3.0 PART ONE: ANALYSIS OF DIFFICULT QUESTIONS

3.1 MATHEMATICS ALT A (121)

In the year 2013 Mathematics Alternative A was tested in two papers. **Paper 1 (121/1)** and **Paper 2 (121/2)**. Each paper consisted of two sections: Section 1 (50 marks) compulsory 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 (121/1) tests mainly Forms 1 and 2 work while Paper 2 (121/2) tests 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 A.

3.1.1 CANDIDATES' GENERAL PERFORMANCE

The table below shows the performance of both papers in the last five years.

Table 8: Candidates' Performance in Mathematics Alt A for the last five years, 2009 – 2013

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
2009	1	335615	100	22.37	19.71
	2		100	19.89	18.78
	Overall		**200**	**42.26**	**37.65**
2010	1	356072	100	26.21	20.63
	2		100	19.92	20.35
	Overall		**200**	**46.07**	**40.02**
2011	1	409887	100	21.36	21.66
	2		100	28.22	23.57
	Overall		**200**	**49.57**	**44.30**
2012	**1**	433017	100	29.46	23.98
	2		100	27.86	23.18
	Overall		**200**	**57.31**	**46.20**
2013	**1**	444774	100	28.12	24.67
	2		100	27.03	22.91
	Overall		**200**	**55.15**	**46.71**

From the table the following observations can be made:

(i) Both papers 121/1 and 121/2 shows a slight decrease in the mean. The decrease in mean is also noted in the overall performance.

INDIVIDUAL QUESTION ANALYSIS

The following is a discussion of some of the questions in which the candidates had major weakness in, as a result of which these questions were poorly performed. The discussion is based on comments from the chief examiners reports and an analysis the students' responses and scores in the questions from sampled scripts.

3.1.2 Mathematics Alt. A Paper 1 (121/1)

The performance of this paper was not as expected. The paper mainly covers Forms 1& 2 work of the syllabus. It's evident from the performance that this has not been covered well as most candidates performed poorly in section I as compared to section II.
Below is a discussion of some questions in which students had weakness in.

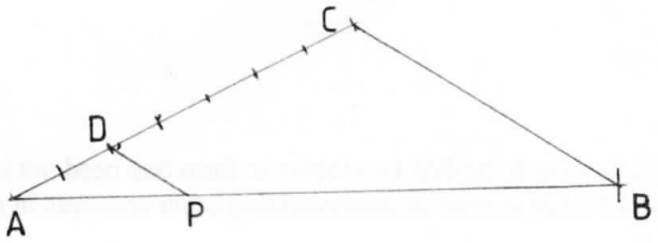
Question 6

A point P on the line AB shown below is such that AP = $\frac{2}{7}$ AB. By construction locate P. (3 marks)

The question tested on geometry, the area of proportional division of a line.

Weaknesses
Most candidates lacked understanding of the concept

Expected response



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

Question 8

Given that $\sin(x + 20)^\circ = -0.7660$, find x, to the nearest degree, for $0^\circ \leq x \leq 360^\circ$. (3 marks)

The question tested on use of the unit circle to solve trigonometric equations.

Weaknesses
Most candidates gave the acute angle whose sine is 0.7660 and failed to realize that the trigonometric ratio was negative.

Expected response

$x + 20 = 230°$ or $x + 20 = 310°$

$x = 210°$

or

$x = 290°$

Advice to teachers

Emphasis on trigonometric ratio for all quadrants in the unit circle is important.

Question 9

A number m is formed by writing all the prime numbers between 0 and 10 in an ascending order. Another number n is formed by writing all the square numbers between 0 and 10 in a descending order.

(a) Find m − n; (2 marks)

(b) Express (m − n) as a product of its prime factors. (1 mark)

The question tested on the knowledge of prime numbers, square numbers and factors.

Weaknesses

Most candidates assumed 1(one) is a prime number whereas it's not. Square numbers also were not understood. Other candidates did not differentiate between ascending and descending.

Expected response

(a)

$$\begin{array}{r} 2357\_ \\ 941 \\ \hline 1416 \end{array}$$

(b) $1416 = 2^3 \times 3 \times 59$

Advice to teachers

Natural number and factors been the first two topics in form one need not be assumed but taught well. This topics form a basis for the learner in understanding other concepts in mathematics.

Question 13

A triangle ABC is such that AB = 5 cm, BC = 6 cm and AC = 7 cm.

(a) Calculate the size of angle ACB, correct to 2 decimal places. (2 marks)

(b) A perpendicular drawn from A meets BC at N. Calculate the length AN correct to one decimal place. (2 marks)

The question tested on use of cosine rule to the solution of triangles.

Weaknesses

Candidates confused the sides in the substitution in the cosine rule, which is an indication of lack knowledge in the use of cosine rule.

Expected response

(a) $5^2 = 7^2 + 6^2 - 2 \times 6 \times 7 \cos C$

$$\cos C = \frac{49 + 36 - 25}{84}$$

$C = 44.42°$

(b) $h = 7 \sin 44.42$
$= 4.9$ cm

Advice to teachers
Teach thoroughly on the use of cosine rule and its application in solution of triangles.

Question 14

A cylindrical pipe $2\frac{1}{2}$ metres long has an internal diameter of 21 millimetres and an external diameter of 35 millimetres. The density of the material that makes the pipe is $1.25\,g/cm^3$. Calculate the mass of the pipe in kilograms. (Take $\pi = \frac{22}{7}$). (4 marks)

Question tested on volume and density, and conversion of units.

Weaknesses
Some candidates used mixed units while others could not convert the units correctly. Use of the relation; $\text{Density} = \frac{\text{mass}}{\text{volume}}$ in finding the mass was not understood by some candidates.

Expected response

Volume of pipe material

$\frac{22}{7}(1.75^2 - 1.05^2) \times 250$ cm

$= 1540\ cm^3$

$\therefore$ mass of pipe

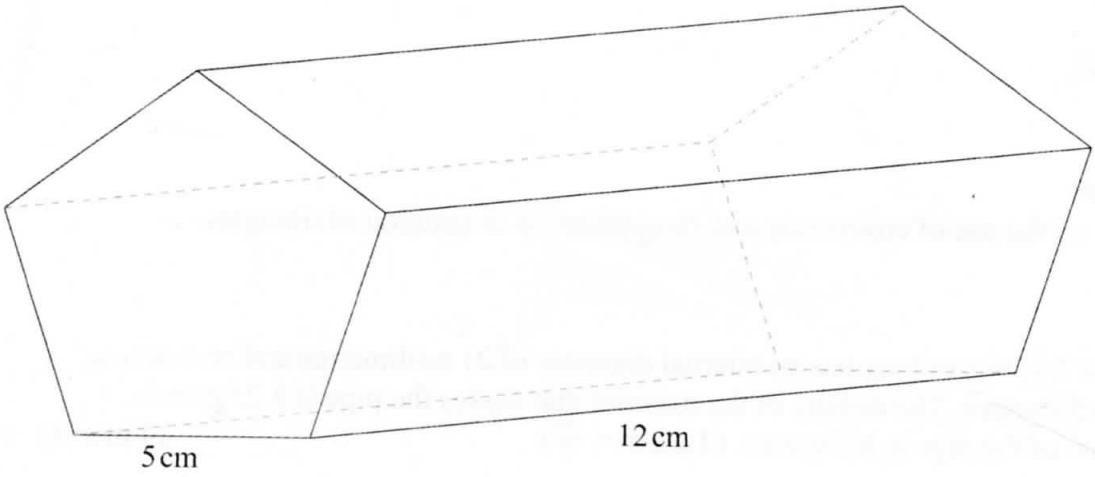
$$= \frac{1540 \times 1.25}{1000}$$

$= 1.925$ kg

Advice to teachers
Emphasis on the conversion of units in measurements is important.

Question 15

The figure below represents a pentagonal prism of length 12 cm. The cross-section is a regular pentagon of side 5 cm.



Calculate the surface area of the prism correct to 4 significant figures. (4 marks)

The question tested on the surface area of a prism.

Weaknesses

The cross-section was a regular pentagon of side 5cm. Most candidates assumed the radius of the circle from which the pentagon was made to be 5cm, hence could not get the area of the pentagonal faces.

Expected response

$h = 2.5 \tan 54^\circ = 3.441 \text{ cm}$

Area of pentagonal faces

$= 2\left(\frac{1}{2} \times 5 \times 3.441 \times 5\right)$

$= 86.025$

Total area

$= 86.025 + 5(12 \times 5)$

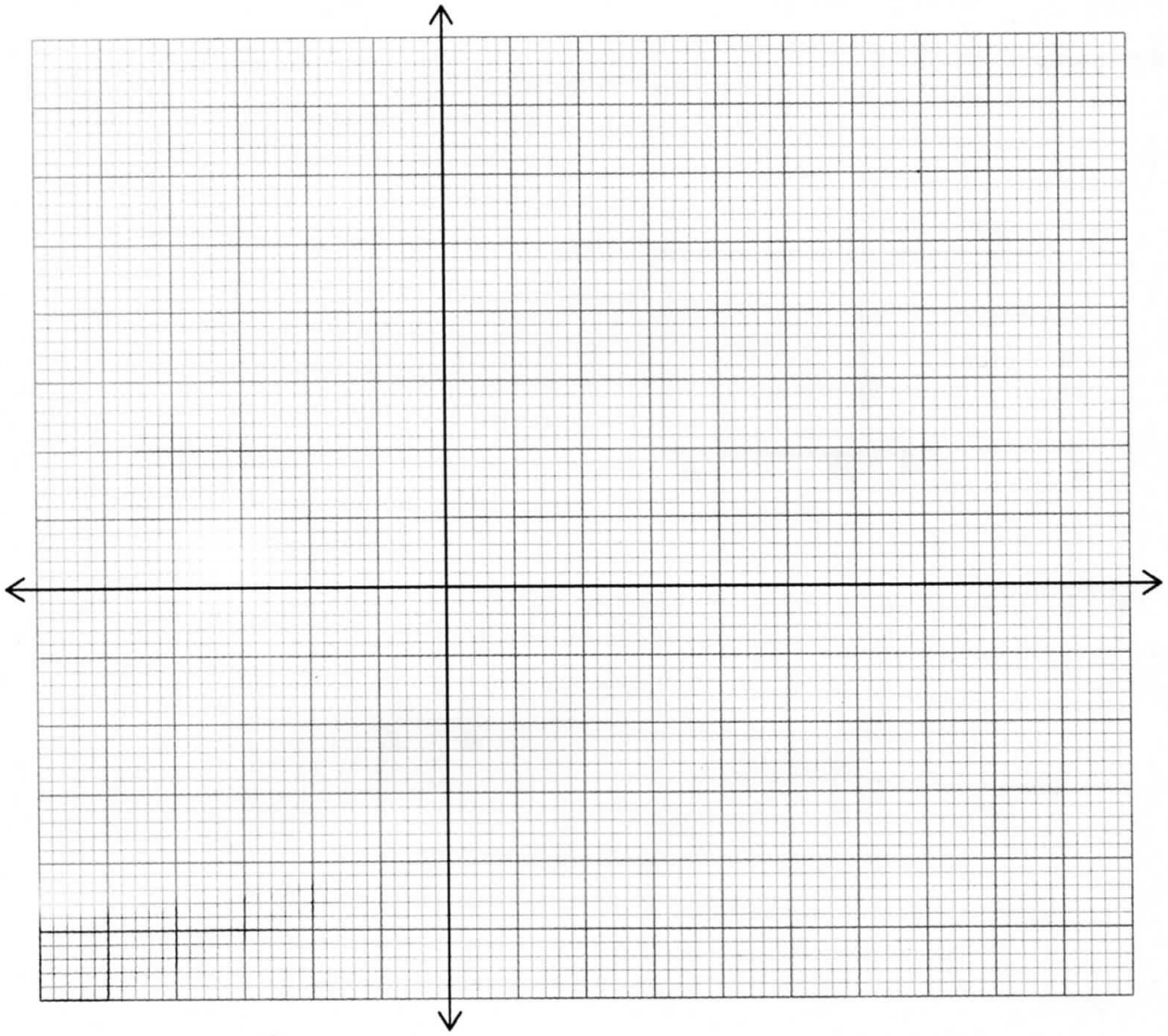
$= 386.0$

Advice to teachers

Teach thoroughly on methods finding the surface area of various prisms having different cross-sections.

Question 23

(a) On the grid provided, draw the square whose vertices are A (6, −2), B (7, −2), C (7, −1) and D (6, −1). (1 mark)



(b) On the same grid, draw:

(i) A′B′C′D′, the image of ABCD, under an enlargement scale factor 3, centre (9, –4); (3 marks)

(ii) A″B″C″D″, the image of A′B′C′D′ under a reflection in the line $x = 0$; (2 marks)

(iii) A‴B‴C‴D‴, the image of A″B″C″D″ under a rotation of +90° about (0,0). (2 marks)

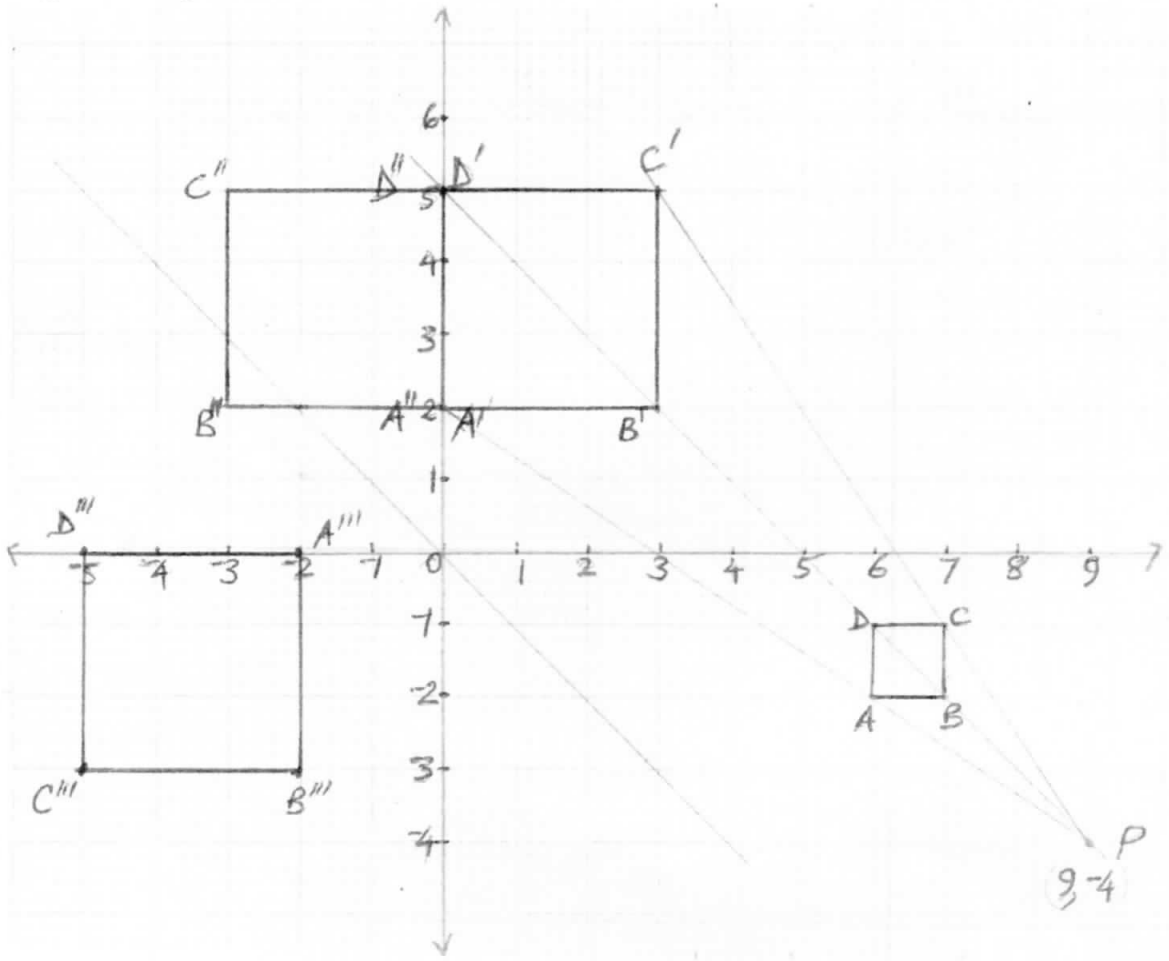
(c) Describe a single transformation that maps A′B′C′D′ onto A‴B‴C‴D‴. (2 marks)

The question tested on transformations. The candidates were required to apply enlargement, reflection and rotation in the Cartesian plane.

Weaknesses

This question was unpopular with most candidates. Of those who chose the question majority only drew the square in part (a) and could not apply the enlargement, reflection and rotation. Describing the single transformation was also a challenge.

Expected response



(a) ABCD √ drawn

(b) (i) Centre identified and used √

(ii) A"B"C"D"

(iii) A"'B"'C"'D"'

(c) Reflection on line $y = -x$

Advice to teachers

Thorough practice in the area of transformations is necessary for the students. In enlargement and rotation more questions for practice should be given in cases where centre of enlargement or rotation is not (0, 0).

3.1.3 Mathematics Alt. A Paper 2 (121/2)

As observed in 121/1, candidates performed better in section I than section II in 121/2. This is an indication that mastery of all topics in the syllabus is lacking. Questions 17 and 22 were very popular in section II and were also performed well by candidates who chose them.

Below is a discussion of some of the questions where candidates had weakness.

Question 2

A quadratic curve passes through the points $(-2, 0)$ and $(1, 0)$. Find the equation of the curve in the form $y = ax^2 + bx + c$, where a, b and c are constants. (2 marks)

The question tested on formation of quadratic equations from the roots.

Weaknesses

Most candidates failed to realize that x coordinates of the points given were the roots of the quadratic curve. Instead the candidates thought it's a straight line and were finding the gradient using the two points.

Expected response

$y = (x + 2)(x - 1)$

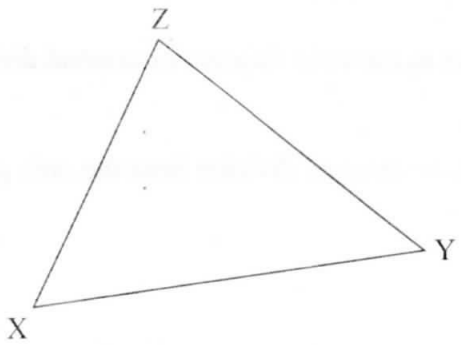
$y = x^2 + x - 2$

Advice to teachers

Thorough exercise on formation of quadratic equation from roots and points at which the curve passes through will help clear the weaknesses.

Question 5

(a) Using a pair of compasses and ruler only, construct an escribed circle to touch side XZ of triangle XYZ drawn below. (3 marks)

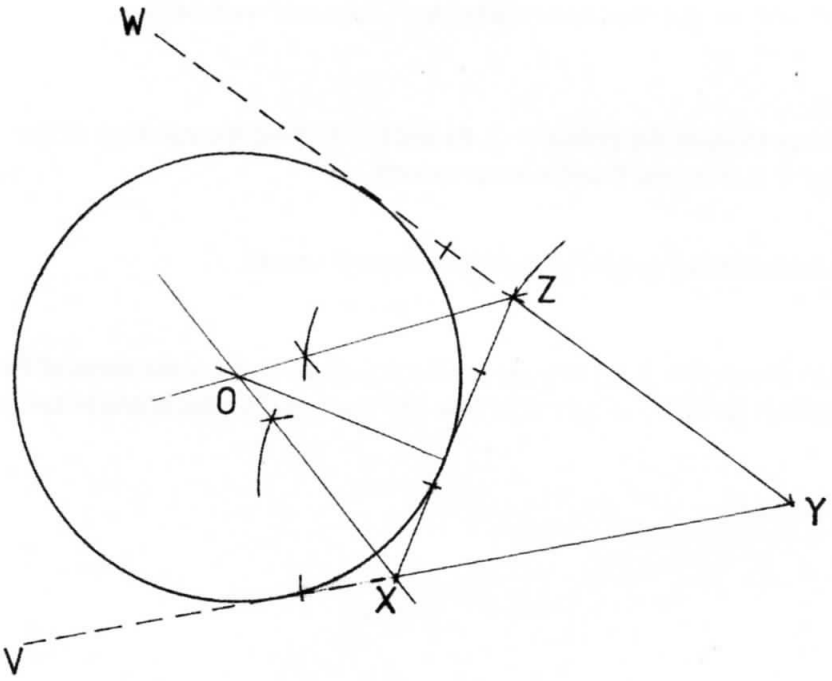


(b) Measure the radius of the circle. (1 mark)

The question tested on construction of an escribed circle

Weaknesses
Candidates were unable to determine the centre of the circle, some bisected the extended lines instead of the angle to get the centre. Other candidates drew inscribed and circumscribed circles instead.
Most candidates' could not determine the radius of the circle by constructions, and instead used try and error method.

Expected response



Advice to teachers
Help students understand, construct and differentiate between inscribed, circumscribed and inscribed circles. Emphasize on the construction of the radius in constructions while teaching.

Question 8

The position vectors of points F, G and H are $\boldsymbol{f}$, $\boldsymbol{g}$ and $\boldsymbol{h}$ respectively. Point H divides FG in the ratio 4:−1. Express $\boldsymbol{h}$ in terms of $\boldsymbol{f}$ and $\boldsymbol{g}$. (2 marks)

The question required the candidates to use ratio theorem in external division of a line.

Weaknesses
Most candidates could not interpret the external division from the ratio given.

Expected response

$$\underset{\sim}{h} = \frac{-1}{4+(-1)}\underset{\sim}{f} + \frac{4}{4+(-1)}\underset{\sim}{g}$$

$$= \frac{-1}{3}\underset{\sim}{f} + \frac{4}{3}\underset{\sim}{g}$$

Advice to teachers
Expose students more on external division and interpretation of given ratios.

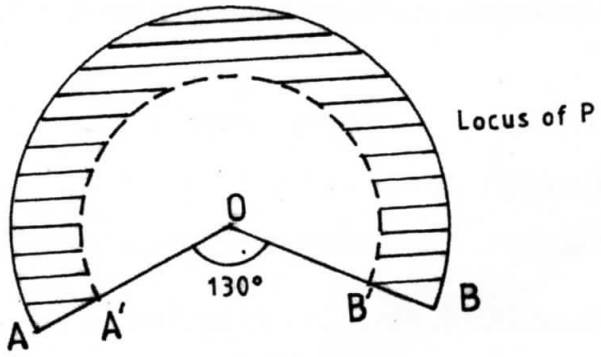
Question 12

A point P moves inside a sector of a circle, centre O, and chord AB such that $2\,cm < OP \leq 3\,cm$ and angle APB $= 65°$. Draw the locus of P. (4 marks)

The question required the candidates to use the knowledge of loci of inequalities combined with loci involving chords and constant angle loci in constructing the given loci.

Weaknesses
Most candidates only considered one side of the inequality and ignored the other.

Expected response

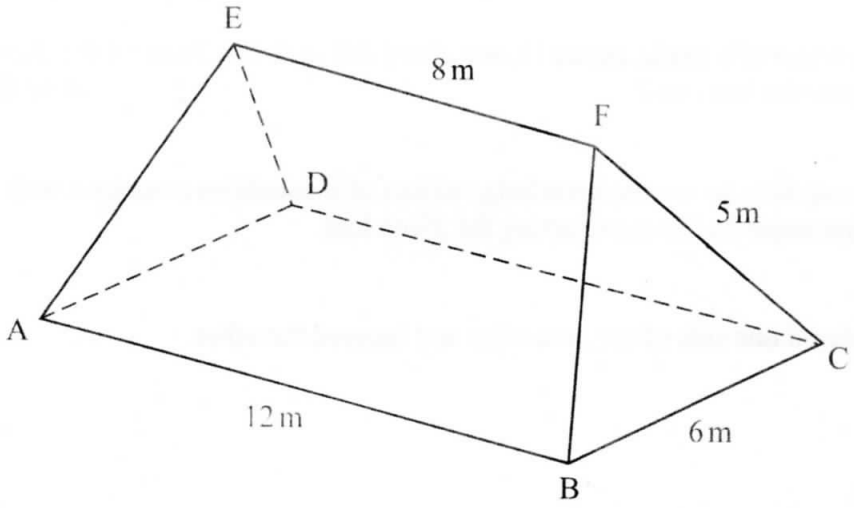


$\angle AOB = 130°$
arc AB - solid curve
arc A′B′ - broken curve
region shown

Advice to teachers
Give students thorough practice involving different types of loci.

Question 20

The figure ABCDEF below represents a roof of a house. AB = DC = 12 m, BC = AD = 6 m, AE = BF = CF = DE = 5 m and EF = 8 m.



(a) Calculate, correct to 2 decimal places, the perpendicular distance of EF from the plane ABCD. (3 marks)

(b) Calculate the angle between:

(i) the planes ADE and ABCD; (2 marks)

(ii) the line AE and the plane ABCD, correct to 1 decimal place; (2 marks)

(iii) the planes ABFE and DCFE, correct to 1 decimal place. (3 marks)

The question required the candidates to identify and calculate angles between a line and between two planes.

Weaknesses

Most candidates could not correctly identify the angles.

Expected response

(a) ⊥ distance of EF from place ABCD

slant height from F to BC

$= \sqrt{5^2 - 3^2}$

$= 4$

∴ ⊥ distance of EF from plane ABCD

$= \sqrt{4^2 - 2^2}$

$= \sqrt{12} = 3.46$ m

(b) (i) angle between planes

ADE and ABCD

$= \tan^{-1}\frac{\sqrt{12}}{2}$

$= 60°$

(ii) angle between line AE and plane ABCD

$= \sin^{-1}\frac{\sqrt{12}}{5}$

$= 43.9°$

(iii) angle between planes

ABFE and DCFE

$= 2\left(\tan^{-1}\frac{3}{\sqrt{12}}\right)$

$= 81.8°$

Advice to teachers

There is need to use 3-D models when teaching this topic to assist the students visualize the angles.