3.2 MATHEMATICS ALT B (122)

In the year 2018 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 2018 KCSE Mathematics Alt B.

3.2.1 CANDIDATES' GENERAL PERFORMANCE

Table 10: Candidates' Performance in Mathematics Alt B for the last five years 2014 - 2018

Year	Paper	Candidature	Maximum score	Mean Score	Standard Deviation
2014	1		100	13.71	12.68
	2	**1293**	100	11.16	13.28
	Overall		**200**	**24.76**	**24.71**
2015	1		100	9.35	11.76
	2	**1387**	100	7.26	12.53
	Overall		**200**	**16.58**	**22.72**
2016	1		100	9.37	11.28
	2	**1457**	100	8.02	10.6
	Overall		**200**	**17.18**	**20.67**
2017	1		100	7.07	8.58
	2	**1486**	100	13.39	13.26
	Overall		**200**	**20.20**	**20.26**
2018	1		100	9.13	10.61
	2	**1161**	100	8.38	11.14
	Overall		**200**	**17.44**	**20.36**

From the table it is observable that the subject registered a dismal performance as signified by the means.

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 candidates answer scripts and chief examiners report.

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

Question 3

Ngata's office is on the twenty second floor in a storey building. On a certain day, he walked up five floors from his office to another office. He then took a lift to the third floor. Calculate the number of floors he went through while in the lift. (2 marks)

The question tested on integers.

Weaknesses

Many candidates could not interpret the requirement of the question.

Expected response

Let n be the number of floors Ngata went through while in the lift

$22 + 5 - n = 3$

$n = 27 - 3$

$n = 24$

Number of floors while in lift = 24

Advice to teachers

Ensure that the students understand the concept of integers as applied to real life situations.

Question 6

Three villages K, L and M are such that L is 53 km from K on a bearing of 295°. Village M is 75 km east of village L.

(a) Using a scale of 1 cm to represent 10 km, draw a diagram to show the positions of villages K, L, and M. (2 marks)

(b) Use the scale drawing to determine the bearing and distance of village M from K. (2 marks)

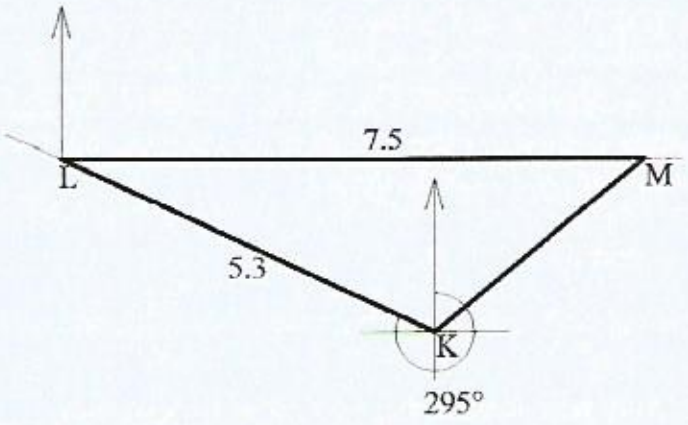
The question tested on scale drawing i.e location of points using bearing and distance.

Weaknesses

Many candidates failed to attempt the question. Those who attempted could not get the correct locations of L and M.

Expected response

(a)



(b) Bearing of M from K = 050°
Distance of M from K = 35 km

Advice to teachers

Scale drawing should be taught practically and learners should practice more to get the concept.

Question 16

A triangle ABC with vertices A(2,3), B(1,1) and C(4,0) is mapped onto triangle A′B′C′ by an enlargement scale factor 2, centre (–1,0).
On the grid provided, draw:

(a) triangle ABC; (1 mark)

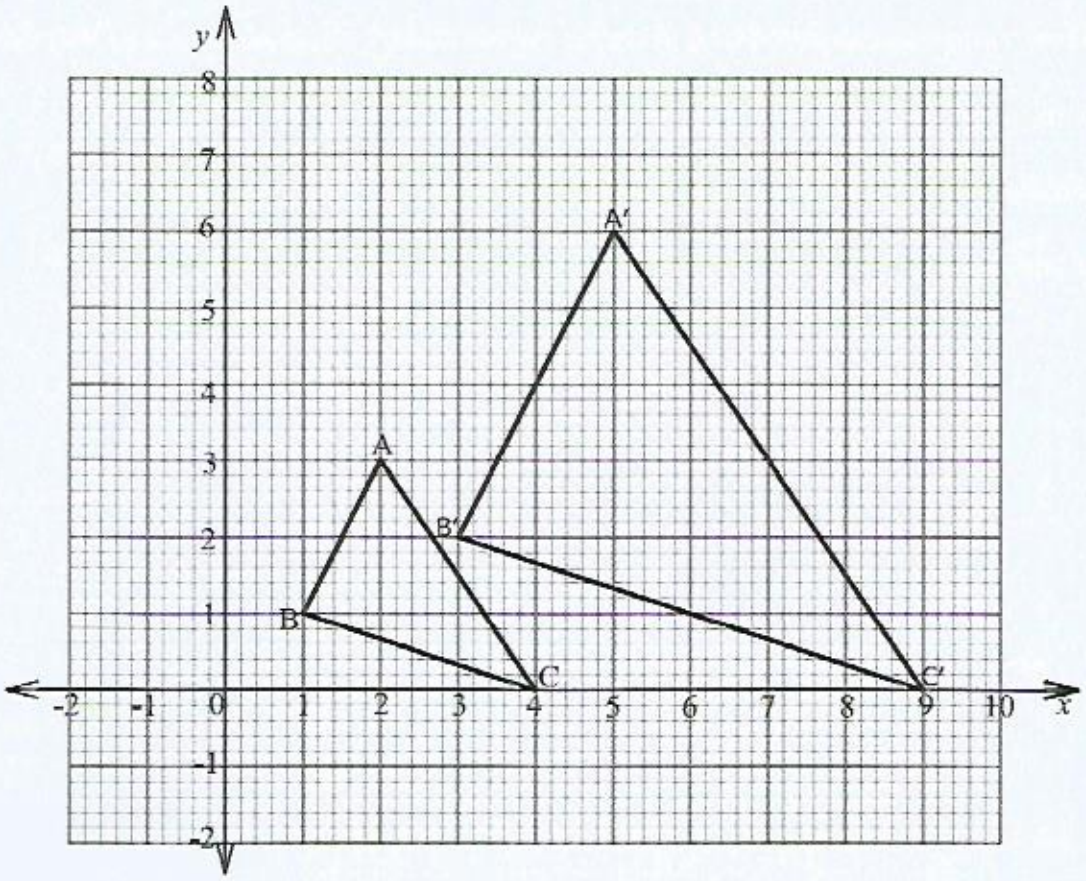
(b) triangle A′B′C′. (3 marks)

The question tested on Similarity and Enlargement. Candidates were required to apply the properties of enlargement to construct the object and image.

Weaknesses

Most candidates were not able to get the image.

Expected response



Advice to teachers

Emphasize more on obtaining images of an enlargement.

Question 21

The vertices of a triangle ABC are A(–3,2), B(–1,2) and C(–1,4).

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

(b) Triangle ABC is reflected on line $y = x + 1$.

(i) Draw line $y = x + 1$. (2 marks)

(ii) Draw triangle A′B′C′, the image of triangle ABC under reflection in the line $y = x + 1$. (2 marks)

(c) Draw triangle A″B″C″, the image of triangle A′B′C′ under a rotation of –90° about (0,0). (2 marks)

(d) Under a translation $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$, triangle A′B′C′ is mapped onto A‴B‴C‴.

(i) Find the coordinates of A‴B‴C‴. (2 marks)

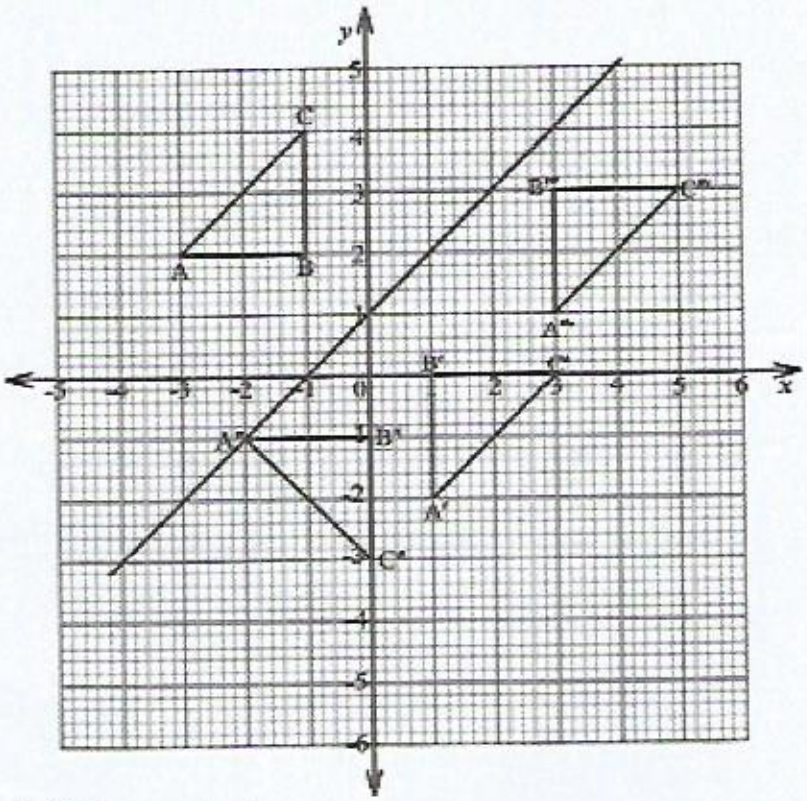
(ii) Draw triangle A‴ B‴ C‴. (1 mark)

The question tested on application of reflection, rotation and transformation in the Cartesian plane.

Weaknesses

Many candidates were unable to reflect, rotate and translate the object correctly.

Expected response



(a) Δ ABC correctly drawn

(b)(i) Line $y = x+1$

(ii) Plotting of points A′,B′ and C′
ΔA′B′C′ correctly drawn

(c) Points A″, B″ and C″ plotted
ΔA″B″C″ correctly drawn

(d)(i) $\begin{pmatrix}1\\-2\end{pmatrix}+\begin{pmatrix}2\\3\end{pmatrix}=\begin{pmatrix}3\\1\end{pmatrix}$,

$\begin{pmatrix}1\\0\end{pmatrix}+\begin{pmatrix}2\\3\end{pmatrix}=\begin{pmatrix}3\\3\end{pmatrix}$,

$\begin{pmatrix}3\\0\end{pmatrix}+\begin{pmatrix}2\\3\end{pmatrix}=\begin{pmatrix}5\\3\end{pmatrix}$

(ii) $\therefore A''(3,1), B''(3,3), C''(5,3)$

$\Delta A''B''C''$ correctly drawn

Advice to teachers

Emphasize more on transformations as used in reflection, rotation and translation.

Question 22

A car started from rest and moved at a constant acceleration of 0.5 m/s^2 for 20 seconds. It maintained a constant velocity for the next 10 seconds before accelerating at 0.8 m/s^2 for 25 seconds. It then decelerated uniformly and came to rest after 15 seconds.

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

(b) Use the graph to determine:

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

(ii) the total distance covered by the car; (2 marks)

(iii) the average speed of the car, correct to 2 decimal places. (2 marks)

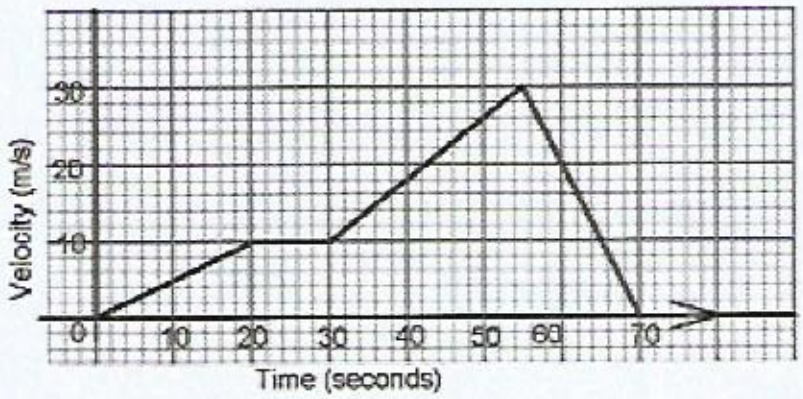
The question tested on linear motion. The candidates were required to draw and interpret the velocity- time graph.

Weaknesses

Many candidates who attempted this question were unable to draw the velocity time graph.

Expected response

a)



Scale
Acceleration parts
Constant speed
Deceleration

b (i) $\text{Deceleration} = \frac{30}{15}$

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

(ii) Total distance covered

$= \frac{1}{2}\times 10\times 20 + 10\times 10 + \frac{1}{2}(10+30)\times 25 + \frac{1}{2}\times 15\times 30$

$= 100 + 100 + 500 + 225$

$= 925\text{m}$

iii) Average speed

$= \frac{925}{70}$

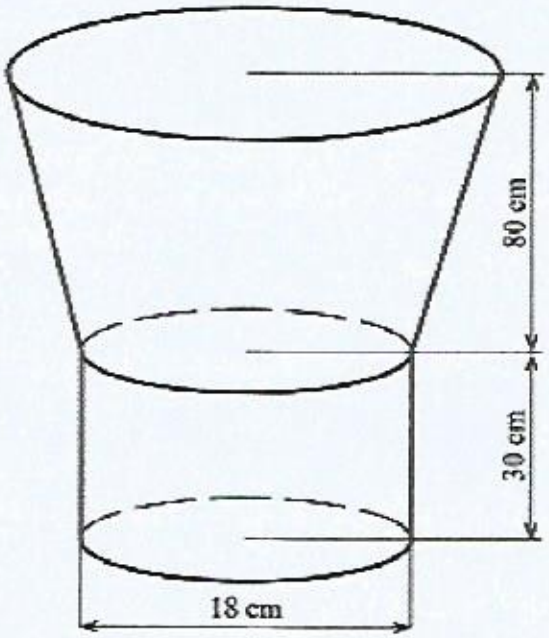
$= 13.21\text{m/s}$

Advice to teachers

Emphasize more on the drawing and interpretation of graphs of linear motion.

Question 23

The figure below represents a wooden model. The model consist of a frustrum part and a cylindrical part. The diameter of the cylindrical part is 18 cm and the height is 30 cm. The height of the frustrum part is 80 cm.



If the vertical height of the cone from which the frustum was cut was 120 cm, calculate:

(a) the larger radius of the frustrum; (2 marks)

(b) the slant height of the frustrum; (4 marks)

(iii) the surface area of the model. (4 marks)

The question tested on surface area of a frustum and a cylinder.

Weaknesses

Many candidates were unable to use similarity to calculate the radius of the frustum.

Expected response

(a) $\frac{120}{40} = \frac{r}{9}$

$r = 27$

(b) Slant height of larger cone

$=\sqrt{27^2+120^2}$

$=123$

Slant height of smaller cone

$=\sqrt{40^2+9^2}$

$=41$

Slant height of cone $=123-41$

$=82$ cm

(c) Surface Area of model

$$\frac{22}{7}\times27\times27+\left(\frac{22}{7}\times27\times123-\frac{22}{7}\times9\times41\right)+\frac{22}{7}\times2\times9\times30+\frac{22}{7}\times9^2$$

$2291.14+9277.71+1697.14+254.57$

$=13520.56\text{cm}^2$

Advice to teachers

Emphasize more on surface area of frustum

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

Question 1

Round off each of the numbers in the expression below correct to 3 significant figures.

$$\frac{2436\times0.2562}{0.05117}$$

Hence, without using mathematical tables or a calculator, evaluate the expression. (3 marks)

The question required the candidates to round the given number to the given significant figures and hence evaluate without using a calculator or mathematical tables.

Weaknesses

Most candidates could not eliminate the decimals, hence could not evaluate the expression.

Expected response

$$\frac{2440\times0.2562}{0.0512}=\frac{2440\times0.2560\times10000}{0.0512\times10000}$$

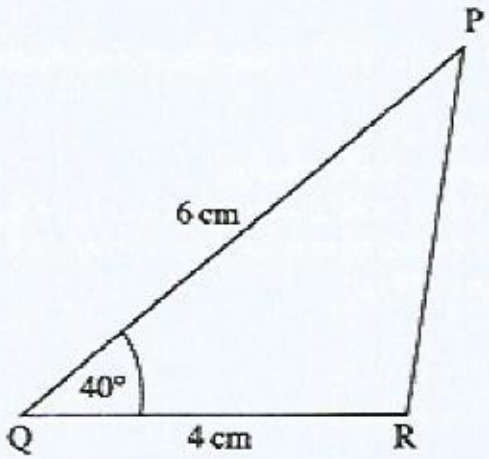
$=12200$

Advice to teachers

The fact that many candidates could not evaluate the expression without using a calculator shows an over reliance on use of the calculator. These over reliance on use of calculator should be discouraged until mastery of concept is understood.

Question 9

In the triangle PQR shown below, PQ = 6 cm, QR = 4 cm and ∠ PQR = 40°.



Find, correct to 1 decimal place:

(a) PR; (2 marks)

(b) the obtuse ∠ QRP. (2 marks)

The question tested on application of the sine and cosine rules to solve for sides and angles of triangles.

Weaknesses

Candidates were unable to use the sine and cosine rules effectively.

Expected response

(a) $PR^2 = 36 + 16 - 2\times6\times4\times\cos40$

$PR = \sqrt{15.23}$

$= 3.9\text{cm}$

(b) $\frac{\sin 40}{3.9} = \frac{\sin \angle QRP}{6}$

$\sin \angle QRP = \frac{6 \times \sin 40}{3.9}$

$= 0.9889$

$\angle QRP = 81.4^{\circ}$

$= 180 - 81.4$

$= 98.6^{\circ}$

Advice to teachers

Emphasize on application of sine and cosine rules.

Question 10

The tangent to the curve $y = x^2 + 3$ at x = 1 passes through the point (4, 10). Find the instantaneous rate of change of the curve at x = 1. *(2 marks)*

The question tested on instantaneous rate of change.

Weaknesses

Inability to obtain the y coordinate at x = 1.

Expected response

at $x = 1, y = 4$

Inst. Rate of change

$= \frac{10 - 4}{4 - 1}$

$= \frac{6}{3}$

$= 2$

Advice to teachers

Emphasis on getting the points on a line or curve of a given equation.

Question 14

The vertices of a triangle LMN are L(2, 2), M(2, 4) and N(4, 5).Triangle LMN is mapped on to triangle L'M'N' whose vertices are L'(−2, 2), M'(−4, 2) and N'(−5, 4) by a matrix **T**.
Find **T**. **(3 marks)**

The question tested on determination of matrix of transformation.

Weaknesses

Many candidates were unable to form equations involving the matrices hence could not solve the equations to get the matrix of transformation.

Expected response

(a) $\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} 2 & 2 & 4 \\ 2 & 4 & 5 \end{pmatrix} = \begin{pmatrix} -2 & -4 & -5 \\ 2 & 2 & 4 \end{pmatrix}$

$2a + 2b = -2$ and $2a + 4b = -4$ $\Rightarrow$ $a = 0$, $b = -1$, $\quad 2c + 2d = 2$, $c = -1$, $2c + 4d = 2$ $d = 0$

$$T = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$$

Advice to teachers

Emphasize more on multiplication of matrices.

Question 15

There were 6 apples and 8 oranges in a basket. Two fruits were picked one at a time without replacement. Determine the probability of picking an orange and an apple. (3 marks)

The question tested on probability.

Weaknesses

Most candidates were not able to get the correct probabilities without replacement.

Expected response

P(O,A) or P(A,O) =

$$\frac{8}{14} \times \frac{6}{13} + \frac{6}{14} \times \frac{8}{13}$$

$$= \frac{48}{91}$$

Advice to teachers

Emphasize more on probabilities without replacement.

Question 16

Given that $\mathbf{a} = 2\boldsymbol{i} + 5\boldsymbol{j}$ and $\mathbf{b} = 5\boldsymbol{i} + 2\boldsymbol{j}$, find $|\mathbf{b} - \mathbf{a}|$, correct to 1 decimal place. (2 marks)

The question tested on finding the magnitude of a vector.

Weaknesses

Many candidates were not able to subtract the vectors and hence could not get the magnitude.

Expected response

$$\mathbf{b}-\mathbf{a}=\begin{pmatrix}5\\2\end{pmatrix}-\begin{pmatrix}2\\5\end{pmatrix}=\begin{pmatrix}3\\-3\end{pmatrix}$$

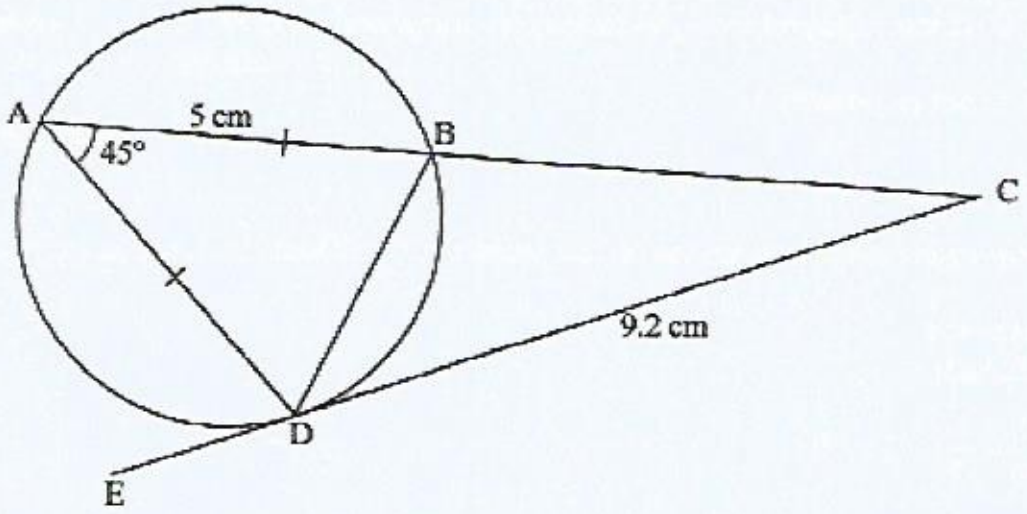
$$|\mathbf{b}-\mathbf{a}|=\sqrt{(9+9)}$$
$$=\sqrt{18}$$
$$=4.2$$

Advice to teachers

Emphasize more on operations on vector and magnitude of a vector.

Question 18

In the figure below, line EDC is a tangent to the circle at D. Angle DAB = 45°, AD = AB = 5 cm and DC = 9.2 cm.



(a) **Find the size of:**

(i) ∠ BDC; (1 mark)

(ii) ∠ ADE; (2 marks)

(iii) ∠ BCD. (1 mark)

(b) Find, correct to 1 decimal place, the lengths of:

(i) BC; (4 marks)

(ii) DB. (2 marks)

The question tested on circles, chords and tangents.

Weaknesses

Candidates were unable to relate angles in alternate segments. They were also unable to find the required lengths.

Expected response

(a) (i) $\angle BDC = 45°$

(ii) $\angle ADE = \angle ABD = \frac{180-45}{2}$

$= 67.5°$

(iii) $\angle BCD = 67.5 - 45$

$= 22.5°$

(b) (i) Let BC = x

$x(x+5) = (9.2)^2$

$x^2 + 5x - 84.64 = 0$

$x = \left(\frac{-5 \pm \sqrt{363.56}}{2}\right)$

$x = 7.0$

(ii) Using ΔABD

$BD^2 = 5^2 + 5^2 - 2 \times 5 \times 5 \cos 45$

$= 16.64$

$BD = 3.8cm$

Advice to teachers

Emphasize on cirles, chords and tangents.

Conclusion

Major weaknesses have been observed in some areas of the syllabus. These areas include **Transformations, Circles, chords and tangents, probability and graphs of Linear motion.** 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 have more applications relating to real life situations in the course of the teaching and learning.