Name _____ Adm. No. _____

Candidate's Signature _____

Date _____

121/1
MATHEMATICS ALT A
PAPER 1
OCT / NOV 2014
2 ½ HOURS

KIBWEZI DISTRICT FORM 4 INTER-SCHOOLS EXAMINATION
Kenya Certificate of Secondary Education (K.C.S.E)
MATHEMATICS ALT A
PAPER 1
2 ½ HOURS

INSTRUCTIONS TO CANDIDATES

1. Write your name and admission number in the spaces provided above.
2. Sign and write the date of examination in the spaces provided.
3. The paper contains two sections: Section **I** and **II**.
4. Answer all questions in section **I** and **only five** questions from section **II**.
5. All answers and working must be written on the question paper in the spaces provided below each question.
6. Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.
7. Marks may be given for correct working even if the answer is wrong.
8. Non-programmable silent electronic calculators and KNEC mathematical tables may be used except where stated otherwise.

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

Candidates should check carefully to ascertain that all the pages are printed as indicated and no questions are missing.

This paper consists of 15 printed pages.

Turn Over

SECTION I – 50 MARKS

1. Evaluate: $^{2}/_{5}$ of $1^{2}/_{3} - ½ \sqrt{\frac{1^{2}/_{3} - 2\,½}{^{1}/_{3} - ^{19}/_{27}}} + ^{2}/_{3}$ (3 marks)

2. Solve for x in the equation (2 marks)

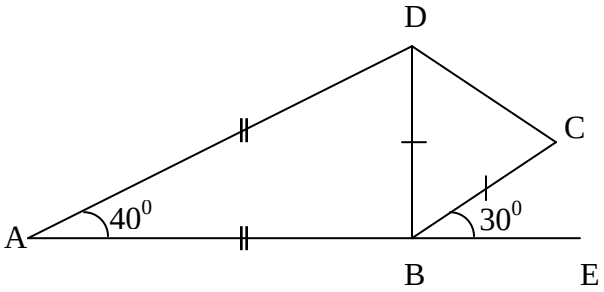
$2^{2x-1} \times (^{1}/_{8})^{1-x} = 4^{3x+1}$

3. Juma deposited sh. 4,500 in a bank which paid compound interest at 12% p.a
Calculate the amount after two years. (2 marks)

4. Four men can dig 2 acres of land in 3 days working 4 hours a day. How many men are required to dig 5 acres of land in 4 days working 3 hours a day at the same rate? (3 marks)

5. A two digit number is such that the sum of the digits is 12. If the digits are interchanged the value of the new number formed is fifteen more than twice the value of the original number.
Find the original number. (4 marks)

6. In the quadrilateral ABCD below, angle BAD = 40^0. AB is extended to E and angle CBE = 30^0, AB = AD and BD = BC.



Calculate the value of angle BCD. (3 marks)

7. Use the tables of squares, cube roots and reciprocals to evaluate

$$\sqrt[3]{\frac{0.008}{0.375}} - \frac{10}{37.5^2}$$

(4 marks)

8. Make t the subject of the formula:

$$Q = \left(\frac{b - t}{t}\right)^{\frac{1}{2}}$$

Hence evaluate t when b = 20 and Q = 3

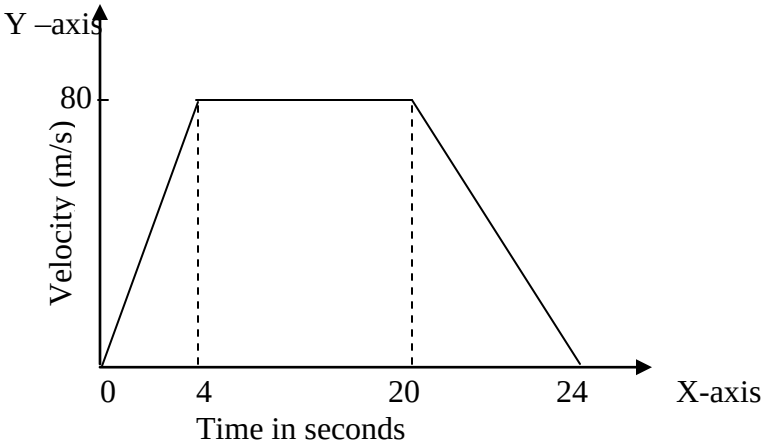
(4 marks)

9. Simplify completely

$$\frac{3(x + y)}{x^2 + xy - 2y^2} + \frac{3x + y}{x^2 - y^2}$$

(3 marks)

10. The figure below is a velocity time graph for a car



(a) Find the total distance traveled by the car. (2 marks)

(b) Calculate the deceleration of the car. (1 mark)

11. The gradient of a line L through A (2x, 4) and B(-1, x) is $^{1}/_{7}$. Find the equation of a line perpendicular to L through B. (3 marks)

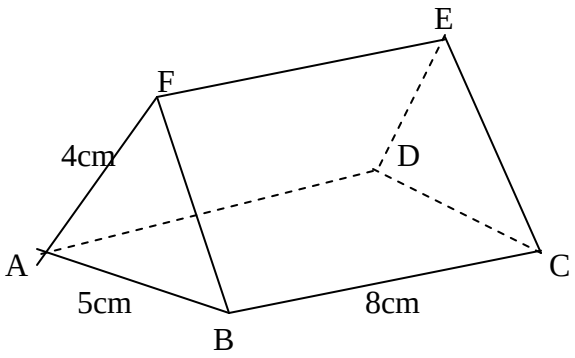
12. Solve the inequality $3 - 2x < x \leq \frac{2x + 5}{3}$

State the integral values which satisfy these inequalities. (3 marks)

13. Draw the line AB = 4cm, hence draw the locus of point P such that < APB = 60^0. (3 marks)

14. Point Q is 2400 nautical miles to the east of point P(60^0N, 35.8^0W). Find the longitude of Q. (3 marks)

15.



The figure above is a triangular prism of uniform cross-section in which AF = 4cm, AB = 5cm and BC = 8cm.

(a) If angle BAF = 30^0, calculate the surface area of the prism. (3 marks)

(b) Draw a clearly labeled net of the prism. (1 mark)

16. A man imported a vehicle at sh. 600,000 and sold it at sh. 1,080,000. Find his percentage profit if he spent sh. 60,000 for clearing the vehicle from the port and a further sh. 40,000 for shipping. (3 marks)

SECTION II – 50 MARKS

17. (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

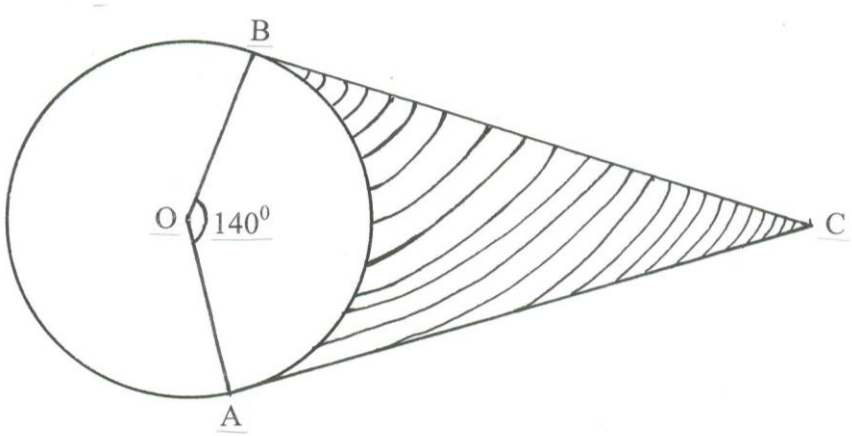
(i) $A^1B^1C^1D^1$ the image of ABCD, under an enlargement scale factor 3, centre (9,-4). (3 marks)

(ii) $A^{11}B^{11}C^{11}D^{11}$, the image $A^1B^1C^1D^1$ under a reflection in the line x = 0. (2 marks)

(iii) $A^{111}B^{111}C^{111}D^{111}$, the image of $A^{11}B^{11}C^{11}D^{11}$ under a rotation of $+90^0$ about the origin. (2 marks)

(c) Describe a single transformation that maps $A^1B^1C^1D^1$ onto $A^{111}B^{111}C^{111}D^{111}$. (2 marks)

18. In the diagram below, O is the center of the circle, AC and BC are tangents to the circle. Angle AOB = 140^0 and the radius of the circle is 10.5cm.



Calculate;

(a) the length of the chord AB. (3 marks)

(b) the area of the kite OACB. (4 marks)

(c) the shaded area. (3 marks)

19. Using a pair of compasses and ruler only,

(a) Construct triangle XYZ such that XY = 8cm, YZ = 6cm and angle XYZ = 30^0. (3 marks)

(b) Measure the length of XZ. (1 mark)

(c) Draw a circle that touches the vertices X, Y and Z. (2 marks)

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

(e) Calculate the area of the circle outside the triangle to 2 d.p. (3 marks)

20. The figures below show the weight in kgs of 30 people living near a town.

60	83	57	46	80	32	108	78	75	36
55	45	53	41	61	48	93	42	58	38
50	58	51	63	77	74	49	66	66	60

(a) Make a frequency distribution table taking groups 30 – 39, 40 – 49 etc. (3 marks)

(b) State the modal class. (1 mark)

(c) Calculate the

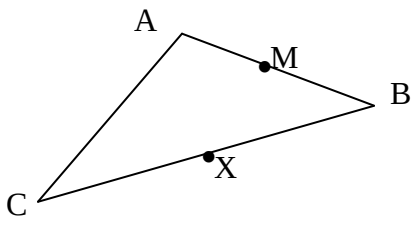
(i) mean (2 dp) (3 marks)

(ii) median (2 dp) (3 marks)

21. (a) Given vector $\overrightarrow{DE} = 2a + b$ and $\overrightarrow{DC} = 3b - a$, express the vector $\overrightarrow{CE}$ in terms of a and b in the simplest form. (2 marks)

(b) Given $\overrightarrow{OT} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ and $\overrightarrow{OV} = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$, find the magnitude of the vector quantity VT. (3 marks)

(c) In the figure below, X divides CB in the ratio 1 : 3 and M is the mid point of AB.



(i) Express MX in terms of b and c given that $\overrightarrow{AB} = b$ and $\overrightarrow{AC} = c$. (3 marks)

(ii) Determine the position vector of X. (2 marks)

22. (a) An arithmetic progression (AP) is such that the first term is -5, the last term is 135 and the sum of the progression is 975. Calculate:-

(i) the number of terms in the series. (4 marks)

(ii) the common difference of the progression. (2 marks)

(b) The sum of the first three terms of a Geometric Progression (GP) is 27 and the first term is 36. Determine the common ratio and the value of the fourth term. (4 marks)

23. A port B is on a bearing of 080^0 from a port A and at a distance of 95km. A submarine is stationed at port D which is on a bearing of 200^0 from A and a distance of 124km from B. A ship leaves B and moves directly southwards to an Island P which is on a bearing of 140^0 from A. The submarine at D on realizing that the ship was headed for Island P, decided to head for Island P to intercept the ship.

(a) Draw a scale diagram showing the relative positions of A, B, D, and P.
Use a scale of 1cm to represent 20km. (4 marks)

(b) Use your diagram to find

(i) the distance from A to D. (2 marks)

(ii) the bearing of the submarine from the ship when the ship was setting off from B. (1 mark)

(iii) the bearing of Island P from D. (1 mark)

(iv) the distance the submarine had to cover to reach Island P. (2 marks)

24. Two towns A and B are 80km apart. Juma started cycling from town A to town B at 10.00 am at an average speed of 40km/h. Mutuku started his journey from town B to town A at 10.30 am and traveled by car at an average speed of 60km/h.

Calculate

(i) the distance from town A when Juma and Mutuku met. (5 marks)

(ii) the time of the day when the two met. (2 marks)

(b) Kamau started cycling from town A to town B at 10.20am. He met Mutuku at the same time as Juma did. Determine Kamau's average speed. (3 marks)

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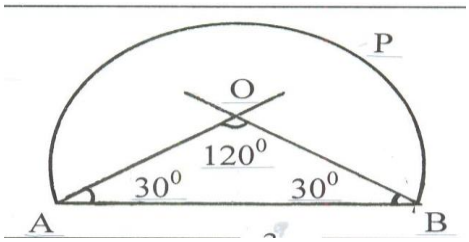
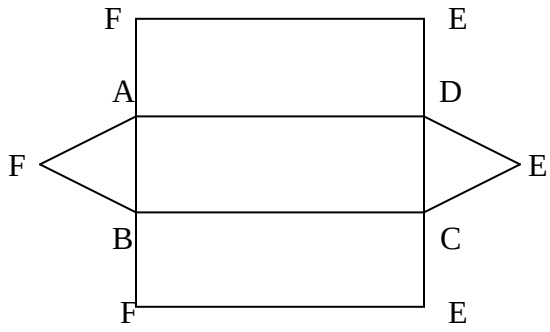
MARKING SCHEME

SECTION I – 50 MARKS

1.	$^{2}/_{5} \times {}^{5}/_{3} - ½ \sqrt{\dfrac{{}^{5}/_{3} - {}^{5}/_{2}}{{}^{-10}/_{27}}} + {}^{2}/_{3}$	M1	
	$^{2}/_{3} - ½ \sqrt{\dfrac{{}^{-5}/_{6}}{{}^{-10}/_{27}}} + {}^{2}/_{3}$		
	$^{2}/_{3} - {}^{1}/_{2} \sqrt{{}^{9}/_{4}} + {}^{2}/_{3}$	M1	
	$^{2}/_{3} - ¾ + {}^{2}/_{3}$		
	$= {}^{7}/_{12}$	A1	
		03	
2.	$2^{2x-1} \times 2^{-3+3x} = 2^{6x+2}$		
	$2x - 1 - 3 + 3x = 6x + 2$	M1	
	$5x - 4 = 6x + 2$		
	$x = -6$	A1	
		02	
3.	Amount $= 4500 (1 + {}^{12}/_{100})^2$	M1	
	$= 4500 (1.12)^2$		
	= Kshs. 5,644.80	A1	
		02	
4.	M A D H		
	4 2 3 4	M1	
	7 5 4 3		
	${}^{5}/_{2} \times ¾ \times {}^{4}/_{3} \times 4$	M1	
	= 10 men	A1	
		03	

5.	Let the number be xy $x + y = 12$ $y = 12 - x$ $10y + x - 2(10x + y) = 15$ $8y - 19x = 15$ $8(12 - x) - 19x = 15$ $96 - 8x - 19x = 15$ $-27x = -81$ $x = 3$ $y = 12 - 3 = 9$ $\therefore$ original number = 39	M1 M1 A1 B1	
		04	
6.	Angle ABD = $\frac{180 - 40}{2} = 70^0$ Angle DBC = $180 - (70^0 + 30^0) = 80^0$ Angle BCD = $\frac{180 - 80}{2} = 50^0$	B1 B1 B1	
		03	
7.	$\sqrt[3]{0.008} = 0.2$ Reciprocal of 0.375 = 2.6667 $37.5^2 = 1406$ Reciprocal of 1406 = 0.0007 $\therefore$ 0.2 x 2.6667 – 10 x 0.0007 = 0.5264	 B1 B1 M1 A1	
		04	
8 .	$Q^2 = \frac{b - t}{t}$ $Q^2 t = b - t$ $t(Q^2 + 1) = b$ $\Rightarrow t = \frac{b}{Q^2 + 1}$ $t \Rightarrow \frac{20}{3^2 + 1} = \frac{20}{10} = 2$	M1 M1 A1 B1	
		04	
9.	$\frac{3(x + y)}{(x + y)(x + 2y)} + \frac{3x + y}{(x - y)(x + y)}$ $\frac{3(x + y)(x - y) + (3x + y)(x + 2y)}{(x + y)(x + 2y)(x - y)}$	 M1	

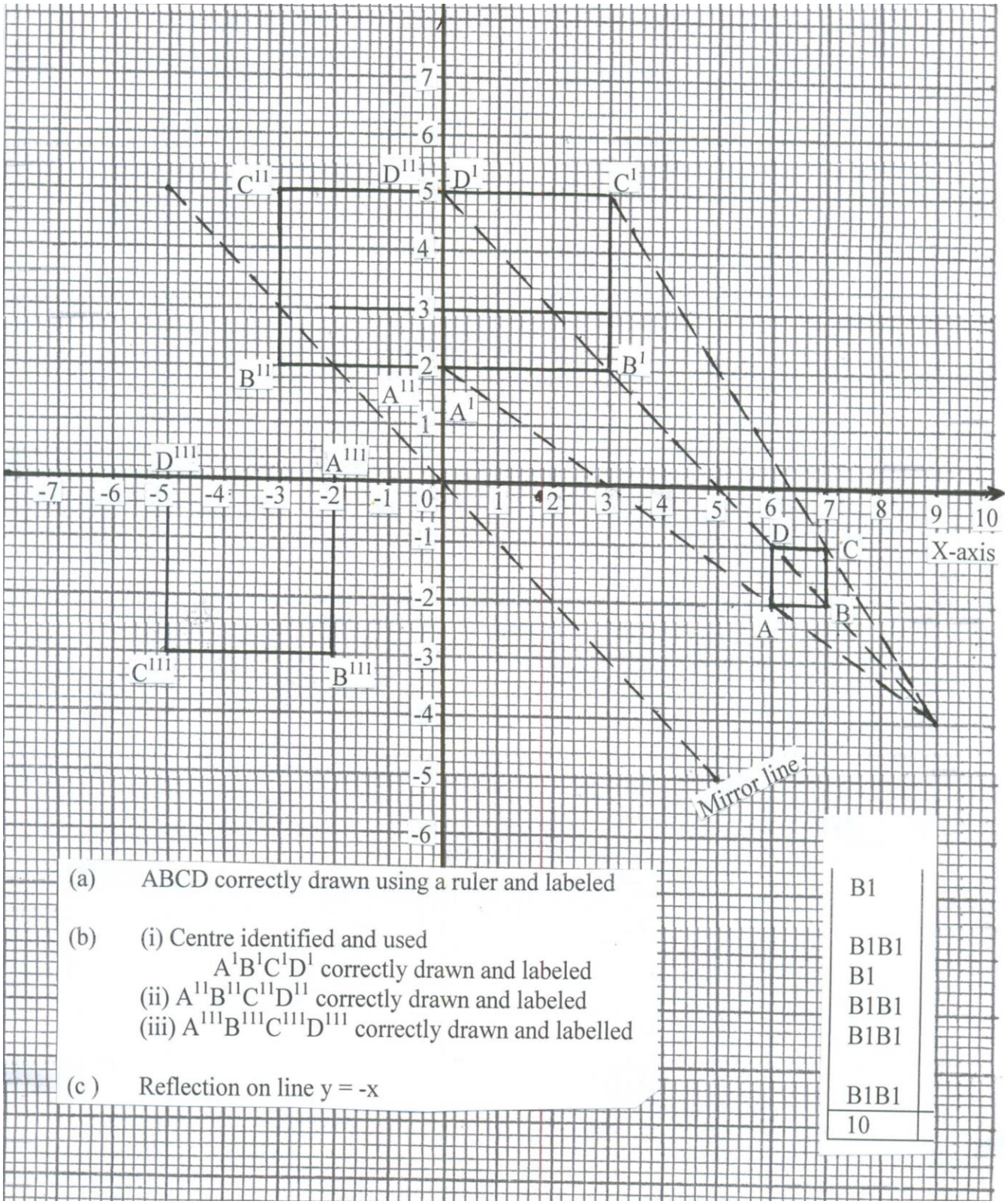
	$\frac{3x^2 - 3y^2 + 3x^2 + 7xy + 2y^2}{(x + y)(x + 2y)(x - y)}$ $\frac{6x^2 + 7xy - y^2}{(x + y)(x + 2y)(x - y)}$ $\frac{(x + y)(6x - y)}{(x + y)(x + 2y)(x - y)}$ $= \frac{6x - y}{(x + 2y)(x - y)}$	M1 A1	
		03	
10. (a)	½ x 4 x 80 + 80 x 16 + ½ x 4 x 80 160 + 1280 + 160 = 1600m	M1 A1	
(b)	$\Longrightarrow \frac{-80}{4}$ $= -20\ m/s^2$	B1	
		03	
11.	$\frac{4 - x}{2x + 1} = \frac{1}{7}$ $28 - 7x = 2x + 1$ $27 = 9x$ $x = 3$ Grad. of line h = -7 $\frac{y - 3}{x + 1} = -7$ $y = -7x - 4$	 B1 M1 A1	
		03	
12.	$3 - 2x < x$ $3 < 3x$ $1 < x$ Or $x > 1$ $3x \leq 2x + 5$ $x \leq 5$ Integral values 2, 3, 4, 5	 B1 B1 B1	
		03	
13.		B1 B1 B1	√ construction 30^0 at A and B √ location of centre O √ locus of P

14.	$60 \times \theta \times \cos 60^0 = 2400$ $\theta = \frac{2400}{30}$ $= 80^0$ New longitude of B = $80^0 - 35.8^0$ $= 44.2^0$E	M1 A1 B1	
		03	
15.	(a) Triangular faces = ½ x 4 x 5 sin 30^0 x 2 Rectangular faces = 8 x 5 + (4 x 8 x 2) 10 + 40 + 64 = $114cm^2$ (b) 	M1 M1 A1 B1	
		03	
16.	Total exp. ⇨ 600,000 + 100,000 ⇨ 700,000 sh. Profit 1,080,000 – 700,000 = 380,000 % profit = $\frac{380,000}{700,000}$ x 100 = 54.29%	M1 M1 A1	
		03	

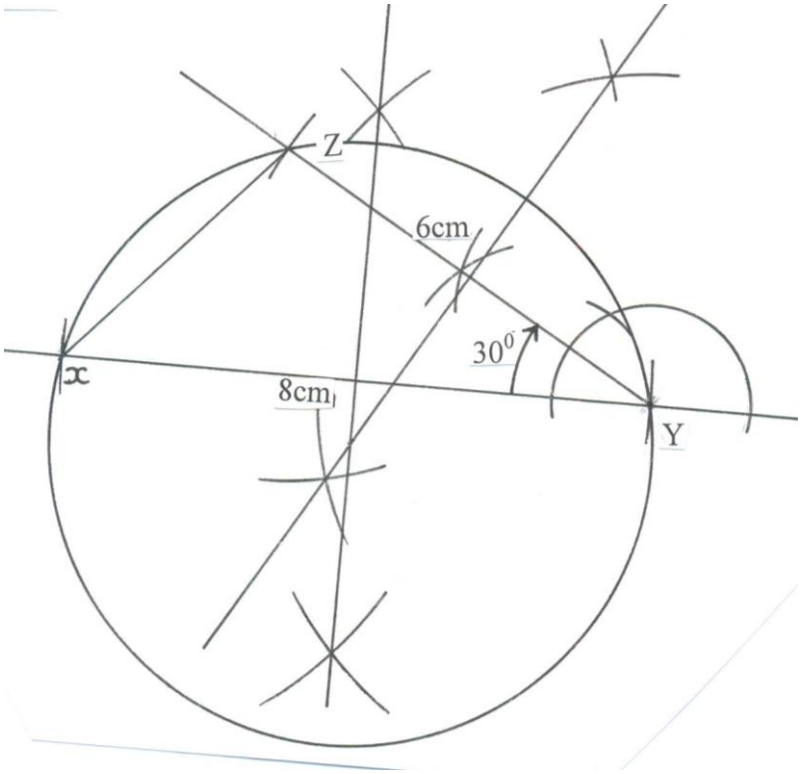
SECTION II – 50 MARKS

17.

-



(a)	ABCD correctly drawn using a ruler and labeled	B1
(b)	(i) Centre identified and used	B1B1
	$A^1B^1C^1D^1$ correctly drawn and labeled	B1
	(ii) $A^{11}B^{11}C^{11}D^{11}$ correctly drawn and labeled	B1B1
	(iii) $A^{111}B^{111}C^{111}D^{111}$ correctly drawn and labelled	B1B1
(c)	Reflection on line y = -x	B1B1
		10

18.	(a)	$\sin 70^0 = \frac{\frac{1}{2} AB}{10.5}$	M1	
		$\Rightarrow \frac{1}{2} AB = \sin 70^0 \times 10.5$ $= 9.867cm$		
		$AB = 2 (9.867)$	M1	
		$= 19.734cm$	A1	
	(b)	$\tan 70^0 = \frac{BC}{10.5}$	M1	
		$\Rightarrow BC = 10.5 \tan 70^0$ $= 28.85cm$	A1	
		Area = (½ x 28.85 x 10.5) x 2	M1	
		$= 302.925cm^2$	A1	
	(c)	Shaded area $= 302.925 - {}^{140}/_{360} \times {}^{22}/_{7} \times 10.5^2$	M1	
		$= 302.925 - 134.75$	M1	
		$= 168.175cm^2$	A1	
			10	
19.				
		XY and YZ	B1	
		∠XYZ construction of $\angle 30^0$	B1	
		Completing Δ XYZ	B1	
	(b)	XZ = 4.0cm ± 0.1	B1	
	(c)	Bisecting any 2 sides	B1	
		Curve circle	B1	

(d) Radius = 4.2cm $\pm$ 0.1 — B1

(e) Area of circle $\longrightarrow$ $3.142\ (4.2)^2$ — M1
Area of Δ $\longrightarrow$ $\frac{1}{2} \times 8 \times 6 \sin 30^0$ — M1
Area $= 55.425 - 12$
$= 43.43cm^2$ — A1

10

20. (a)

Class	Tally	Freq.	X	Fx	cf
30 – 39	III	3	34.5	103.5	3
40 – 49	~~III~~ I	6	44.5	267	9
50 – 59	~~IIII~~ II	7	54.5	381.5	16
60 – 69	~~IIII~~ I	6	64.5	387	22
70 – 79	IIII	4	74.5	298	26
80 – 89	II	2	84.5	169	28
90 – 99	I	1	94.5	94.5	29
100 - 109	1	1	104.5	104.5	30
				$\sum fx = 1805$	
B1	B1	B1		B1	B1

(b) 50 – 59 — B1

(c) (i) Mean $= \frac{1805}{30}$ — M1
$= 60.17$ kgs — A1

(ii) Median $= \frac{49.5 + {}^{6}/_{7} \times 10 + 59.5}{2}$ — M1

$= \frac{58.07 + 59.5}{2}$

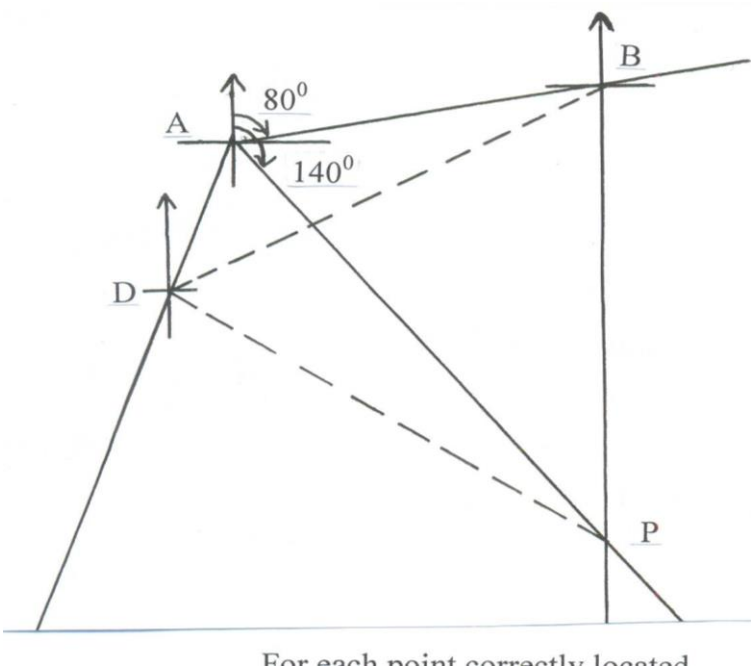
$= 58.79$kgs — A1

10

21. (a) CE $= 2a + b - (3b - a)$ — M1
$= 2a + b - 3b + a$
$= 3a - 2b$ — A1

(b) VT = OT – OV
$\begin{pmatrix} -2 \\ 5 \end{pmatrix} - \begin{pmatrix} 5 \\ -1 \end{pmatrix} = \begin{pmatrix} -7 \\ 6 \end{pmatrix}$ — M1

Magnitude VT $= \sqrt{(-7)^2 + 6^2}$ — M1
$= \sqrt{85}$
$= 9.23$ — A1

	(c)	(i) $\overrightarrow{BC} = c - b$ $\overrightarrow{BX} = \frac{3}{4}(c - b)$	M1	
		$\overrightarrow{MX} = \frac{1}{2}b + \frac{3}{4}c - \frac{3}{4}b$	M1	
		$= \frac{3}{4}c - \frac{1}{4}b$	A1	
		(ii) $\overrightarrow{AX} = b + \frac{3}{4}c - \frac{3}{4}b$	M1	
		$= \frac{3}{4}c + \frac{1}{4}b$	A1	
			10	
22.	(a)	(i) $\frac{n}{2}(2a + (n-1)d) = 975$	M1	
		$\frac{n}{2}(-10 + 140) = 975$	M1	
		$\longrightarrow n = \frac{2 \times 975}{130}$	M1	
		$= 15$ terms	A1	
		(ii) $-5 + 14d = 135$	M1	√subt
		$14d = 140$		
		$\longrightarrow d = 10$	A1	
	(b)	$a + ar + ar^2 = 27$ ($a = 36$)		
		$36 + 36r + 36r^2 = 27$	M1	√ subt
		$4r^2 + 4r + 1 = 0$		
		$(2r + 1)(2r + 1) = 0$	M1	√ fact
		$\longrightarrow 2r + 1 = 0$		
		$r = -\frac{1}{2}$	A1	
		4^{th} term $= 36(-\frac{1}{2})^3$		
		$= -4\frac{1}{2}$	B1	
			10	
23.				
		Point A	B1	
		Point B	B1	
		Point D	B1	
		Point P	B1	
		For each point correctly located		

	(b)	(i) 2.3 x 20 = 46km ± 1km	B1B1	
		(ii) $241^0 \pm 1^0$	B1	
		(iii) $123^0 \pm 1^0$	B1	
		(iv) 6.5 x 20 = 130km ± 1km	B1	
			10	
24.	(a)	(i) 80 – 20 = 60km 60 + 40 = 100km/hr	B1 B1	
		$\frac{60}{100} = \frac{3}{5}$ hrs or 36 min		
		$^3/_5$ x 40 = 24km	M1	
		24 + 20 = 44km	M1 A1	
		(ii) 10.30am + 36 11.06 a.m	 M1 A1	
	(b)	T. Taken 11.06 - 10.20 46	 M1	
		44 x $^{60}/_{46}$	M1	
		= 57.39 km/hr	A1	
			10	

Name _____ Adm. No. _____

Candidate's Signature _____

Date _____

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SECTION I – *50 MARKS*

Answer all the questions in this section

1. Determine the inverse of the matrix .

$$T = \begin{pmatrix} 2 & 4 \\ 1 & -2 \end{pmatrix} .$$

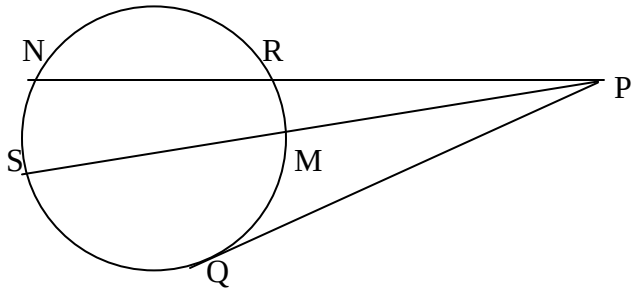
Hence find the co-ordinate to the point at which the two lines $2x = 8 – 4y$ and $x = 2y + 2$ meet. (3 marks)

2. Find the centre and the radius of a circle whose equation is $x^2 + y^2 – 4x + 6y -3 = 0$ (3 marks)

3. An electric pole is supported to stand vertically on a level ground by a tight wire. The wire is pegged at a distance of 6m from the foot of the pole. The angle the wire makes with the ground is 3 times the angle it makes with the pole.
Determine the length of the wire. (3 marks)

4. In a triangle ABC, a = 8cm, c = 10cm and angle ABC = 60^0. Calculate the values of side b and angle BCA. (4 marks)

5. In the figure below, RN and MS are chords of a circle that meet at an external point P.
PQ is a tangent to the circle at Q. Given that PR = 2cm, PN = 12cm and PM = 3cm, find the length of:



(i) PS (2 marks)

(ii) PQ (1 mark)

6. Express the number 1470 and 7056 each as product of its prime factors. Hence evaluate.
$\frac{1470^2}{\sqrt{7056}}$ leaving the answer in prime factor form. (3 marks)

7. Evaluate without using tables or calculator:-

$\text{Log}(3x + 8) - 3\log 2 = \log(x - 4)$ (3 marks)

8. The interior angle of a regular polygon is three times the exterior angle. Determine the number of sides in the polygon. (3 marks)

9. Using an assumed mean of 342, calculate the standard deviation of the set of these five numbers: 327, 332, 342, 347 and 352. (3 marks)

10. Solve the equation: $2\sin^2 x - 3\cos x = 0$ for the values of x in the domain $0^0 \leq x \leq 360^0$. (4 marks)

11. Transformations M and N are represented by the matrices $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ and $\begin{pmatrix} 3 & 0 \\ 1 & 3 \end{pmatrix}$ respectively. Point R has co-ordinates (3, -2), find the co-ordinates of R^1 the image of R under a transformation represented by MN (R). (3 marks)

12. The equation of a curve is $y = 4 + 3x - x^2$. Find the equation of the normal drawn to the curve at the point P (3, -5). Leave your answer in the form $y = mx + c$. (3 marks)

13. Two similar cans have different heights 8cm and the other one 10cm. If the surface area of the larger can is $480cm^2$, find the surface area of the smaller can. (3 marks)

14. The radius of a cylinder was found to be 14.0cm and its height 15.5cm. Find the percentage error in its volume correct to 4 significant figures. (Take $\pi = {}^{22}/_{7}$) (3 marks)

15. A bag contains 5 blue balls and 3 red balls. A ball is picked at random and replaced. A second ball is then picked. Find the probability that;-

(a) Both balls are red. (1 mark)

(b) The two balls are of different colours. (2 marks)

16. A school hall is 14m longer than its breadth and its area is $1800m^2$. What is its breadth? (3 marks)

SECTION II – *50 MARKS*

Answer only five questions in the section.

17. Mrs. Mutua earns a basic salary of sh. 19,800 per month and a house allowance of sh. 13,500 per month.

Monthly taxable income in Kshs.	Rate of tax in shs. Per £
0 – 10,164	2
10,165 – 19,740	3
19,741 – 29,316	4
29,317 – 38,892	5
Over 38,892	6

Use the monthly tax rates above to calculate:-

(a) (i) The tax payable before relief. (4 marks)

(ii) The tax payable after relief if she enjoys a personal relief of Kshs. 1,162 per month. (2 marks)

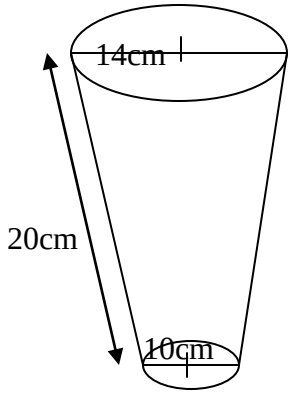
(b) The following deductions were also made from Mrs. Mutua's salary. A service charge of Kshs. 150, Ksh. 420 for NSSF and 3% of basic salary as WCPS. Calculate;

(i) Total monthly deductions made from her salary. (2 marks)

(ii) Her net income per month. (2 marks)

18. A bucket is in the shape of a frustrum with base radius 10cm and top radius 14cm. The slant height of the bucket is 20cm as shown below. The bucket is full of water.

(a) Calculate the volume of the water to 2 dp (Take $\pi = 3.142$) (5 marks)



(b) All the water is poured into a cylindrical container of circular radius 12cm. If the cylinder has height 40cm, calculate the surface area of the cylinder which is not in contact with water to 2 dp. (5 marks)

19 A school uniform supplier is asked to supply two sizes of shirts: Medium and large. The total number of shirts must not be more than 500. The number of medium shirts must not be less than the number of large shirts. Moreover the number of medium shirts must not be more than 300 and the number of large shirts must be atleast 150.

If x represents the number of medium shirts and y the number of large shirts;-

(a) Write down, in terms of x and y, all the linear inequalities representing the above information. (4 marks)

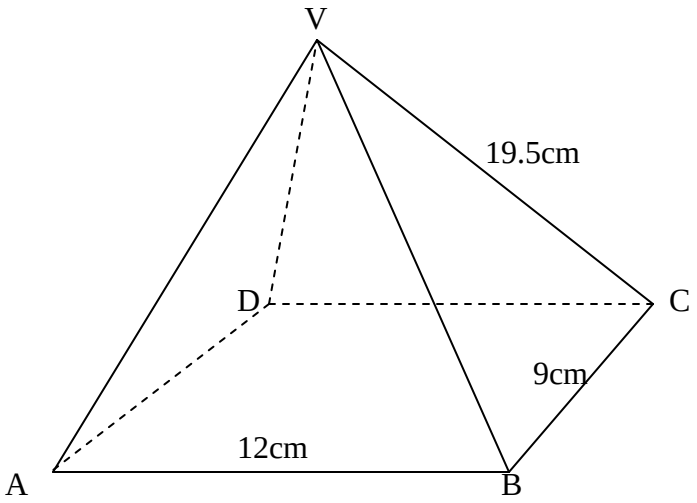
(b) On the grid provided, draw the inequalities and shade the unwanted regions. (4 marks)

(c) The profits were as follows:

Medium shirt :	shs. 150
Large shirt :	shs. 200

Use the graph to determine the number of shirts of each size that should be supplied for maximum profit. (2 marks)

20. The figure below is a right pyramid with a rectangular base ABCD of length 12cm and width 9cm. The slanting edge is 19.5cm long.



(a) Determine the height of the pyramid. (2 marks)

(b) Find the angle line AE makes with base ABCD. (3 marks)

(c) Calculate the angle between planes VAD and VBC. (3 marks)

(d) Calculate the volume of the pyramid. (2 marks)

21. The velocity of a body traveling in a straight line is given by $V = 10 + 5t - 2t^2$, where V is in m/s and t is in seconds. Calculate:-

(a) the velocity of the body after 2 seconds. (2 marks)

(b) the acceleration of the body after 2 seconds. (1 mark)

(c) the distance covered by the body between the 2^{nd} and the 4^{th} second. (4 marks)

(d) the time when the body will be momentarily at rest. (3 marks)

22. Given that $y = 2 \sin (2x + 30^0) – 3 \cos 2x$

(a) Complete the table below for the missing values of y correct to 1 decimal place. (3 marks)

X^0	-75	-60	-45	-30	-15	0	15	30	45	60	75	90	105	120
$Y = 2 \sin (2x + 30^0) – 3\cos 2x$	0.9	-0.5		-2.5		-2		0.5		2.5	2.6			-0.5

(b) On the grid provide below, draw the graph of $y = 2 \sin (2x + 30^0) – 3 \cos 2x$.
Use the scale 1cm for 15^0 on the x-axis
1 cm for 1 unit on the y-axis (3 marks)

(c) Use your graph to solve the equation :
$2 \sin (2x + 30^0) = 3 \cos x – 1$ (2 marks)

(d) Find the amplitude and period of the graph in (b) above. (2 marks)

23. A rural factory manufactures broilers food made from sunflower seed, millet and maize in the ratio 5 : 3 : 1. Sunflower seeds are imported in to the country from Philippines at a cost of $204.50 for 30kg or from Germany at £ 96.4 for 20kgs. The exchange rate is 1 us $ =£ 0.718. Bags are filled with the food at the rate of 420 grammes per second.

(a) How much is the quantity of sunflower seed in 15kg of the food? (2 marks)

(b) Determine the cheapest source of this sunflower seed, clearly stating the difference in cost in terms of US$. (3 marks)

(c) Determine the number of bags of the food packed in 4 hours given a bag is 15kg. (2 marks)

(d) A trader buys the food from the factory and sells each bag at Ksh. 1377, thereby making a profit of 12.5%. Determine his buying price. (3 marks)

24. (a) Sketch the graph of $y = 6x - x^2$. (2 marks)

(b) Using 4 trapezia, determine the area bounded by the curve $y = 6x - x^2$ and the lines $x = 0$ and $x = 6$ (3 marks)

(c) Calculate the exact area of the region in (b) above. (3 marks)

(d) Find the percentage error in calculating the area using trapezium method. (2 marks)

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MATHEMATICS ALT A
PAPER 2
OCT / NOV 2013

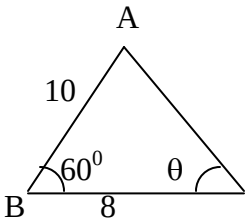
KIBWEZI DISTRICT FORM 4 INTER-SCHOOLS EXAMINATION
Kenya Certificate of Secondary Education (K.C.S.E)
MATHEMATICS ALT A
PAPER 2

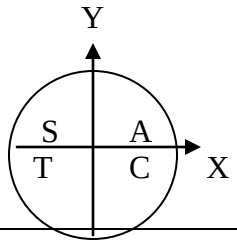
MARKING SCHEME

1. det $\Rightarrow$ $-4 - 4 = -8$ $T^{-1} = \frac{-1}{8}\begin{pmatrix}-2 & -4\\ -1 & 2\end{pmatrix}$ $\begin{pmatrix}2 & 4\\ 1 & -2\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}8\\ 2\end{pmatrix}$ $-\frac{1}{8}\begin{pmatrix}-2 & -4\\ -1 & 2\end{pmatrix}\begin{pmatrix}2 & 4\\ 1 & -2\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix} = \frac{-1}{8}\begin{pmatrix}-2 & -4\\ -1 & 2\end{pmatrix}\begin{pmatrix}8\\ 2\end{pmatrix}$ $\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix} = \frac{-1}{8}\begin{pmatrix}-24\\ -4\end{pmatrix}$ $\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}3\\ 0.5\end{pmatrix}$ $\Rightarrow (x, y) = (3, 0.5)$	B1 M1 A1	√ inv
	03	
2. $x^2 + y^2 - 4x + 6y - 3 = 0$ $x^2 - 4x + y^2 + 6y = 3$ $x^2 - 4x + (-2)^2 + y^2 + 6y + (3)^2 = 3 + 4 + 9$ $(x - 2)^2 + (y + 3)^2 = 16$ $(x - 2)^2 + (y + 3)^2 = 4^2$ Centre (2, -3) Radius = 4 units	M1 M1 A1	both radius and centre
	03	
3. Let the angle with the pole be x $3x + x = 90$ $\therefore x = {}^{90}/_{4} = 22.5^0$ Wire $\longrightarrow \frac{6}{\text{Sin } 22.5} = 15.68\text{m}$	M1 A1 B1	
	03	

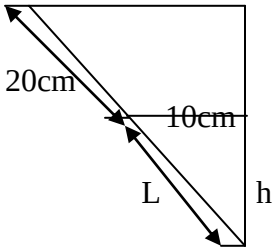
This paper consists of 10 printed pages

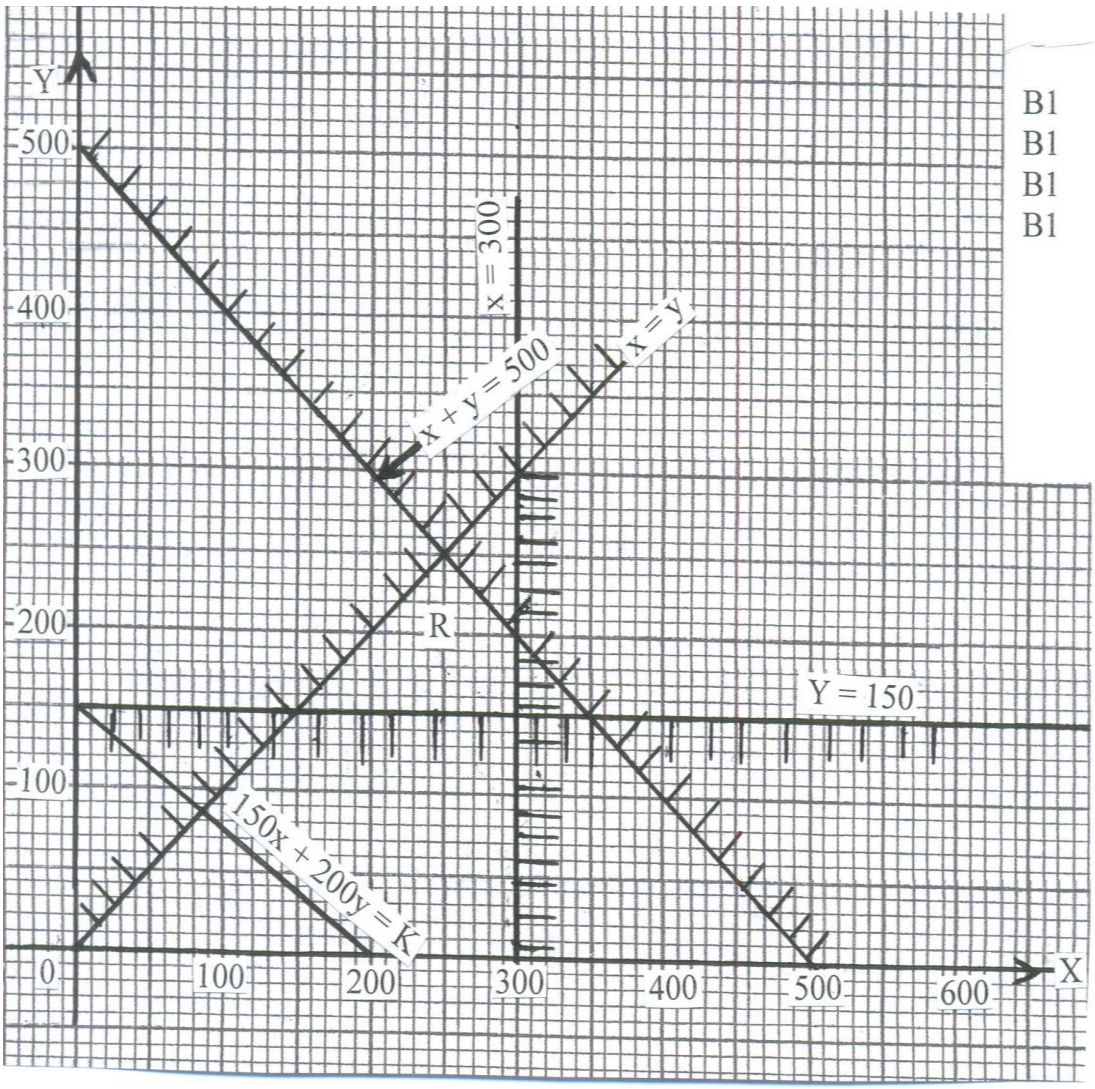
Turn Over

4. 	$b^2 = 10^2 + 8^2 - 2\,(10)\,(8)\cos 60^0$ $= 84$ $\longrightarrow$ $b = \sqrt{84} = 9.165$cm $\frac{9.615}{\sin 60^0} = \frac{10}{\sin \theta}$ $\sin\theta \longrightarrow \frac{10 \sin 60^0}{9.165} = 0.9449$ $\theta = \sin^{-1}(0.9449)$ $= 70.89^0$	M1 A1 M1 A1	
		04	
5. (i)	PR x PN = PM x PS 2 x 12 = 3 x PS $\longrightarrow$ PS = 8cm	M1 A1	
(ii)	$PQ^2 = 2 \times 12 = 24$ $\longrightarrow$ $PQ = \sqrt{24} = 4.899$cm	B1	
		03	
6.	$1470 = 2 \times 3 \times 5 \times 7 \times 7$ $2 \times 3 \times 5 \times 7^2$ $7056 = 2^4 \times 3^2 \times 7^2$ $\frac{1470^2}{\sqrt{7056}} = \frac{2^2 \times 3^2 \times 5^2 \times 7^4}{2^2 \times 3 \times 7}$ $= 3 \times 5^2 \times 7^3$	B1 M1 A1	
		03	
7.	$\text{Log}\left(\frac{3x+8}{8}\right) = \log(x-4)$ $\frac{3x+8}{8} = x - 4$ $5x = 40$ $x = 8$	M1 M1 A1	√ single logs √ linear eqn
		03	
8.	$3x + x = 180^0$ $x = \frac{180^0}{4} = 45^0$ $n = \frac{360^0}{45^0} = 8$ sides	M1 M1 A1	
		03	

9.	$d = (X – A)$ | d | -15 | -10 | 0 | 5 | 10 | $\sum d = -10$ | | d^2 | 225 | 100 | 0 | 25 | 100 | $\sum d^2 = 450$ | $s.d = \sqrt{\left(\frac{450}{5}\right) - \left(\frac{-10}{5}\right)^2}$ $= \sqrt{86}$ $= 9.274$	B1 M1 A1	
		03	
10.	 $2 (1 – \cos^2 x) – 3 \cos x = 0$ $2 \cos^2 x + 3 \cos x – 2 = 0$ $(\cos x + 2) (2 \cos x – 1) = 0$ Either $\cos x = -2$ or ½ $x = \cos^{-1} (½) = 60^0$ $\therefore x = 60^0$ or 300^0	M1 M1 A1 B1	√subt √ fact both √
		04	
11.	$MN \begin{pmatrix} 3 & 0 \\ 1 & 3 \end{pmatrix} \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix} = \begin{pmatrix} 6 & 0 \\ 2 & 6 \end{pmatrix}$ $\begin{pmatrix} 6 & 0 \\ 2 & 6 \end{pmatrix} \begin{matrix} R \\ \begin{pmatrix} 3 \\ -2 \end{pmatrix} \end{matrix} = \begin{matrix} R^1 \\ \begin{pmatrix} 18 \\ -6 \end{pmatrix} \end{matrix}$ $\therefore R^1 (18, -6)$	M1 M1 A1	
		03	
12.	$\frac{dy}{dx} = 3 – 2x \ (x = 2)$ Gradient $= 3 – 2 (2)$ $= -3$ $g_1 \times g_2 = -1 \longrightarrow g_2 = {}^1/_3$ Eqn : $\frac{y + 5}{x – 3} = \frac{1}{3}$ $y = {}^1/_3 x – 6$	M1 M1 A1	√ eqn only
		03	
13.	$L.S.F = {}^{10}/_8 = {}^5/_4$ $A.S.F = {}^{25}/_{16}$ $\frac{25}{16} = \frac{480}{x}$	B1 M1	

$x = 480 \times {}^{16}/_{25}$ $= 307.2cm^2$	A1	
	03	
14. Max. Vol $= {}^{22}/_{7} \times (14.05)^2 \times 15.55 = 9647cm^3$ Actual vol $= {}^{22}/_{7} \times 14^2 \times 15.5 = 9548cm^3$ Min vol $= {}^{22}/_{7} \times (13.95)^2 \times 15.45 = 9449cm^3$ % error $= \frac{½ (9647 - 9449)}{9548} \times 100$ $= 1.037\%$ (4 sfs)	M1 M1 A1	for both min & max
	03	
15. (a) $P(RP) = {}^{3}/_{8} \times {}^{3}/_{8}$ $= {}^{9}/_{64}$	B1	
(b) P(RB) or P(BR) $= ({}^{3}/_{8} \times {}^{5}/_{8}) + ({}^{5}/_{8} \times {}^{3}/_{8})$ $= {}^{15}/_{32}$	M1 A1	
	03	
16. Let breadth = x; length = (x + 14) m $x(x + 14) = 1800$ $x^2 + 14x - 1800 = 0$ $(x + 50)(x - 36) = 0$ Either x = -50 or 36 $\therefore$ Breadth = 36m	M1 M1 A1	√ exp √ fact
	03	
SECTION II – 50 MARKS		
17. (a) (i) Taxable income (P.M) = 19,800 + 13500 = Kshs.33,300	B1	
Tax payable 1st 10,164 ${}^{2}/_{20} \times$ sh 10,164 = sh. 1016.40 Next 9576 ${}^{3}/_{20} \times$ sh 9576 = sh. 1436.40 Next 9576 ${}^{4}/_{20} \times$ sh 9576 = sh. 1915.20 Rem 3984 ${}^{5}/_{20} \times 3984$ = sh 996.00 Total tax = Kshs. 5364	M1 M1 A1	
(ii) Net tax = 5364 – 1162 = Ksh 4202 p.m	M1 A1	

	(b)	(i) T. Deductions = 150 + 420 + 494 + 4202 = Kshs. 5366 p.m	M1 A1	
		(ii) Net monthly pay = 33,300 – 5366 = Kshs. 27,934	M1 A1	
			10	
18.	(a)	 $\frac{10}{14} = \frac{L}{20 + L}$ L = 50cm $h = \sqrt{50^2 - 10^2}$ h = 48.99cm $H = \sqrt{70^2 - 14^2}$ H = 68.59cm	B1 B1	for both 48.99 & 68.59
		Vol big cone = $^1/_3$ x 3.142 x 14^2 x 68.59 = 14,079.973	M1	
		Vol small cone = $^1/_3$ x 3.142 x 10^2 x 48.99 = 5,130.886		
		Vol of water 14,079.973 – 5,130.886 = 8,949.09cm^3	M1 A1	
	(b)	3.142 x 12^2 x h = 8949.09 h = 19.78cm	M1 A1	
		S.A = 2 x 3.142 x 12 (40 – 19.78) =1,524.75cm^2	M1M1 A1	
			10	
19.	(a)	(i) x + y ≤ 500 …….(i) x ≥ y ……(ii) x ≤ 300 …….. (iii) y ≥ 150 …….. (iv)	B1 B1 B1 B1	
	(b)	(i) x + y = 500; x = 0, y = 500 y = 0, x = 500		
		(ii) x = y		
		(iii) x = 300		
		(iv) y = 150		



B1 1st inequality
B1 2nd inequality
B1 3rd inequality
B1 4th inequality

(c) 150x + 200y = K (K = 50,000)

When x = 0, y = 150

y = 0, x = 200

Medium shirts = 250 B1

Large shirts = 250 B1

10

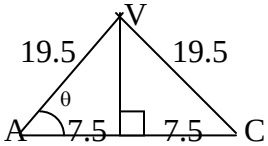
20. (a) AC = $\sqrt{12^2 + 9^2}$ = 15cm M1

Or^2 = $19.5^2 - 7.5^2$

= $\sqrt{324}$

= 18cm A1

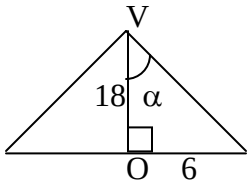
(b)



Cos θ = $\frac{7.5}{19.5}$ = 0.3846 M1

θ = $\cos^{-1}$ (0.3846)

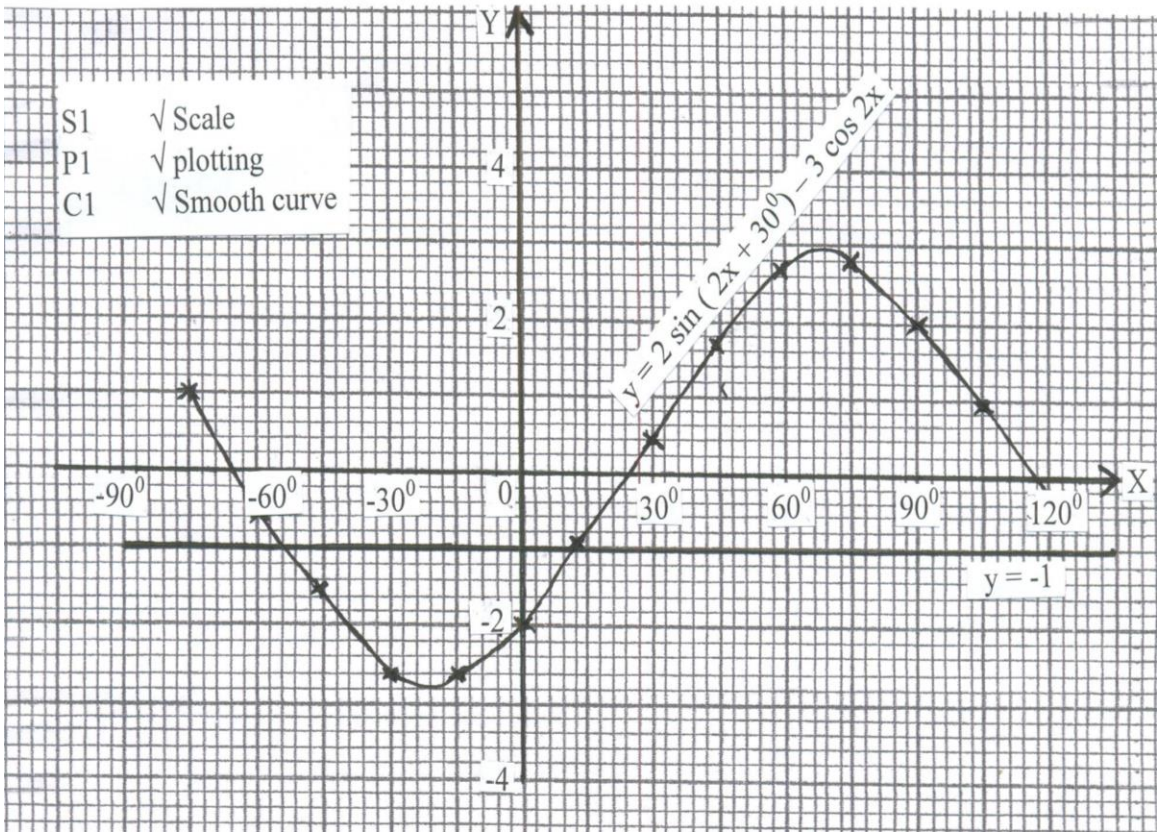
= 67.38^0 A1

	(c)		Tan α = $^{6}/_{18}$ = 0.3333 α = $\tan^{-1}$ (0.3333) = 18.43^{0} Required angle = 2 (18.43) = 36.86^{0}	B1 M1 A1	angle α identified
	(d)	Vol	= $^{1}/_{3}$ x 12 x 9 x 18 = $648cm^{3}$	M1 A1	
				10	
21.	(a)	At t = 2,	V = 10 + (5(2) – $2(2)^{2}$ = 10 + 10 – 8 = 12 m/s	M1 A1	
	(b)	a =	$\frac{dv}{dt} \longrightarrow$ 5 – 4t (t = 2) = 5 -4 (2) = $-3m/s^{2}$	 B1	
	(c)	$S = \int_{2}^{4} (10 + 5t – 2t^{2})\, dt$			
		=	$\left[10t + {}^{5}/_{2}t^{2} – {}^{2}/_{3}t^{3}\right]_{2}^{4}$	M1	√ integ
		=	(40 + 40 – $42^{2}/_{3}$) – (20 + 10 – $5^{1}/_{3}$)	M1	
		=	$37^{1}/_{3} – 24^{2}/_{3}$	M1	
		=	$12^{2}/_{3}$ m	A1	
	(d)	At rest, V =0 $\longrightarrow$ $2t^{2} – 5t – 10 = 0$ t = $\frac{5 \pm \sqrt{25 – (4 \times 2 (-10)}}{2 (2)}$		 M1	√ subt
		=	$\frac{5 \pm \sqrt{105}}{4}$	M1	
		t = 3.812 sec		A1	
				10	

22. (a)

X^0	-75	-60	-45	-30	-15	0	15	30	45	60	75	90		105	120
$Y = 2 \sin (2x + 30^0) – 3 \cos 2x$			-1.7		-2.6		-0.9		1.7			2		0.9	

B3 all √



(c) $2 \sin (2x + 30^0) = 3 \cos 2x – 1$

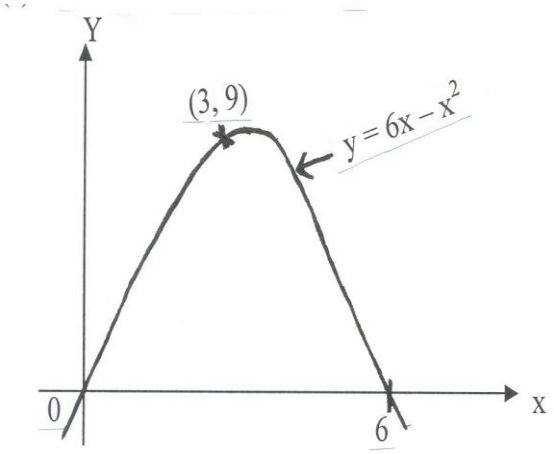
$y = -1$

$x = -54^0$ or 12^0 ($\pm 1^0$) B1B1

(d) Amplitude = 2.7 (± 0.1) B1

Period = 180^0 B1

10

23.	(a)	$^5/_9$ x 15 $=8^1/_3$ kgs	M1 A1	
	(b)	Philippines cost per kg $= \frac{204.5}{30}$ = US$ 6.817	M1	
		Germany cost per kg $\frac{96.4}{20 \times 0.718}$ = US $ 6.713	M1	
		Germany by 6.817 – 6.713 = $ 0.104	A1	
	(c)	$\frac{4 \times 420 \times 3600}{15 \times 1000}$ = 403.2 bags	M1 A1	
	(d)	Buying price $\frac{1377}{112.5}$ x 100 =1,224/=	M1M1 A1	
			10	
24.	(a)	 $6x - x^2 = 0$ x = 0 or 6		
		$\frac{dy}{dx}$ $6 - 2x = 0$ x = 3 When x = 3, y $6(3) - (3)^2 = 9$ Turning point (3, 9)	B2	√ sketch

(b) h $\frac{6-0}{4} = 1.5$		
X | 0 | 1.5 | 3 | 4.5 | 6 Y | 0 | 6.75 | 9 | 6.75 | 0	B1	√ table of values
Area = ½ (1.5) (0 + 2 (6.75 + 9 + 6.75) + 0)	M1	√subt
$= {}^{1.5}/_{2}$ [2 (22.5)]		
= 1.5 x 22.5		
= 33.75 sq. units	A1	
(c)		
Area = $\int_0^6 (6x - x^2)\, dx$ $\left(3x^2 - \frac{x^3}{3}\right)_0^6$	M1	√ integ
= $3(6)^2 - \frac{(6)^3}{3} - 0$	M1	
= 108 -72		
= 36 sq. units	A1	
(ds % error = ($\frac{36 - 33.75}{36}$) x 100	M1	
= 6.25%	A1	
	10	