Name _____ Index No. _____

Candidate's signature _____

Date _____

121/1
MATHEMATICS ALT A
PAPER 1
JULY / AUGUST 2011
2 ½ HOURS

NZAUI / MUKAA FORM 4 CLUSTER EXAMINATION
Kenya Certificate of Secondary Education
MATHEMATICS ALT A
PAPER 1
2 ½ HOURS

INSTRUCTIONS TO CANDIDATES

a) Write your name and admission number in the spaces provided above.
b) Sign and write the date of examination in the spaces provided above.
c) This paper consists of TWO sections. Section I and Section II.
d) Answer ALL the questions in Section I and only five questions from Section II.
e) All answers and working must be written on the question paper in the spaces provided below each question.
f) Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.
g) Marks may be given for correct working even if the answer is wrong.
h) Non-programmable silent electronic calculators and KNEC mathematical tables may be used except where stated otherwise.
i) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

FOR EXAMINER'S USE ONLY

SECTION I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

SECTION II

17	18	19	20	21	22	23	24	Total

GRAND TOTAL

This paper consists of 17 printed pages

Turn Over

SECTION I (50 MARKS)
Answer <u>all</u> the questions in this section in the spaces provided.

1. Without using a calculator, evaluate (4 marks)

$$\frac{{}^{7}/_{4} \div ({}^{8}/_{3} + 3{}^{7}/_{12})}{{}^{6}/_{11} \text{ of } {}^{55}/_{21} \div {}^{33}/_{7} + {}^{1}/_{3}}$$

2. Three metal rods have lengths of 216cm, 324cm and 270cm. The rods are cut into shorter pieces all of the same length and there is no left over metal. What is the maximum length of one of the pieces. (3 marks)

3. In the figure below, $\angle$ ABC = 2 $\angle$AOB. Find the value of X. (3 marks)

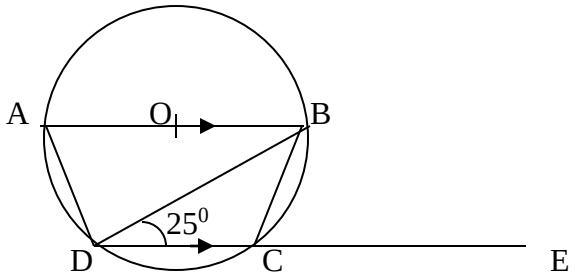
$x+30^0$ x^0 $2x^0$ $x+20^0$ A B C O

4. Use tables of reciprocals only to find the value of

$$\frac{5}{0.0829} - \frac{14}{0.581}$$

(3 marks)

5. The figure below (not drawn to scale) shows a circle ABCD centre O with DC produced to E. AB is parallel to CD and $\angle$ BDC = 25^0. Calculate the size of $\angle$BCE. (3 marks)



6. Simplify as far as possible (3 marks)

$$\frac{6a^2b^2 + 13ab - 5}{3a^2b^2 - 13ab + 4}$$

7. Three men, together working eight hours a day can do some work in five days. How many days would two such men, working 10 hours a day take to do the same work, if they work at half the rate. (2 marks)

8. Without using tables or calculator find the value of x if; $7^{x+1} - 7^{x-1} = 336\sqrt{7}$ (3 marks)

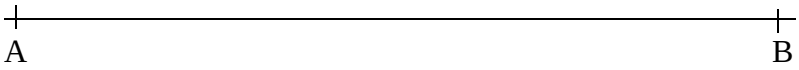
9. The straight line passing through the point (-3, -4) is perpendicular to the line whose equation is $2y + 3x = 11$ and intersect the X-axis and Y –axis at the points P and Q respectively. Find the length of PQ. (4 marks)

10. Use the exchange rates below to answer this question

	Buying	Selling
1 U.S. Dollar	63.00	63.20
1UK£	125.30	125.95

A tourist arrived in Kenya with 4800 UK sterling pounds (£). He converted the pounds to Kenya shillings at a commission of 5%. While in Kenya, he spent ¾ of his money. He then changed the balance to U.S dollars, with no commission charged. Calculate to the nearest U.S dollar, the amount he received. (3 marks)

11. Point C divides AB given internally in the ratio 5 : 2. By construction, determine the position of point C. (3 marks)



12. The length of a rectangle is increased in the ratio 5 : 3 while the width is reduced in the ratio 7 : 9. Determine the percentage change in the area of the rectangle. (3 marks)

13. A tank can be filled by a tap A in 20 minutes. The same tank can be emptied when full in 30 minutes by tap B. Both taps at the same time and tap B turned off after 10 minutes. Starting with an empty tank find the time taken to fill the tank. (4 marks)

14. Given that $A = \begin{pmatrix} 2 & 4 \\ 3 & 6 \end{pmatrix}$ and $B = \begin{pmatrix} 11 & 3 \\ 4 & 1 \end{pmatrix}$,

Find C such that B.C = A (3 marks)

15. The size of each interior angle of a regular polygon is one and half times the size of the exterior angle. Find the number of sides of the polygon. (3 marks)

16. Express $\dfrac{\sqrt{3} - 2\sqrt{2}}{2\sqrt{3} + \sqrt{2}}$ in the form $a + b\sqrt{c}$

Where a, b and c are real numbers. (3 marks)

SECTION II (50 marks)

Answer only five questions in this section in the spaces provided.

17. A certain number of form four students agreed to contribute equally to buy a gift worth sh. 1200 for their class prefect's birthday. Five students pulled out and so the others agreed to contribute an extra sh. 10. Their contribution enabled them to buy a gift worth sh. 200 more than they originally expected.

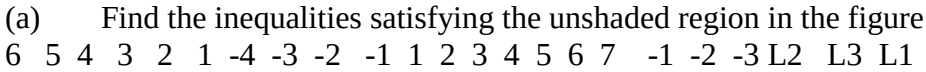
(a) If the original number of students was X, write an expression of how much each was originally going to contribute. (1 mark)

(b) Write down two expressions of how much each contributed after the five students pulled out. (2 marks)

(c) Calculate how many students made the contribution. (5 marks)

(d) Find how much each contributed. (2 marks)

18. (a) Find the inequalities satisfying the unshaded region in the figure below. (6 marks)

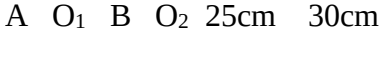


(b) Solve the following pair of simultaneous inequalities and represent the results on a number line (4 marks)

$-5x + 7 < 12$

$^1/_3x + 2 \leq 5$

19. Below are two intersecting circles whose centres are 40cm apart.



Calculate

(i) Length AB. (4 marks)

(ii) Angle AO_1B and AO_2B. (4 marks)

(iii) The shaded area. (2 marks)

20. 3.5cm 12cm 14cm 10cm 14cm

A right frustrum of base radius 14cm, top radius 3.5cm and height 12cm is stuck onto a cylinder of base radius 15.4cm and height 10cm and further attached to a hemisphere to form a closed solid as shown above. (Use $\pi = {}^{22}/_{7}$)

Find

(a) The full height of the solid. (1 mark)

(b) The volume of the solid. (4 marks)

(c) The total surface area of the solid. (5 marks)

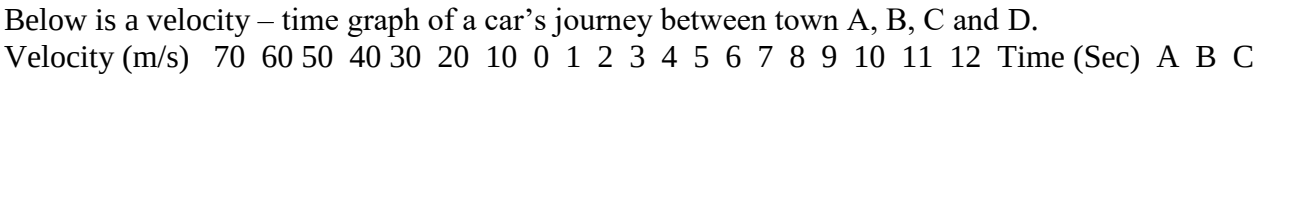
21. Nzukuna's piece of land was surveyed and the measurements recorded in a field book as shown below

	B	
	550	120 to L
To K 150	450	
	250	90 to M
To J 60	40	
	A	

(a) Given that the baseline XY = 600M, use a scale of 1cm to represent 60M to draw the map of the piece of land. (5 marks)

(b) Calculate the area of the piece of land in hectares. (5 marks)

22. Below is a velocity – time graph of a car's journey between town A, B, C and D.



Calculate

(a) The car's acceleration in the first 4 sec in m/s^2. (1 mark)

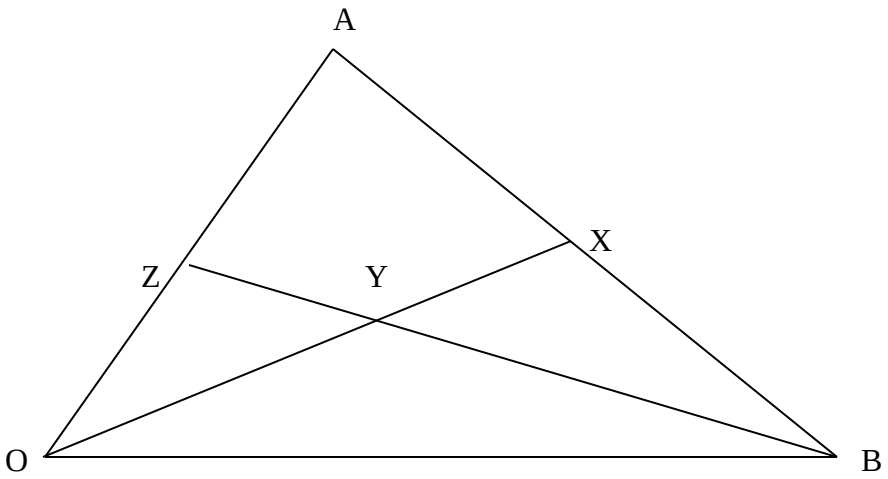
(b) The distance in metres between town A and B. (2 marks)

(c) Velocity of the car in m/s between town B and C. (1 mark)

(d) The distance in metres covered by the car between C and D. (3 marks)

(e) How far in kilometers is the car from town D after 6 seconds since the start of the journey. (3 marks)

23.



In the figure above O is the origin, OA = a and OB = b. The point X is on AB such that AX = 2XB and Y is the midpoint of OX.

(a) Find in terms of a and b, the vectors

(i) OX (2 marks)

(ii) BY (2 marks)

(b) BY produced meets OA at Z. Given that OZ = ha and BZ = KBY where h and k are constants, find the position vector of Z. (4 marks)

(c) Name the type of a quadrilateral PQRS such that when PQ = p, QR = q, RS = r and PS = 2q. Express r in terms of p and q. (2 marks)

24. A triangle whose vertices are P(1, 4), Q (1, 2) and R(4, 2) is given the following transformations;

(i) A reflection along line y = -x to $P_1Q_1R_1$
(ii) $P_1Q_1R_1$ is then given a quarter turn rotation about the origin to $P_2Q_2R_2$
(iii) $P_2Q_2R_2$ is then given an enlargement of linear scale factor -2 about (0, 0) to $P_3Q_3R_3$

(a) On the grid provided, plot triangle PQR and its image $P_1Q_1R_1$. (3 marks)
(b) Plot triangle $P_2Q_2R_2$ and state its coordinates. (3 marks)
(c) Locate triangle $P_3Q_3R_3$ on the grid and state its coordinates. (4 marks)

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MARKING SCHEME

1.	$\frac{7/4 \times 12/75}{10/33 + 1/3}$		
	$= \frac{7/25}{7/11}$	M1	Num
		M1	Deno
	$= 7/25 \times 11/7$	M1	Mult
	$= 11/25$	A1	
		04	
2.	$216 = 2^3 \times 3^3$ $324 = 2^2 \times 3^4$ $270 = 2 \times 3^3 \times 5$	B1	Prime factorisation
	GCD $= 2 \times 3^3$	M1	GCD
	$= 54$ Maximum length = 54cm	A1	CAO
		03	
3.	A B C O		

This paper consists of 12 printed pages

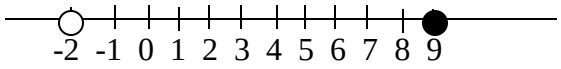
Turn Over

$x + 2y + 2y + x + 20 = 180$ $2x + y = 80$ …….(i) $x + 30 + x + y + 2x = 180$ $4x + y = 150$ …… (ii) } $4x + y = 150$ $2x + y = 80$ $2x = 70^0$ $x = 35^0$	B1 M1 A1	for (i) (xii) √ to solve
	3	
4. $5 \times \frac{1}{8.29 \times 10^{-2}} - 14 \times \frac{1}{5.81 \times 10^{-1}}$ $5 \times 0.1206 \times 10^2 - 14 \times 0.1721 \times 10$ $60.3 - 24.094$ $=36.206$	M1 M1 A1	
	3	
5. $\angle ADB = 90^0$ (Subtended by diameter) $\angle ABD = 25^0$ (Alternate) $\angle DAB = 65^0$ (< sum in a Δ) $\angle DCB = 115^0$ $\angle BCE = 65^0$	B1 B1 B1	
	3	
6. $\frac{6a^2b^2 + 15ab - 2ab - 5}{3a^2b^2 - 12ab - ab + 4}$ $\frac{3ab(2ab + 5) - 1(2ab + 5)}{3ab(ab - 4) - 1(ab - 4)}$ $\frac{(3ab - 1)(2ab + 5)}{(3ab - 1)(ab - 4)}$ $\frac{2ab + 5}{ab - 4}$	 M1 M1 A1	 for num for den
	3	
7. Same rate $= \frac{1}{\cancel{5}} \times \frac{3}{\cancel{2}\,1} \times \frac{\cancel{8}}{\cancel{10}} \frac{\cancel{4}}{\cancel{2}}\, 2\, 1$ $= 6$ days At half the rate $= 2 \times 6$ $= 12$ days	 M1 A1	
	2	

8.	$7^x \cdot 7 - \frac{7^x}{7} = 336 \cdot \sqrt{7}$ $7^x (7 - {}^1/_7) = 336 \cdot 7^{\frac{1}{2}}$ $7^x ({}^{48}/_7) = 336 \cdot 7^{\frac{1}{2}}$ $7^x = 336 \cdot 7^{\frac{1}{2}} \cdot {}^7/_{48}$ $7^x = 7 \cdot 7^{\frac{1}{2}} \cdot 7$ $7^x = 7^{2\frac{1}{2}}$ $x = 2\frac{1}{2}$ or ${}^5/_2$	M1 M1 A1	
		03	
9.	$2y = -3x + 11$ $y = -{}^3/_2 x + {}^{11}/_2$ Gradient = ${}^2/_3$ $\frac{y+4}{x+3} = \frac{2}{3}$ $3y + 12 = 2x + 6$ $\frac{x}{3} - \frac{y}{2} = 1$ P(3, 0) Q (0, -2) PQ = $\sqrt{3^2 + (-2)^2}$ $= \sqrt{13} = 3.606$	 B1 M1 M1 A1	 for gradient for equation
		04	
10.	4800 x 125.30 x ${}^{95}/_{100}$ = Ksh 571368 ¾ x 571368 = Ksh 428,526 Amount remained = $\frac{571368 - 428526}{63.20}$ = 2260.16 $\simeq$ 2260	M1 M1 A1	 or equivalent C.A.O
		03	

11.	B1 B1 B1	AD Dividing AD Point C
	03	
12.  $y \longrightarrow {}^{7}/_{9}y$ $x \longrightarrow {}^{5}/_{3}x$ $A_1 = xy$ $A_2 = {}^{5}/_{3}x \cdot {}^{7}/_{9}y$ $= \frac{35}{27} xy$ % change $= \frac{\frac{35}{27}xy - xy}{xy} \times 100\%$ $= {}^{8}/_{27} \times 100\%$ $= 29.63\%$	M1 M1 A1	New Area % change in area
	3	
13. Tap A – Rate in 1 min = $^{1}/_{20}$ Tap B – Rate in 1 min = $^{1}/_{30}$ Fraction filled in 1 min = $^{1}/_{20} - {}^{1}/_{30}$ $= {}^{1}/_{60}$ In 10 min = $10 \times {}^{1}/_{60}$ $= {}^{1}/_{6}$ Fraction to be filled by A = $^{5}/_{6}$ Time taken = $({}^{5}/_{6} \times 20) + 10$ mins $= {}^{100}/_{6} + 10$ min $= 26{}^{2}/_{3}$ mins = 26 min 40 sec	M1 M1 M1 A1	
	4	

14.	Let C $= \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ $\begin{pmatrix} 11 & 3 \\ 4 & 1 \end{pmatrix} \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 2 & 4 \\ 3 & 6 \end{pmatrix}$ $11a + 3c = 2 \qquad 11b + 3d = 4$ $4a + c = 3 \qquad 4b + d = 6$ $a = 7, b = 14$ $c = -25, d = -50$ $c = \begin{pmatrix} 7 & 14 \\ -25 & -50 \end{pmatrix}$	M1 M1 A1	for both pairs
		3	
15.	Let the exterior angle be x^0 $x + \frac{3x}{2} = 180$ $2x + 3x = 360$ $x = 72^0$ No. of sides $= \frac{360}{72}$ $= 5$	M1 M1 A1	
		3	
16.	$\frac{\sqrt{3} - 2\sqrt{2}}{2\sqrt{3} + \sqrt{2}}$ Conjugate of denominator $= 2\sqrt{3} - \sqrt{2}$ $\frac{(\sqrt{3} - 2\sqrt{2})(2\sqrt{3} - \sqrt{2})}{(2\sqrt{3} + \sqrt{2})(2\sqrt{3} - \sqrt{2})}$ $\frac{2 \times 3 - \sqrt{6} - 4\sqrt{6} + 4}{4 \times 3 - 2\sqrt{6} + 2\sqrt{6} - 2}$ $= \frac{10 - 5\sqrt{6}}{10}$ $= 1 - \frac{\sqrt{6}}{2}$	M1 M1 A1	
		03	
17.	(a) sh. $\frac{1200}{x}$ (b) (i) $\frac{1200}{x} + 10$	B1 B1	

	(ii) $\frac{1400}{x-5}$	B1	
	(c) $\frac{1200}{x} + 10 = \frac{1400}{x-5}$	M1	
	$\frac{1200 + 10x}{x} = \frac{1400}{x-5}$		
	$1200 (x – 5) + 10x (x – 5) = 1400x$	M1	
	$1200x – 6000 + 10x^2 – 50x = 1400x$		
	$10x^2 – 250x – 6000 = 0$		
	$x^2 – 25x – 600 = 0$		
	$x^2 – 40x + 15x – 600 = 0$		
	$x (x – 40) + 15 (x – 40) = 0$		
	$(x – 40) (x + 15) = 0$	M1	
	$x = 40$ or $x = 15$		
	$x = 40$	A1	
	Those who contributed = 35	B1	
	(d) Each contributed sh. $\frac{1400}{35}$	M1	
	Sh. 40	A1	
		10	
18.	(a) Eqn. of L_1 , $y = 6x + 6$	M1	for eqn
	Inequality , $y < 6x + 6$	A1	inequality
	Equation L_1, $y = x – 2$	M1	
	Inequality , $y \geq x – 2$	A1	
	Eqn of L_3 , $y = -{}^3/_2x + 6$	M1	
	Inequality $2y < -3x + 12$	A1	
	(b) $-5x + 7 < 12$		
	$-5x < 5$		
	$x > -1$	B1	
	${}^1/_3x + 2 \leq 5$		
	$x + 6 \leq 15$		
	$x \leq 9$	B1	
	$-1 < x \leq 9$	B1	
		B1	
		10	

19.	θ β		
	$\text{Cos } \theta = \frac{40^2 + 25^2 - 30^2}{2 \times 40 \times 25}$	M1	
	$= 0.6625$		
	$\theta = 48.51$		
	$\text{Sin } 48.51^0 = {}^{x}/_{25}$	M1	
	$x = 25 \text{ sin } 48.51^0$	M1	
	$x = 18.73$		
	$\therefore AB = 2 \times 18.73$		
	$= 37.46$	A1	
	(ii) Angle $AO_1B = 2 \times 48.51^0$	M1	
	$= 97.02^0$	A1	
	$\text{Sin } \beta = \frac{18.73}{30}$		
	$\text{Sin } \beta = 0.6243$		
	$\beta = 38.63^0$		
	$\angle AO_2B = 2 \times 38.63$	M1	
	$= 77.26^0$	A1	
	Area shaded = Area of sector – area of triangle		
	$= \frac{77.26^0}{360} \times 3.142 \times 30^2 - \frac{1}{2} \times 30^2 \text{ sin } 77.26^0$	M1	
	$= 606.88 - 438.92$		
	$= 173.96$	A1	
		10	

20. (a) Full height = 14 + 10 + 12cm M1
= 36cm

(b) Volume of hemisphere = ½ x $^4/_3$ x $^{22}/_7$ x 14 x 14 x 14cm^3 M1
= 5749$^1/_3$cm^3

Volume of cylinder = $^{22}/_7$ x 14 x 14 x 10cm^3 M1
= 6160cm^3

3.5cm 12cm 14cm h

$$\frac{h}{h+12} = \frac{3.5}{14} = \frac{1}{4}$$

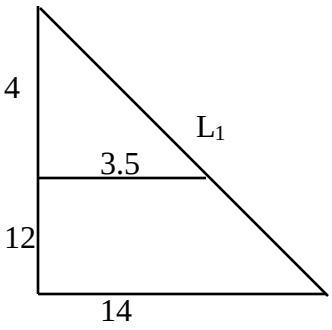
$$4h = h + 12$$
$$h = 4$$

Volume of top = $^1/_3$ x $^{22}/_7$ x 14 x 14 x 16 – $^1/_3$ x $^{22}/_7$ x 3.5 x 3.5 x 4 M1
= 3285$^1/_3$ – 51$^1/_3$
= 3234cm^3

Total volume = 5749$^1/_3$ + 6160 + 3234cm^3 M1
= 15143$^1/_3$cm^3

C_1 SA of hemisphere = $\frac{4}{2}$ x $\frac{22}{7}$ x 14 x 14 cm^2
= 1232cm^2 M1

SA of cylinder = 2 x $^{22}/_7$ x 14 x 14 x 10cm^2 M1
= 880cm^2



$L_1 = \sqrt{4^2 + 3.5^2}$
= 5.315

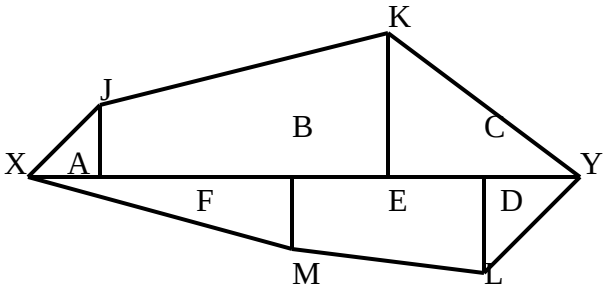
$L_2 = \sqrt{16^2 + 14^2}$
= 21.26

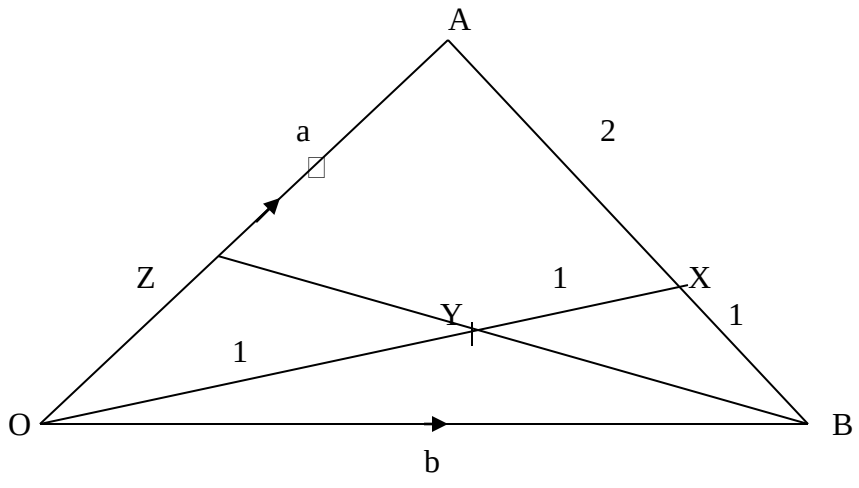
SA of top = $^{22}/_7$ x 14 x 21.26 – $^{22}/_7$ x 3.5 x 5.315 M1
935.44 – 58.465
876.975
877cm^2

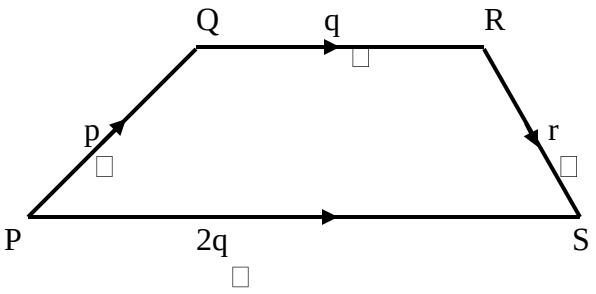
Area of circle = $^{22}/_7$ x 3.5 x 3.5
= 38.5cm^2 M1

Total SA = 1232 + 880 + 877 + 38.5
= 3027.5cm^2 A1

10

21. (a) 	B1 B1 B1 B1 B1	for AxB for C for D for E for F
(b) Area of A = ½ x 40 x 60 = 1200m^2 B = ½ x 410 (60 + 150) = 43050m^2	M1	for AxB
C = ½ x 150 x 150 = 11250m^2 D = ½ x 50 x 120 = 3000m^2	M1	
E = ½ (90 + 120) 300 = 31500m^2 F = ½ x 250 x 90 = 11250m^2	M1	
Total area = 101250m^2 Area in ha = $\frac{101250}{10000}$ = 10.125 ha	M1 A1	
	10	
22. (a) Accn = $\frac{F.V - I.V}{t}$ = $\frac{50 - 20}{4}$ = 7 ½ m/s^2	B1	
(b) Dist = Average velocity x time = $\left(\frac{20 + 50}{2}\right)$ x 4 = 35 x 4 = 140m	M1 A1	
(c) Velocity = 50m/s	B1	
(d) $\left(\frac{50 + 10}{2}\right)$ x 2 = 30 x 2 = 60m	M1 A1	

(e)	Total distance = 140 + 50 x 5 + 60 = 450m Distance traveled in 6sec = 140 + 2 x 50 = 240m Distance from D = 450m – 240m = 210m = 0.21km	 M1 M1 A1	
		10	
23.	 		
(a)	(i) OX = OA + AX = a + $^2/_3$b – $^2/_3$a = $^1/_3$a + $^2/_3$b	 M1 A1	
	(ii) BY = BO + OY = -b + ½ ($^1/_3$a + $^2/_3$b) = -b + $^1/_6$a + $^1/_3$b = $^1/_6$a – $^2/_3$b	 M1 A1	
(b)	OZ = ha …… (i) OZ = OB + BZ = b + k ($^1/_6$a – $^2/_3$b) ……. (ii) = b + $^1/_6$ka – $^2/_3$kb	 M1	

$= {}^{1}/_{6}ka + (1 - {}^{2}/_{3}k)\, b$ $ha = {}^{1}/_{6}ka + (1 - {}^{2}/_{3}k)\, b$ $1 - {}^{2}/_{3}k = 0$ $1 = {}^{2}/_{3}k$ $k = {}^{3}/_{2}$ $h = {}^{1}/_{6} \times {}^{3}/_{2}$ $h = ¼$ $\therefore OZ = ¼\ a$ c)  Quadrilateral is a trapezium $r = -q - p + 2q$ $r = q - p$	M1 A1 B1 B1 B1	
	10	
24. Transformations on Graph paper	B1 B1 B1 B1 B1B1 B1B1 B1B1	Correct Scale ΔPQR Δ $P_1Q_1R_1$ Δ $P_2PQ_2PR_2$ $P_2(1, -4)$ Q_2 (1, -2) R_2 (4, -2) $\Delta P_3PQ_3R_3$ P3(-2, 8) Q3 (-2, 4) R_3 (-8, 4)
	10	

Name _____ Index No. _____

Candidate's signature _____

Date _____

121/2
MATHEMATICS ALT A
PAPER 2
JULY / AUGUST 2011
2 ½ HOURS

NZAUI / MUKAA FORM 4 CLUSTER EXAMINATION
Kenya Certificate of Secondary Education
MATHEMATICS ALT A
PAPER 2
2 ½ HOURS

INSTRUCTIONS TO CANDIDATES

a) Write your name and admission number in the spaces provided above.
b) Sign and write the date of examination in the spaces provided above.
c) This paper consists of TWO sections. Section I and Section II.
d) Answer ALL the questions in Section I and only five questions from Section II.
e) All answers and working must be written on the question paper in the spaces provided below each question.
f) Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.
g) Marks may be given for correct working even if the answer is wrong.
h) Non-programmable silent electronic calculators and KNEC mathematical tables may be used except where stated otherwise.
i) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

FOR EXAMINER'S USE ONLY

SECTION I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

SECTION II

17	18	19	20	21	22	23	24	Total

GRAND TOTAL

This paper consists of 17 printed pages

Turn Over

SECTION 1 (50 marks)

Answer all the questions in this section in the spaces provided.

1. Evaluate using logarithms giving your answer to 4.sf. (4 marks)

$$\frac{16.49^2 \times \sqrt{0.6318}}{327.5}$$

2. The nineth term of an arithmetic progression is twice the fourth term. The sum of the first five terms is 80. Find the first term and the common difference. (3 marks)

3. The positions of two places A and B on the earth's surface are (60^0N, 50^0E) and (40^0N, 130^0W) respectively. Calculate the shortest distance in km between A and B along a great circle. (Take radius of the earth = 6370km) (3 marks)

4. Make K the subject of the formula and simplify it.

$$t = \frac{2y + 1}{\sqrt{2ky + k}}$$

(3 marks)

5. Prove that:

$$\frac{\text{Cos } \theta}{\text{Cos } (90 - \theta)} + \frac{\text{sin } \theta}{\text{Sin } (90 - \theta)} = \frac{1}{\text{Cos } \theta \text{ sin } \theta}$$

(3 marks)

6. Solve for x given that

$(\text{Log}_{10} x)^2 = \log_{10} x^5 - 6$

(4 marks)

7. Mr. Serah, a businesswoman withdrew sh. 56,740 from a financial institution which included both the principal and compound interest accrued within 3 years. If the compound interest rate was 12% p.a and compounding was done semi-annually, calculate the principal invested. (Give your answer correct to 1s.f) (3 marks)

8. Given that $8.1 \leq x \leq 8.3$ and $10.5 \leq y \leq 10.7$, calculate the percentage error in y/x giving your answer correct to 2 d.p (4 marks)

9. In what ratio should grade A coffee costing sh. 45 per kg be mixed with grade B coffee costing sh. 35 per kg so that a profit of 10% is made by selling the mixture st 45.10 per kg. (3 marks)

10. (a) Expand $(1 - \frac{1}{2} x)^8$ upto the fourth term. (1 mark)

(b) Use your expansion to evaluate $(0.99)^8$ (2 marks)

11. The mass of a certain rod varies jointly as its length and the square of its radius. A rod 20cm long and radius 5cm has a mass of 12kg. Find the mass of a similar rod of length 40cm and radius 2cm. (3 marks)

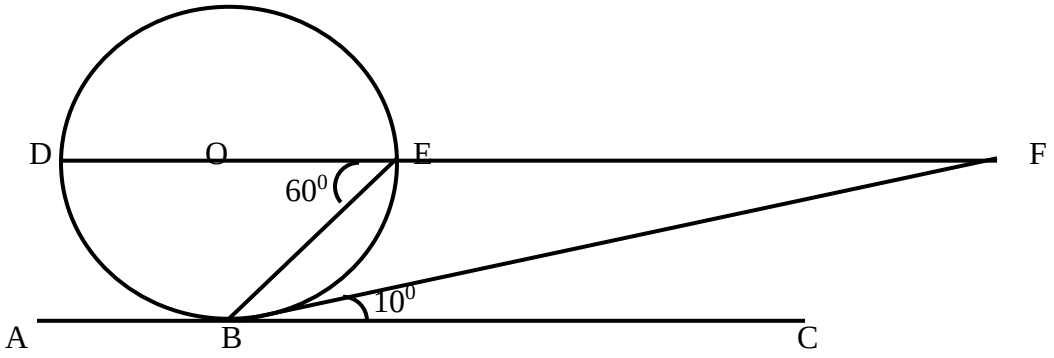
12. A point S divides line PQ externally in the ratio 4 : 3. The position vectors of P and Q are $2i + j – 3k$ and $i – 2j + k$ respectively.

Find the position vector of S. (3 marks)

13. A rectangle whose area is $15cm^2$ is transformed by the matrix $\begin{pmatrix} 3 & 1 \\ 1 & 1 \end{pmatrix}$

Determine the area of its image under the matrix of the transformation. (3 marks)

14. In the figure below, O is the centre of the circle. ABC is a tangent to the circle at B. $\angle FBC = 10^0$ and $\angle DEB = 60^0$. DF is a straight line.

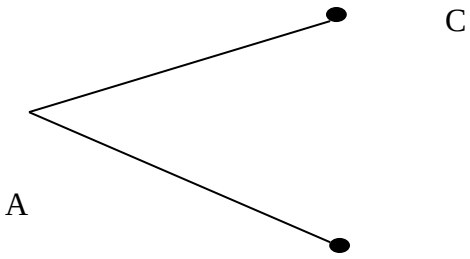


Find

(i) $\angle EBF$ (2 marks)

(ii) $\angle BFE$ (1 mark)

15. In the figure below, construct the locus of all points P on the same side of BC as A such that $\angle BPC = \angle BAC$ (2 marks)



16. AB is a bar hinged at A and supported by a rod PQ. Given that angle BAC = 55^0, angle PQC = 105^0, PQ = 20cm and PB = 12cm, calculate the length of QB correct to 4sf. (3 marks)

55^0 A Q C P B 12cm 20cm 105^0

SECTION II (50 marks)

Answer only five questions in this section in the spaces provided.

17. (a) Two integers are selected at random from the integers 1 to 6. If the same integer may be selected twice, find the probability that

(i) Their difference is 3. (3 marks)

(ii) Their difference is 4 or less. (2 marks)

(iii) The two integers are equal. (2 marks)

(b) A bag contains 10 balls of which 3 are red, 5 are white and 2 are green. Another bag contains 12 balls of which 4 are red, 3 are white and 5 are green. A bag is chosen at random and then a ball chosen at random from the bag. Find the probability that the ball so chosen is red. (3 marks)

18. The table below shows the values of A and B.

B	-2	-1	1	2
A	-11	3	7	21

(a) If the variables A and B are connected by an equation in the form $A = KB^3 + m$ where k and m are constants, draw a linear graph to represent this relationship. (4 marks)

(b) Use your graph to determine the constants k and m. (3 marks)

(c) (i) Write the law connecting A and B. (1 mark)

(ii) Use the law to find the value of B when A = 80 correct to 1 decimal place. (2 marks)

19. The equation of a curve is $y = {}^1/_3x^3 + 2x^2 - 5x + 3$

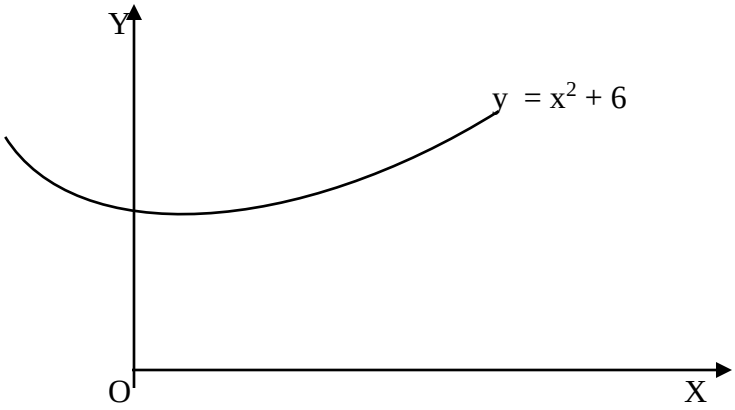
(a) Find $\frac{dy}{dx}$ (1 mark)

(b) Determine the coordinates of the turning points of the curve $y = {}^1/_3x^3 + 2x^2 - 5x + 3$ (3 marks)

(c) Sketch the curve $y = {}^1/_3x^3 + 2x^2 - 5x + 3$ in the space provided below. (3 marks)

(d) Find the equation of the tangent to the curve $y = {}^1/_3x^3 + 2x^2 - 5x + 3$ at $x = -3$. (3 marks)

20. The diagram below is a sketch of the curve $y = x^2 + 6$



(a) (i) Use the trapezium rule with six strips to estimate the area bounded by the curve, the x-axis, the y-axis and the line $x = 3$. (4 marks)

(ii) Calculate the same area by integration. (3 marks)

(b) Assuming the area in (a) (ii) above is exact, calculate the percentage error made when the trapezium rule is used (Give your answer to 3s.f) (3 marks)

21. The figure below shows triangle ABC on a cartesian plane.

(a) Given that A (-5, 4) is mapped onto $A^1(-5, -6)$ by a shear with y-axis invariant,
(i) Find the shear matrix. (3 marks)

(ii) Draw triangle $A^1B^1C^1$ the image of triangle ABC under the shear. (3 marks)

(b) Triangle $A^1B^1C^1$ is mapped onto $A^{11}B^{11}C^{11}$ by a transformation defined by the matrix

$$\begin{pmatrix} -1 & 0 \\ 2 & -1 \end{pmatrix}$$

(i) Draw triangle $A^{11}B^{11}C^{11}$. (2 marks)

(ii) Describe fully a simple transformation that maps ABC onto $A^{11}B^{11}C^{11}$. (2 marks)

22. 100 sticks were collected and their lengths recorded to the nearest centimeter grouped as shown in the table below.

Length(cm)	60 – 64	65 – 69	70 – 74	75 – 79	80 – 84	85 – 89	90 – 94	95 - 99
Frequency	2	8	17	26	24	16	6	1

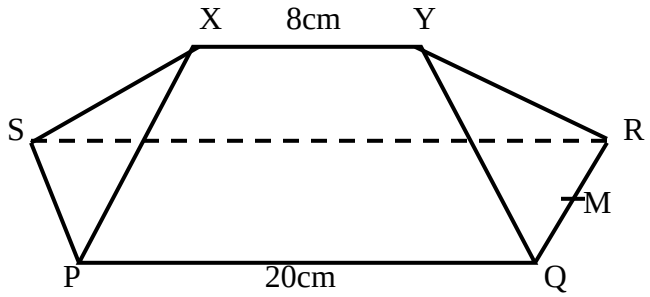
(a) State the modal frequency. (1 mark)

(b) Draw the cumulative frequency curve to represent this information. (4 marks)

(c) Use your graph to estimate the
(i) Median length. (1 mark)

(ii) Lower and upper quartiles hence the interquartile range. (3 marks)

23. The figure below shows a model of a roof with a rectangular base PQRS. PQ = 20cm and QR = 10cm. The ridge XY = 8cm is centrally placed. The faces PSX and QRY are equilateral triangles. M is the midpoint of QR



Calculate

(a) The length of YM (1 mark)

(b) The height of X above the base PQRS. (2 marks)

(c) The angle between the planes PQYX and PQRS. (3 marks)

(d) The angle between the planes QRY and PQRS . (2 marks)

(e) The acute angle between the lines PR and XY. (2 marks)

24. The table below shows the taxation rates for income earned in a certain month.

Income (Kshs per month)	Tax rate (%)
1 – 9680	10
9681 – 18800	15
18801 – 27920	20
27921 – 37040	25
37041 and above	30

Monanyi earned a basic salary of Ksh 21,000 that month. In addition he got the following allowances

I) House allowance of Ksh 9,000
II) Medical allowance of Ksh 3,600

He had a life insurance policy towards which he paid Ksh 1,800 p.m. He was therefore entitled to an insurance relief at the rate of 15% of the premium paid. He also claimed a personal relief of Ksh 1,162 p.m.

(a) Calculate the net tax paid by Monanyi that month. (8 marks)

(b) The following deductions were also made from his pay

NHIF – Ksh 320
Co-op loan – Ksh 4,750

Calculate Monanyi's net pay for the month. (2 marks)

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MARKING SCHEME

1. No: 16.49^2	Log: 1.2171 x 2		
	2.4342	M1	√ logs
0.6318	$\overline{1}$.8006 ÷ 2		
	$\overline{2}$ + 1.8006 ÷ 2	M1	Ad/sub
	$\overline{1}$ + 0.9003 (+)		
	1.9003		
	2.3345		
	(-)	M1	div by 2
327.5	2.5152		
6.598×10^{-1}	1.8193		
	= 0.6598	A1	C.A.O
		04	
2. $a + 8d = 2(a + 3d)$		M1	both equations
$^5/_2(2a + 4d) = 80$			
$a + 8d = 2a + 6d$			
$a - 2d = 0$ ……(i)		M1	attempt to solve simultaneously
$a + 2d = 16$ …(ii)			
$2a = 16$			
$a = 8$			
$d = 4$		A1	both
		04	
3. $\theta = 180 - (40 + 60)$			
$= 80^0$		B1	
$AB = \frac{80}{360} \times 2 \times \frac{22}{7} \times 6370$		M1	
	= 8897.78km	A1	accept 8898km
		03	

This paper consists of 12 printed pages

Turn Over

4.	$t^2 = \frac{(2y+1)^2}{2ky+k}$ $t^2 = \frac{2y+1}{k}$ $k = \frac{2y+1}{t^2}$	M1 M1 A1	
		03	
5.	$\frac{\cos\theta}{\sin\theta} + \frac{\sin\theta}{\cos\theta}$ $\frac{\cos^2\theta + \sin^2\theta}{\sin\theta\cos\theta}$ $\frac{1}{\sin\theta\cos\theta}$	M1 M1 A1	
		03	
6.	$t^2 - 5t + 6 = 0$ $(t-2)(t-3) = 0$ $t = 2$ or $t = 3$ $\log_{10}x = 2$ $x = 100$ $\log_{10}x = 3$ $x = 1000$	M1 M1 A1 B1	Both both values
		04	
7.	$P(1 + {}^{12}/_{200})^6 = 56740$ $P = \frac{56740}{(1.06)^6}$ $P = 40{,}000$ (1 s.f)	M1 M1 A1	 C.A.O
		03	
8.	QMax = $\frac{10.7}{8.1} = 1.321$ QMin = $\frac{10.5}{8.3} = 1.265$ Q = $\frac{10.6}{8.2} = 1.293$ % error = $\frac{\frac{1}{2}(1.321 - 1.265)}{1.293} \times 100\%$ $= 2.17\%$	B1 M1 M1 A1	for min and max absolute error percentage error
		04	

9.	Cost price = $\frac{100}{110}$ x 45.10 = sh 41	B1	
	A loses 45 – 41 = 4 B gains 41 – 35 = 6	M1	
	∴ A : B = 6 : 4 = 3 : 2	A1	
		03	
10.	(a) $(1 - \frac{1}{2}x)^8 = 1(-\frac{1}{2}x)^0 + 8(-\frac{1}{2}x)^1 + 28(-\frac{1}{2}x)^2 + 56(-\frac{1}{2}x)^3$ $= 1 - 4x + 7x^2 - 7x^3$	B1	
	(b) $\frac{1}{2}x = 0.01$ $x = 0.02$ $0.99^8 = 1 - 4(0.02) + 7(0.02)^2 - 7(0.02)^3$	M1	
	$= 0.922744$	A1	C.A.O
		03	
11.	$m \alpha lr^2$ $m = klr^2$	M1	
	$12 = k \times 20 \times 5^2$ $k = 0.024$	A1	
	$m = 0.024 \times 40 \times 2^2$ $m = 3.84kg$	B1	
		03	
12.	PS : SQ = 4 : -3 $\overrightarrow{PQ} = \begin{pmatrix}1\\-2\\1\end{pmatrix} - \begin{pmatrix}2\\1\\-3\end{pmatrix} = \begin{pmatrix}-1\\-3\\4\end{pmatrix}$	M1	
	$\overrightarrow{OS} = \overrightarrow{OP} + \overrightarrow{PS}$ $= \begin{pmatrix}2\\1\\-3\end{pmatrix} + 4\begin{pmatrix}-1\\-3\\4\end{pmatrix}$	M1	$\overrightarrow{OS} = 4\begin{pmatrix}1\\-2\\1\end{pmatrix} - 3\begin{pmatrix}2\\1\\-3\end{pmatrix}$ $\overrightarrow{OS} = \begin{pmatrix}-2\\-11\\13\end{pmatrix}$
	$= \begin{pmatrix}-2\\-11\\13\end{pmatrix}$	A1	
		03	

13.	det m = 3 – 1 = 2 $\frac{\text{Area of image}}{\text{Area of object}} = 2$ Area = 2 x 15 $30cm^2$	B1 M1 A1	
		03	
14.	(i) $\angle$ OBE = 60^0 base angle of isosceles Δ OBE OB is ⊥ or to tangent ABC ∴ $\angle$ EBF = 90 – (60 + 10) = 20^0 (ii) $\angle$ BFE = 180 – (120 + 20) = 40^0	B1 B1 B1	
		03	
15.	A C O B	B1 B1	Centre of arc correctly located Major arc through A (BAC)
		02	
16.	$\angle$ APQ = 50^0 ∴ BPQ = 130^0 $PB^2 = 20^0 + 12^2 - 2 \times 20 \times 12 \cos 130^0$ $400 + 144 - 480 \cos 130^0$ $544 - 480 \cos 130$ PB = 29.20cm	B1 M1 A1	
		03	

17.	(a) (i)							
		1	2	3	4	5	6	
	1	0	1	2	3	4	5	B1 sample space
	2	1	0	1	2	3	4	
	3	2	1	0	1	2	3	
	4	3	2	1	0	1	2	
	5	4	3	2	1	0	1	
	6	5	4	3	2	1	0	
	No. of outcomes = 6							B1
	P(3) = $^{6}/_{36}$							B1
	= $^{1}/_{6}$							
	(ii) No of outcomes = 34							B1
	P(4 or less) = $^{34}/_{36}$							B1
	= $^{17}/_{18}$							
	(iii) No of outcomes = 6 (diff of 0)							B1
	P(0) = $^{6}/_{36}$							B1
	= $^{1}/_{6}$							
(b)	P(red) = P(A red or B red)							
	½ x $^{3}/_{10}$ + ½ x $^{4}/_{12}$							M1 either ½ x $^{3}/_{10}$ or ½ x $^{4}/_{12}$ Seen
								M1 Addition
	= $^{19}/_{60}$							A1
								10

18. Plot A against B^3

B	-2	-1	1	2
B^3	-8	-1	1	8
A	-11	3	7	21

B1 Values of B3

S1
P1
L1

20.0 15.0 10.0 5.0 0 -12 -8 -4 4 8 12 B^3 -5.0 -10.0 -15.0

(b) K = Gradient $= \frac{21 - 7}{8 - 1}$	M1	
$= {}^{14}/_{7} = 2$	A1	
M = A – Intercept = 5.0	B1	
(c) (i) The law is $A = 2B^3 + 5$	B1	
(ii) $80 = 2B^3 + 5$ $B^3 = 37.5$ $B = 3.3$	M1 A1	
	10	

19.	(a)	$\frac{dy}{dx} = x^2 + 4x - 5$	B1	
	(b)	$x^2 + 4x - 5 = 0$		
		$(x + 5)(x - 1) = 0$	M1	
		$x = -5$ or $x = 1$	A1	Both
		When $x = -5$, $y = 36^1/_3$; $(-5, 36^1/_3)$		
		When $x = 1$, $y = {}^1/_3$; $(1, {}^1/_3)$	B1	both coordinates
	(c)	Y intercept ($x = 0$)		
		$y = 3$; $(0, 3)$	B1	y – intercept
			B2	√ sketch
	(d)	$\frac{dy}{dx} = (-3)^2 + 4(-3) - 5$		
		When $x = -3$, $y = 27$		
		$\frac{y - 27}{x + 3} = -8$	M1	
		$y - 27 = -8x - 24$		
		$y + 8x = 3$	A1	
			10	

20. (a) (i)

x	0	0.5	1	1.5	2	2.5	3
y	6	6.25	7	8.25	10	12.25	15

B1

Area = ½ x 0.5 { (6 + 15) + 2 (6.25 + 7 + 8.25 + 10 + 12.25)} M1

= 0.25 (21 + 2 x 43.75) M1

= 27.125 A1

(ii) Area = $\int_0^3 (x^2 + 6)\,dx$ M1

= $\left(\frac{x^3}{3} + 6x \right)_0^3$ M1

= 9 + 18

= 27 A1

(b) % error = $\frac{27.125 - 27}{27}$ x 100% M1 error

M1 √ expression for % error

= 0.463% A1 C.A.O

10

21. (a) $\begin{pmatrix} 1 & 0 \\ k & 1 \end{pmatrix} \begin{pmatrix} -5 \\ 4 \end{pmatrix} = \begin{pmatrix} -5 \\ -6 \end{pmatrix}$ M1 $k = \frac{-6 - 4}{-5}$

-5k + 4 = -6

k = 2 A1 k = 2

$\therefore \begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix}$ B1

A B C A^1 B^1 C^1 A^{11} B^{11} C^{11} -6 -4 -2 0 2 4 6 X

Y 4 2 0 -2 -4 -6

(ii) $\begin{pmatrix}1 & 0\\2 & 1\end{pmatrix}\begin{pmatrix}-3 & 1\\1 & 2\end{pmatrix} = \begin{pmatrix}-3 & 1\\-5 & 4\end{pmatrix}$ (B C; B^1 C^1)	M1	
$B^1(-3, -5)$; $C^1(1, 4)$	A1	May be implied
	B1	$A^1B^1C^1$ drawn
(b) (i) $\begin{pmatrix}-1 & 0\\2 & -1\end{pmatrix}\begin{pmatrix}-5 & -3 & 1\\-6 & -5 & 4\end{pmatrix} = \begin{pmatrix}5 & 3 & -1\\-4 & -1 & -2\end{pmatrix}$		
$A^{11}(5, -4)$; $B^{11}(3, -1)$; $C^{11}(-1, -2)$	B1	coordinate
	B1	$A^{11}B^{11}C^{11}$ drawn
(ii) A rotation of 180^0 about the origin	B2	B^1 if centre not stated
	10	

22. Modal frequency = 26 B1

Upper limits of length (cm)	C.F
59.5	0
64.5	2
69.5	10
74.5	27
79.5	53
84.5	77
89.5	93
94.5	99
99.5	100

B1

100 80 60 40 20 0 Q_3 Q_2 Q_1 Cumulative frequency S1
P1
CI

59.5 64.5 79.5 89.5 99.5 109.5

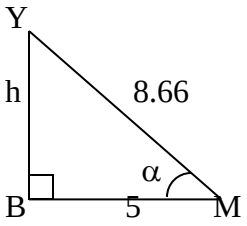
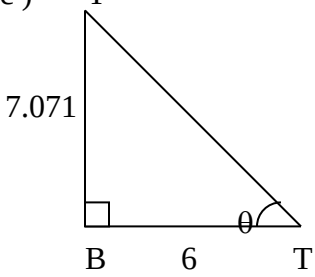
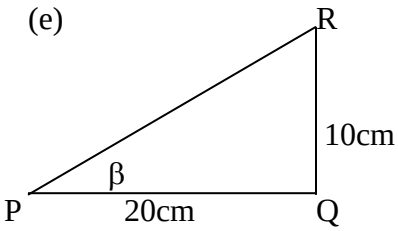
(i) Median (½ x 100)th or 50th value

∴ median = 79.5cm B1

(ii) Q_1 = (¼ X 100) = 25th value
= 74.5cm B1

Q_3 = (¾ x 100) = 75th value
= 84.5cm B1
Interquartile range = 84.5 – 74.5 = 10 M1A1

10

23.	(a)	YM = $\sqrt{10^2 - 5^2}$ YM = 8.660cm	B1	
	(b)	 $h = \sqrt{75 - 25}$ h = 7.071	M1 A1	
	(c)	 $\text{Tan } \theta = \frac{7.071}{6}$ $\theta = 49.68^0$ NB: ptT is on PQ	B1 M1 A1	BT = 6cm
	(d)	See fig (b) $\text{Sin } \alpha = \frac{7.071}{8.66}$ $= 54.74^0$	M1 A1	
	(e)	 $\text{Tan } \beta = {}^{10}/_{20}$ $\beta = 26.57^0$	M1 A1	
			10	
24.	(a)	Taxable income = 21000 + 9000 + 3600 = sh. 33,600	M1 A1	
		Tax 9680 x ${}^{10}/_{100}$ = 968 9120 x ${}^{15}/_{100}$ = 1368 9120 x ${}^{20}/_{100}$ = 1824 5680 x ${}^{25}/_{100}$ = 1420	M1 M1	

Total tax = sh. 5580 Less insurance relief $^{15}/_{100}$ x 1800 270 5310 Less personal relief 1162 Net tax p.m sh 4148 (b) Net pay = 33600 – (4148 + 1800 + 320 + 4750) = sh. 22,582	A1 M1 M1 A1 M1 A1	 subtract insurance relief subtract personal relief	
	10		