and learning.