Name _____ Index No. _____

Candidate's Signature _____

Date _____

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

FORM IV MID YEAR ASSESSMENT TEST
Kenya Certificate of Secondary Education
MATHEMATICS ALT A
PAPER 1
2 ½ HOURS

INSTRUCTION TO CANDIDATES

(a) Write your name and index 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 section: 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-programammable silent 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	

GRAND TOTAL

This paper consists of 15 printed pages

Turn Over

SECTION I (50 MARKS)

Answer all the questions in this section in the spaces provided after every question.

1. Without using a calculator evaluate . (3 marks)

$$\frac{-7\,(-5+3) - 27 \div -3 + 7}{3 \times -7 + -19 \times -1}$$

2. The scale of a map is 1 : 50000. A lake on the map is $6.16cm^2$. Find the actual area of the lake in hectares. (3 marks)

3. The interior angle of a regular polygon is 150^0. Determine the number of sides of the polygon. (3 marks)

4. Write down the inequalities that satisfy the unshaded region in the figure below. (4 marks)

Y-axis (-4, 4) (8, 0) X-axis (c) (a) (-4, -9) (b)

5. Jane travels at an average speed of 60km/hr for 2 hours. She then travels a distance of 84km at an average speed of 70km/hr. Calculate the average speed of the whole journey. (3 marks)

6. Solve the following simultaneous equations.

$4x - 3y = 14$

$3x + y = 4$

7. The figure below is a rhombus ABCD of sides 4cm. BD is an arc of circle centre C.
Given that $\angle ABC = 138^0$, find the area of the shaded region. (3 marks)

4cm

8. Two metal spheres of radius 2.3cm and 2.86cm are melted. The molten material is used to cast equal cylindrical slabs of radius 8mm and length 70mm. If $^1/_{20}$ of the metal is lost during casting. Calculate the number of complete slabs casted. (4 marks)

9. Pipe A can fill a drum in 6 minutes while pipe B can fill it in 10 minutes. A drainage pipe C can empty the full drum in 5 minutes. Pipes A and B are opened and left running for 3 minutes. The drainage pipe C is then opened and all three left running. Find how many more minutes it takes to fill the drum.

10. The image of P(5, 5) under an enlargement scale factor 2 is P^1 (8, 7). Find the coordinates of the centre of enlargement. (3 marks)

11. Find the equation of the perpendicular line that passes through the mid point X of C (-7, 3) and D (3, -8). (3 marks)

12. Solve the trigonometrical equation to the nearest degree given that $0^0 \leq x \leq 180^0$

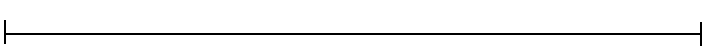
$-\frac{1}{2} \tan (2x - 30^0) = 0.8$ (4 marks)

13. Y is a point (4, -8). If OY = a – 2b and $a = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$, find the column vector for b, where O is the origin. (2 marks)

14. Factorise completely the expression $45a^2 - 20b^2$ and hence or otherwise find its value when a = 5 and b = 3. (3 marks)

15. Make V the subject of the formula $T = \frac{1}{2} m (u^2 - v^2)$. (3 marks)

16. Using a set square, a ruler and pair of compasses. Divide the given line into 5 equal portion. (5 marks)



SECTION II (50 marks)
Answer only five questions in this section

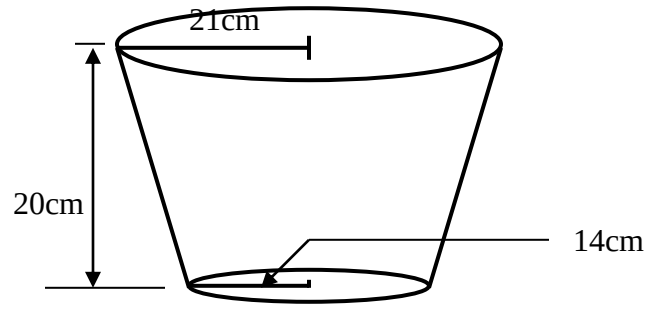
17. (a) Divide $100cm^3$ in the ratio ¼ : ½ : $^1/_5$ to the nearest whole number. (3 marks)

(b) In a Chemistry experiment, a boy mixed some acid solution of 45% concentration with an acid solution of 25% concentration. In what proportion should the two acids be mixed in order to get $100cm^3$ of solution of 30% concentration. (3 marks)

(c) (i) Two blends of tea costing sh. 140 and sh. 160 per kg respectively are mixed in the proportion of 2 : 3 by mass. The mixture is then sold at sh. 240 per kg. Find the gain percent. (2 marks)

(ii) In what ratio should the two blends be mixed to get a mixture that costs sh. 148 per kg. (2 marks)

18. A bucket is in the shape of a frustum with base radius 14cm and top radius 21cm. The height of the bucket is 20cm as shown below. The bucket is full of water.



(a) Calculate the volume of water (Take $\pi = {}^{22}/_{7}$) (6 marks)

(b) All the water is poured into a cylindrical container of a circular radius 14cm. If the cylinder height is 60cm, calculate the surface area of the cylinder which is not in contact with water. (4 marks)

19. A school ordered books worth Ksh. 28,000 priced at Ksh. X each. Because of the number involved the supplier reduced the price of each book by Ksh. 10 and the school finally decided to spend Kshs. 27,300 on the books.

(a) Write down expressions for: -

(i) The number of books originally ordered. (1 mark)

(ii) The number of books finally obtained. 1 mark)

(b) If the second number is 10 more than the first, write down the equation which X must satisfy. Hence find the price at which the school bought the books. (6 marks)

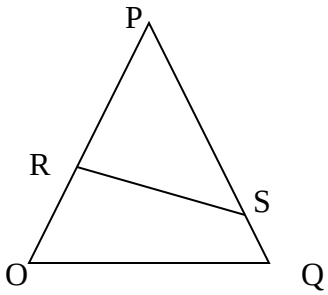
(c) Find the ratio of the number of books to be bought originally to the number of books bought finally. (2 marks)

20. A machine part is a pulley system with two wheels of radii 0.5m and 2m. The centres of the wheels are 4m apart.

(a) If a rope is tied around the wheels externally to complete the pulley. Calculate it's length. (7 marks)

(b) If the rope is tied internally round the pulleys, it is $1^1/_3$m longer than if tied externally. Calculate the length of the required rope to 4 significant figures. (3 marks)

21.



In triangle OPQ above, 2OP = 5OR and 4PQ = 5PS. When RS and OQ are produced, they meet at T. Given that OP = p and OQ = q .

(i) Express the following in terms of $\underset{\sim}{p}$ and $\underset{\sim}{q}$.

OR (1mark)

OS (2 marks)

RS (2 marks)

(ii) Given further that RT = MRS and OT = n OQ, find the values of m and m. (3 marks)

(iii) Find

(a) OT : TQ (1 mark)

(b) RT : TS (1 mark)

22. Mutiso saved Kshs. 2000 during the first year of employment. In each subsequent year he saved 15% more than the proceeding year until he retired.

(a) How much did he save in the second year? (2 marks)

(b) How much did he save in the third year. (2 marks)

(c) Find the common ratio between the savings in two consecutive years. (1 mark)

(d) How much time did he take to save Ksh. 5,800. (2 marks)

(e) How much had he saved after 20 years of service. (2 marks)

23. A triangle has vertices of P (6, 0) Q (6, -5) and R(2, -5). It is mapped onto triangle $P^1Q^1R^1$ by a transformation matrix given by $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

(a) Construct the image triangle $P^1Q^1R^1$ and describe the transformation fully. (3 marks)

(b) Triangle $P^{11}Q^{11}R^{11}$ is the image of triangle $P^1Q^1R^1$ under a reflection in the line $y + x = 0$. State the coordinates of the image triangle $P^{11}Q^{11}R^{11}$. (3 marks)

(c) Triangle $P^{11}Q^{11}R^{11}$ is transformed by matrix $\begin{pmatrix} 2 & -3 \\ 1 & 4 \end{pmatrix}$ onto triangle $P^{111}Q^{111}R^{111}$.

Find the area of image triangle $P^{111}Q^{111}R^{111}$. (2 marks)

(d) What single transformation matrix maps triangle $P^{11}Q^{11}R^{11}$ onto PQR? Describe the transformation fully. (2 marks)

24. A particle moves in a straight line and passes a point Q when t = 0 sec but velocity V = 5m/s, it accelerates at the rate of a m/s^2 given by the formula a = 6t + 4 when t is time taken.

(a) Express the velocity of the particle at t seconds in terms of t. (3 marks)

(b) What is the velocity at t = 3 sec? (3 marks)

(c) Calculate the distance covered between t = 1 and t = 4. (4 marks)

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MARKING SCHEME

1. $\frac{-7 \times -2 + 9 + 7}{-21 + 19} = \frac{14 + 16}{-2}$	M1 1 A1	for numerator or 14 + 16 seen denominator or -2 seen corr. Answer
= -15		
	3	
2. L.S.F ⟶ 1 : 50000 1 rep 500m A.S.F ⟶ $1cm^2$ rep $250000cm^2$	B1	for A.S.F
Area = $\left(\frac{6.16 \times 250000}{10000}\right)$ ha	M1	
154 ha	A1	
	3	
3. Interior angle $180 - 150 = 30^0$	M1	Substitution
$n = \frac{360}{30} = 12$ sides	A1	
	2	
4. (a) $x \geq -4$	B1	
(b) $y = -x$		
$y + x \leq 0$	B1	
(c) Gradient = ¾		
$y = ¾ x - 6$	M1	
$y - ¾ x > -6$	A1	
	4	

This paper consists of 10 printed pages

Turn Over

5.	Asf = 48 : 147 Lsf = $\sqrt{48}$: $\sqrt{147}$ $\frac{\sqrt{48}}{\sqrt{147}} = \frac{4.8}{x}$ x = 8.4cm vsf = $(4.8)^3 : (8.4)^3$ $4^3 : 7^3$ 64 : 343	M1 A1 M1 A1	Lsf & equating to the ratio corr. answer cubing Lsf corr. Answer
		4	
6.	$4x - 3y = 14$ $4x = 14 + 3y$ $x = {}^7/_2 + {}^3/_4 y$ $3({}^7/_2 + {}^3/_4 y) + y = 4$ $^{21}/_2 + {}^9/_4 y + y = 4$ $42 + 9y + 4y = 16$ $13y = 16 - 42$ $13y = -26$ $y = -2$ $x = {}^7/_2 + {}^3/_4 x - 2$ $= {}^7/_2 - {}^3/_2 = {}^4/_2 = 2$ $x = 2$	M1 M1 A1	correct substitution for two correct values of x and y
		3	
7.	Area rhombus = $4 \times 4 \sin 42^0$ Area of sector = $\frac{42}{360} \times \frac{22}{7} \times 4 \times 4$ $10.71 - 5.867$ $= 4.796$	M1 M1 A1	√ for both area √ dict in area
		3	
8.	Vol of the two Spheres = $^4/_3 \times {}^{22}/_7 (2.3^3 + 3.86^3)$ $= 291.99$ Remaining material = $^{19}/_{20} \times 291.99$ $= 277.297$ No. of slabs = $\frac{277.297}{\pi \times 0.8^2 \times 7}$ = 19 slabs	M1 $^{22}/_7$ M1 M1 A1	follow through if $^{22}/_7$ not used as π
		4	

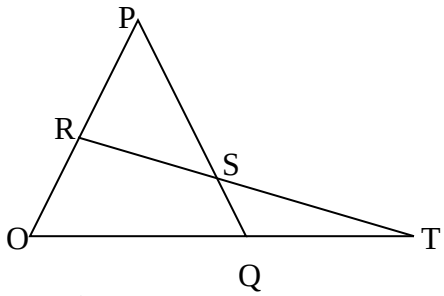
9.	1 minute A = $^1/_6$ of drum B = $^1/_{10}$ of drum C = $-^1/_5$ of drum	B1	
	1 minute A and B = $^1/_6 + ^1/_{10} = \frac{5+3}{30}$ $= ^8/_{30}$ $= ^4/_{15}$ 3 minutes = $^{12}/_{15}$	M1	
	Remaining $1 - ^4/_5 = ^1/_5$ $= ^1/_5$	M1	
	Fraction filled by the three in one minute $\frac{4}{15} - \frac{1}{5} = \frac{4-3}{15} = \frac{1}{15}$	M1	
	More time $^1/_5 \div ^1/_{15}$ = 3 minutes	A1	
		5	
10.	Let the centre be (x , y) $\begin{pmatrix} 8-x \\ 7-y \end{pmatrix} = 2 \begin{pmatrix} 5-x \\ 5 \quad y \end{pmatrix}$		
	$8 - x = 10 - 2x$ $x = 10 - 8$ $x = 2$	M1	equating the x –co-ordinate
	$7 - y = 2 (5 - y)$ $y = 10 - 7$ $y = 3$	M1	equating the y – co-ordinates
	Centre (2, 3)	A1	corr answer
		3	
11.	Mid pt $\left(\frac{-7+3}{2} , \frac{3+-8}{2} \right) = (-2, -2.5)$	B1	
	Grd (L_1) = $\frac{y - -2.5}{x - -2} = \frac{y + 2.5}{x + 2}$		
	Grd (L_2) = $\frac{3 - -8}{-7 - 3} = \frac{-11}{10}$		
	$L_1L_2 = -1$ $L_2 = ^{10}/_{11}$		
	$\frac{y + 2.5}{x + 2} = \frac{10}{11}$	M1	

$11y + 27.5 = 10x + 20$ $11y = 10x + 20 - 27.5$ $y = \frac{10x - 7.5}{11}$ Or $11y = 10x - 8.25$	A1	
	3	
12. $\tan(2x - 30^0) = -1.6$ $2x - 30^0 = 57.9946^0$ $\simeq 58^0$	B1	
Angles in 1st quad, $2x - 30 = 58, 418, \ldots$ $2x = 88, 448 \ldots$ $x = 44, 224 \ldots$	B1	
Angles in 3rd quad $2x - 30 = 238, 598 \ldots$ $2x = 268, 628$ $x = 134, 314$ $\therefore x = 44^0, 134^0$	B1 B1	
	4	
13. Let $b = \begin{pmatrix} x \\ y \end{pmatrix}$ $\begin{pmatrix} 4 \\ -8 \end{pmatrix} = \begin{pmatrix} 2 \\ 0 \end{pmatrix} - 2\begin{pmatrix} x \\ y \end{pmatrix}$ $b = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$	M1 A1	
	2	
14. $5(9a^2 - 4b^2)$ $5(3a - 2b)(3a + 2b)$ $5(15 - 6)(15 + 6)$ $5 \times 9 \times 21$ $= 945$	B1 M1 A1	for √ simplified exp. √ substitution & simplification
	3	
15. $T = \frac{1}{2} m(u^2 - v^2)$ $2T = mu^2 - mv^2$ $mv^2 = mu^2 - 2T$	M1	opening brackets

$v^2 = \frac{mu^2 - 2T}{m}$	M1	
$v = \sqrt{\frac{mu^2 - 2T}{m}}$	A1	
	3	
16.	B1	A line drawn slunt to touch the given line at one end
	B1	subdivided to 5 equal sections
	B1	// lines drawn from slunt line to touch the given line, all complete.
	3	
SECTION II		
17. (a) ¼ : ½ : $^1/_5$ = 5 : 10 : 4		
¼ ⟶ $^5/_{19}$ x 1000 = 263	B1	
½ ⟶ $^{10}/_{19}$ x 1000 = 526	B1	
$^1/_5$ ⟶ $^4/_{19}$ x 1000 = 210	B1	
(b) Let vol. of 45% be x		
∴ 25% = 100 – x		
$\frac{0.45x + 0.25(100 - x)}{100} = 30\%$	M1	
0.20x = 5.0		
x = 25cm^3	A1	
Vol. of 45% = 25		
Vol. of 25% = 75		
Ratio = 1 : 3	B1	
(c) (i) Cost of 1kg mixture		
$^2/_5$ x 140 x $^3/_5$ x 160	M1	
= 152		
Profit = 240 – 152		
= Sh. 88		
Gain = $^{88}/_{152}$ x 100 = 57.9	A1	
(ii) 140 160		
148		
12 8	M1	follow through for alternative
Ratio 3 : 2	A1	
	10	

18. (a)	$H = a + 20$ $\frac{H}{h} = \frac{21}{14}$	M1	
	$\frac{h + 20}{h} = \frac{21}{14} = \frac{3}{2}$		
	$\frac{h + 20}{h} = \frac{3}{2}$	M1	
	$2(h + 20) = 3h$ $2h + 40 = 3h$ $h = 40$		
	$H = 60$	A1	
	$v = \frac{1}{3}\pi R^2H + -\frac{1}{3}\pi r^2h$		
	$\frac{1}{3} \times \frac{22}{7} \times 21 \times 21 \times 60 - \frac{22}{7} \times \frac{1}{3} \times 14 \times 14 \times 20$	M1	correct substitution
	$27720 - 8213.33$	M1	
	$= 19,506.67cm^3$	A1	
(b)	$v = \pi R^2h$ $= \frac{22}{7} \times 14 \times 14 \times 60$ $= 36960$	M1	
	Volume of cylinder above water $36960 - 19506.67$ $= 17,453.33$	A1	
	Height $= \frac{\text{Volume}}{\text{Base area}}$		
	$= \frac{17453.33}{\frac{22}{7} \times 14 \times 14}$		Method for correct Substitution and answer
	$= 8.1cm$		
	$A = 217$ $= 2 \times \frac{22}{7} \times 14 \times 8.1$		
	$= 712.38cm^2$	A1	
		10	
19. (a) (i)	$\frac{28000}{x}$	B1	
(ii)	$\frac{27300}{x - 10}$	B1	
(b)	$\frac{28000}{x} + 10 = \frac{27300}{x - 10}$	B1	
	$28000 (x - 10) + 10x(x - 10) = 27300x$	M1	removal unknown from den.
	$28000x - 280,000 + 10x^2 - 100x = 27300x$ $10x^2 + 600x - 280,000 = 0$	M1	quadratic eqn
	$x^2 + 60x - 280,000 = 0$		

$x = \frac{-60 \pm \sqrt{60^2 - 4 \times 1x - 28000}}{2 \times 1}$		
$= \frac{-60 \pm 340}{2}$	M1	factorising
Ksh. 140	A1	accuracy
Price = 140 – 10 = Ksh. 130	B1	per price of bks
(c) Original No. of bks : final No. of bks		
$\frac{28000}{140} : \frac{27300}{130}$	M1	
200 : 210		
20 : 21	A1	
	10	
20. W 2		
PU = QV = QW = RS		
$= \sqrt{4^2 - 1.5^2}$	M1	
= 3.708cm	A1	
$\sin \theta = \frac{1.5}{4}$		
$O = 22.02^0$		
$\angle PQR = 135.96^0$	B1	
Arc PR = $\frac{135.96}{360} \times 2\pi \times 0.5$	M1	
= 1.187		
Arc US Subtends $\angle$		
360 – 2 (90 – 22.02)		
$= 224.04^0$	B1	
Arc US = $\frac{224.04}{360} \times 2 \times \pi \times 2$	M1	
= 7.822		
Total length		
= (3.708 x 2) + 1.187 + 7.822	M1	
= 16.42	A1	

(b) $^4/_3$ x 16.42 = 22.90	M1 A1	
	10	
21.  OR = $^2/_5$ p PQ $^5/_4$ PS But PQ = a – p PS = $^4/_5$ PQ = $^4/_5$ (q – p) PS = OS - OP = OS - p OS - p = $^4/_5$ (q – p) OS = $^4/_5$a – $^4/_5$p + p OS = $^1/_5$p + $^4/_5$q RS = RP + PS $^3/_5$ p + PS [PS = $^4/_5$ PQ] RS = $^3/_5$p + $^4/_5$ (q – p) = $^3/_5$ p + $^4/_5$ q - $^4/_5$ p = $^4/_5$ q – $^1/_5$ p RT = MRS = M ($^4/_5$ q – $^1/_5$ p) …(i) OT = nq RT = RO + OT = $^2/_5$ – p + nq …. (ii)	B1 M1 A1 A1	

(i) =(ii) $^4/_5mq - {}^1/_5\ mp = {}^2/_5\ p + nq$ $^4/_5\ qm = nq$ $^4/_5 m = n$ $-{}^1/_5\ mp = {}^2/_5\ p$ $m = {}^2/_5 \times -{}^5/_1$ $m = -2$ $n = {}^4/_5 \times -2$ $= -{}^8/_5$ (iii) (a) $OT = -{}^8/_5\ OQ$ $OQ = -{}^5/_8\ OT$ $OT : TQ = 8 : -3$ (b) $RT = -2RS$ $RT : TS = 2 : -1$	M1 M1 A1 B1 B1	equating (i) & (ii) dropping vectors p and q both values of m and n
	10	
22. (a) $2000 \times {}^{115}/_{100}$ $= 2300$ (b) $2300 \times {}^{115}/_{100}$ $= 2645$ (c) $\frac{2300}{2000} = 1.15$ (d) $\frac{a(r^n - 1)}{r - 1} = 58000$ $2000 \left(\frac{1.15^n - 1}{1.15 - 1}\right) = 58000$ $\frac{20000}{0.15}(1.15^n - 1) = 58000$ $1.15^n - 1 = \frac{58000 \times 0.15}{20000}$ $1.15^n - 1 = 4.35$ $1.15^n = 5.35$	M1 A1 M1 A1 M1 A1 M1	1 for correct ration 1 for correct answer correct substitution and calculation

	$n \log 1.15 = \log 5.35$ $n = \frac{\log 5.35}{\log 1.15} = 12$ years	A1	
(e)	$S_{20} = \frac{2000\ (1.15^{20} - 1)}{1.15 - 1}$	M1	Correct substitution and calculation
	$= \frac{2000\ (1.15^{20} - 1)}{0.15}$ $= 204{,}887.15$	A1	
		10	
23. (a)	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} P & Q & R \\ -6 & 6 & 2 \\ 0 & -5 & -5 \end{pmatrix} = \begin{pmatrix} P^1 & Q^1 & R^1 \\ 0 & -5 & -5 \\ -6 & -6 & -2 \end{pmatrix}$	B1	
	^{P1} (0, -6) Q^1 (-5, -6) and R^1 (-5, -2)	B1	
	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ T1 a negative quarter turn about origin or ¾ turn about origin (270^0)	B1	
(b)	Draw the line y =-x 0, y + x =0 Reflect points P^1 (9, -6) Q^1 (-5, -6) and R^1 (-5, -2) along the line y = -x P^{11} (6, 0) Q^{11} (6, 5) and R^{11} (2, 5)	L1	line y = -x
(c)	Area $\Delta P^{111}Q^{111}R^{111}$ = Def x area of $\Delta P^{11}Q^{11}R^{11}$ Def = 8 - -3 = 11		
	Area of $\Delta P^{11}Q^{11}R^{11}$ = ½ x 4 x 5 = 10 units		
	Area of $\Delta P^{111}Q^{111}R^{111}$ = 11 x 10	M1	
	= 110 units	A1	
(d)	$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} 6 & 6 \\ 0 & 5 \end{pmatrix} = \begin{pmatrix} 6 & 6 \\ 0 & -5 \end{pmatrix}$	M1	
	$\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$		
	Reflection in the line x – axis Or y = 0	A1	
		10	
24.	$V = {}^6/_2\, t^2 + 4t + c$	M1	
	$V = 3t^2 + 4t + 5$	M1A1	
	$V = 3 \times 9 + 12 + 5 = 4$	M1A1	correct substitution and answer
	$d = t^3 + 2t^2 + 5t + c$	M1	
	$t^3 + 2t^2 + 5t$	M1	
	$64 + 32 + 20 - (1 + 2 + 5)$	M1	
	$= 108$	M1A1	
		10	

Name _____ Index No. _____

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Turn Over

SECTION I

1. Use logarithm tables to evaluate (3 marks)

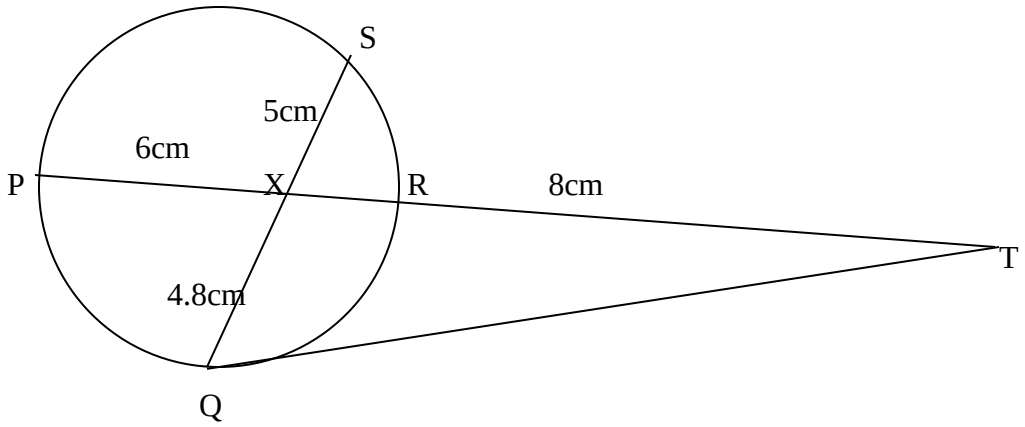
$$\left(\frac{1.681 \times 0.267}{0.042}\right)^{3/2}$$

2. Simplify

$$\frac{9}{2\sqrt{3} - \sqrt{2}}$$

(2 marks)

3. In the figure below QT is a tangent to the circle at Q. PXRT and QXS are straight lines. PX = 6cm, RT = 8cm, QX = 48cm and XS = 5cm



Find the length of

(a) XR (2 marks)

(b) QT (2 marks)

4. A quantity x is partly constant and partly varies as y.
Given that y = 3 when x = 14 and y = 4 when x = 20, find x when y = 16. (2 marks)

5. Solve for θ given

$3 \cos (3\theta - 20^0) + 2 = 0$ for $0^0 \leq \theta\ 180^0$. (3 marks)

6. Find the quadratic equation whose roots are $x = -\frac{3}{2}$ and $x = \frac{4}{3}$. (3 marks)

7. The value of a house was Ksh. 50,000 in January 2005. It depreciated by 20% by the end of the year. Thereafter it depreciated by 10% of its previous years; value .

Find (a) The value of the house at the start of 2006. (2 marks)

(b) The value of the house at the end of 2009. (2 marks)

8. The points P Q and R lie on a straight line. The position vectors of P and R are $2\underset{\sim}{i} + 2\underset{\sim}{j}\ 13\underset{\sim}{k}$ and $5\underset{\sim}{i} - 3\underset{\sim}{j} + 4\underset{\sim}{k}$ respectively. Q divides PR internally in the ratio 2 : 1

Find the position vector of Q in its magnitude. (3 marks)

9. The probability that Wambua will be selected for his school's basketball team is ¼ . If he is selected for the basketball team then the probability that he will be selected for football is $^{1}/_{3}$.

If he is not selected for basketball then the probability that he is selected for football is $^{4}/_{5}$. What is the probability that Wambua is selected for at least one of the two games. (3 marks)

10. Under a combined transformation PQ, the vertices of a triangle ABC, A(3, 2) B (2, -1) and C (-1, -4). The images are A^1 (-2, -3), B^1 (1, -2) and C^1(4, 1). Describe P if Q = $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ (4 marks)

11. A farmer has 100m of metal railing with which to form two adjacent sides of a rectangular enclosing, the other two sides being existing walls of the yards meeting at right angles. What dimensions will give him the maximum area. (3 marks)

12. Expand $(1 + ½ x)^7$ upto the term in x^3.
Use your expansion to find the value of $(0.96)^7$ correct to 3 decimal places. (4 marks)

13. Complete the table below for the function $y = 3x^2 – 8x + 10$ (1 mark)

X	0	2	4	6	8	10
Y	10	6		70		230

Use the values in the table and the trapezoidal rule to estimate the area bounded by the curve $Y = 3x^2 – 8 x + 10$ and the lines $y = 0$, $x = 0$ and $x = 10$. (3 marks)

14. Without using logarithm tables. Find the value of n in the equation.

$\text{Log } n^3 + \log 5n = 5\log_2 - \log(^2/_5)$. (3 marks)

15. Given that a certain circle has a radius of $\sqrt{18}$ and the end points of its diameter are (-3, 2) and (5, 4), write down the equation of the circle in the form $(x - a)^2 + (y + b)^2 = c$ where a, b and c are constants. (3 marks)

16. A train whose length is 86 metres is traveling at 28km/hr in the same direction as a truck whose length is 10 metres. If the speed of the truck is 60km/hr and is moving parallel to the train, calculate the time it takes the truck to overtake the train completely. (3 marks)

SECTION II

17. Last year when the wholesale price of sugar was sh. 36 per kg and that of tea sh. 150 per kg. Mama Juma spent sh. 15,000, to stock her tea kiosk. This year the wholesale price of sugar has increased by 10% while that of tea has increased by 20%. Mama Juma now calculates that she will require sh. 2100 more to buy the same stock as she did last year.

Determine:-

(a) How much sugar and tea mama Juma requires to stock her kiosk. (8 marks)

(b) The percentage increase in the cost of stocking the kiosk. (2 marks)

18. (a) Complete the table below, giving the values correct to 2 decimal places. (2 marks)

x	0	30	60	90	120	150	180	210	240	270	300	330	360
3 cos ($^{x}/_{2}$)	3	2.90	__	2.12	1.50	0.78	__	-0.78	-1.50	__	-2.60	__	-0.300
5 sin ($^{x}/_{2}$ +30)	2.50	3.54	4.33	__	5.00	4.83	__	3.54	2.50	1.29	__	-1.29	__

(b) On the grid provided and using the same axes draw the graphs of
y = 3 cos ($^{x}/_{2}$) and y = 5 sin ($^{x}/_{2}$ + 30) for $0^0 \leq x \leq 360^0$. (4 marks)

(c) Determine the amplitude and period of the wave y = 3 cos $^{x}/_{2}$. (2 marks)

(d) Determine the value of 3 cos ($^{x}/_{2}$) = 5 sin ($^{x}/_{2}$ + 30) (2 marks)

19. The table below shows the tax rates in 2009

Taxable monthly income In Ksh.	Tax payable Rates (%)
1 - 9860	10
9861 – 18800	15
18801 – 27920	20
27921 – 37040	25
37041 and above	30

Mutua's monthly earnings in 2009 were as follows

Basic salary	Ksh.	22,600
House allowance		13,400
Medical allowance		2,660
Transport allowance		1,340

If Mutua is allowed a tax relief of 1325, calculate

(a) His monthly taxable income. (2 marks)

(b) Tax he pays. (6 marks)

(c) Mutua joins an insurance cover and he is further given 8% tax relief.
How much does he earn? (2 marks)

20. The diagram below shows a right pyramid VPQRS with V as the vertex and a rectangular base PQRS. PQ =3cm and QR = 4cm. The height of the pyramid is 6cm.

(a) Calculate

(i) The length PV. (3 marks)

(ii) The angle between face VPQ and the base . (2 marks)

(b) (i) The slant heights VM and VN. (2 marks)

(ii) What is the surface area of the pyramid? (3 marks)

21. The masses of 50 loaves of bread were taken and recorded in the table below.

Mass(gm)	470 – 479	480 – 489	490 – 499	500 – 509	510 – 519	520 – 529	530-539
No. of loaves	1	3	11	21	8	4	2

Using the method of assumed mean of (504.5), estimate

(i) The mean mass. (5 marks)

(ii) The standard deviation of loaves. (5 marks)

22. Two variables A and B are connected by the equation

$A = KB^n$

Where K and n are constants. The table below gives values of A and B.

A	1.50	1.95	2.51	3.20	4.50
B	1.59	2.51	3.98	6.31	11.5

(a) Find the linear equation connecting A and B. (2 marks)

(b) On graph paper draw a suitable straight line graph to represent the relation in (a) above (Scale 1cm to represent 0.1 units on both axes). (5 marks)

(c) Use your graph to estimate the value of k and n to one decimal place. (3 marks)

23. Using a ruler and a pair compasses only construct a parallelogram JKLM such that JK = 8cm and LM = 7cm and angle JKL = 105^0. Construct the loci of P and Q within the parallel lines such that JP ≤ 3cm and KQ ≤ 5cm.

(a) Calculate the area within the parallelogram and outside the area bonded by the loci. (8 marks)
(b) What is the percentage of the area covered by the loci. (2 marks)

24. During installation of electricity bulbs in street lighting, a dealer is required to supply two types of bulbs A and B. The total number of bulbs should not be more than 400. He must supply more of A than B and type A bulbs should not be more than 300 and B should not be less than 80.

(a) Write down in terms of x and y all inequalities representing the information above. (3 marks)

(b) On the grid provided draw all the inequalities and shade the unwanted region. (4 marks)

(c) If type A costs Ksh. 450 per piece and B Ksh. 350 per piece and that the higher the cost the higher the profit,

(i) Use the graph to determine the number of each type of bulb that he should supply to maximize profit. (1 mark)

(ii) Calculate the maximum cost of lighting the streets. (2 marks)

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MATHEMATICS ALT A
PAPER 2
JULY / AUGUST 2011

FORM IV MID YEAR ASSESSMENT TEST
Kenya Certificate of Secondary Education
MATHEMATICS ALT A
PAPER 2

MARKING SCHEME

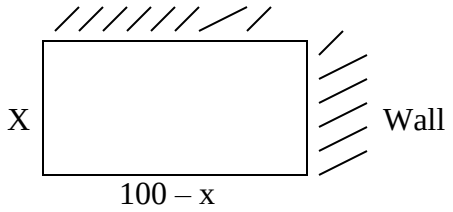
1. No. | Log 1.681 | $\bar{0}.2256$ 0.267 | $\bar{1}.4265$ + | $\bar{1}.6521$ 0.042 | $\bar{2}.6232$ - | $\bar{1}.0289 \times {}^{3}/_{2}$ | $\bar{2}.5435$ $10^{-2} \times 3.495$ = | 0.03495	M1 M1 A1	correct addition correct result
	3	
2. $\frac{9}{2\sqrt{3}-\sqrt{2}} \times \frac{2\sqrt{3}+\sqrt{2}}{2\sqrt{3}+\sqrt{2}}$	1	for conjugate
$= \frac{9\,(2\sqrt{3}+\sqrt{2}}{(2\sqrt{3})^2-(\sqrt{2})^2}$		
$= \frac{18\sqrt{3}+9\sqrt{2}}{12-2}$		
$= \frac{18\sqrt{3}+9\sqrt{2}}{10}$		
$= {}^{9}/_{10}\,(2\sqrt{3}+\sqrt{2}$	A1	
	2	
3. (a) $6.XR = 4.8 \times 5$	M1	
$XR = \frac{4.8 \times 5}{6}$		
$= 4$	A1	
(b) $QT^2 = (6 + 4 + 8)\,18$	M1	
$= 144$		
$QT = 12$	A1	
	4	

This paper consists of 11 printed pages

Turn Over

4.	$x = a + by$ $14 = a + 3b$ $20 = a + 4b$ – $-6 = -b$ $b = 6$ $a = 14 – 18$ $= -4$ $x = -4 + 6y$ when $y = 16$ $x = -4 + (6 \times 16)$ $= -4 + 96$ $= 92$	 M1 A1	
		2	
5.	$3 \cos (3\theta - 20^0) + 2 = 0$ $3 \cos (3\theta - 20^0) = -2$ $\text{Cos} (3\theta - 20^0) = -{}^2/_3 = -0.6667$ $(3\theta - 20^0) = 48.19^0$ $(3\theta - 20^0) = 48.19^0, 131.81^0$ $= 228.19^0, 491.8^0$ $\theta = 50.6^0, 82.73^0, 170.6^0$	 B1 B1B1	
		3	
6.	$x = -{}^3/_2$, $x = {}^4/_3$ $2x = -3$ $3x = 4$ $2x + 3 = 0$ $3x – 4 = 0$ $(2x +3) (3x – 4) = 0$ $2x (3x – 4) + 3(3x – 4) = 0$ $6x^2 – 8x + 9x – 12 = 0$ $6x^2 + x – 12 = 0$	 B1 M1 A1	
		3	
7.	2006 value = 50,000 x 0.8 = 40,000 2009 = 40,000 x $(0.9)^4$ = 26,244	M1 A1 M1 A1	
		4	
8.	$OQ = {}^1/_3 (2i + 3j + 13k) + {}^2/_3 (5i – 3j + 4k)$ □ □ □ □ □ □ □ $= 4i – j + 7k$ □ □ □ $\overline{OQ} = \sqrt{4^2 + (-1)^2 + 7^2}$ $= \sqrt{66}$ $= 8.126$	M1 A1 B1	Accept $\begin{pmatrix} 4 \\ \\ 7 \end{pmatrix}$ -1
		3	

9. P(At least the two games) $= 1 - (\frac{3}{4} \times \frac{1}{5})$ $= 1 - \frac{3}{20}$ $= \frac{17}{20}$	M1 A1	
	3	
10. Let $P = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ $\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} -10 \\ 01 \end{pmatrix} \begin{pmatrix} 3 & 2 & -1 \\ 2 & -1 & -4 \end{pmatrix} = \begin{pmatrix} -2 & 1 & 4 \\ -3 & -2 & 1 \end{pmatrix}$ $\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} -3 & -2 & 1 \\ 2 & -1 & -4 \end{pmatrix} = \begin{pmatrix} -2 & 1 & 4 \\ -3 & -2 & 1 \end{pmatrix}$ $\begin{pmatrix} -3a + 2b & -2d - b \\ -3c + 2d & 2c - d \end{pmatrix} = \begin{pmatrix} -2 & 1 \\ -3 & -2 \end{pmatrix}$ (-3a + 2b = -2) x 1 (-2a – b = 1) x 2 -3a + 2b = -2 + -4a – 2b = 2 -a = 0 a = 0 3(0) + 2b = -2 2b = -2 b = -1 3c + 2d = -3 …. x 1 -2c – d = -2 …. x 2 3c + 2d =-3 4c – 2d = -4 + 7c = 7 c = 1	M1	

$3(-1) + 2d = 3$ $3 + 2d = 3$ $2d = 0,\ d = 0$ $\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ Description – positive quarter two about (0, 0)	A1 B1	
	3	
11.  Let the width of the enclosure be X M; then the length is (100 – x)m Area = x (100 – x) $A = 100x - x^2$ $\frac{dA}{dx} = 100 - 2x$ Area will be maximum when $\frac{dA}{dx} = 0$ $100 - 2x = 0$ $2x = 100$ $x = 50$ Thus the area is maximum at x = 50 Dimensions are 50m by 50m $= (50 \times 50) = 2500m^2$	M1 M1 A1	
	3	
12. $(1 + ½ x)^7 = (1^7)(½ x)^0 + 7(1)^6(½ x)^1 + 21(1)^5(½ x)^2 + 35(1^4)(½ x)^3$ $= 1 + {}^7/_2x + {}^{21}/_4x^2 + {}^{35}/_8x^3$ $(0.96)^7 = (1 + ½ x)^7$ $½ x = -0.04$ $x = -0.08$ Substituting x, $= 1 + {}^7/_2(-0.08) + {}^{21}/_4(-0.08)^2 + {}^{35}/_8(-0.08)^3$ $= 1 - 0.28 + 0.0336 - 0.00224$ $= 1.0336 - 0.28224$ $= 0.75136$ $= 0.751$ (3 d.p)	M1 M1 M1 A1	
	4	

13.	Missing values Y : 26 , 138 Area = ½ x 2 (10 + 230) + 2(6 + 26 + 70 + 138) = 240 + 480 = 720	 B1 M1 M1 A1	
		4	
14.	Log $(n^3 \times 5n) = \log (2^5 \div {}^{2}/_{5})$ $n^3 \times 5n = 2^5 \times {}^{5}/_{2}$ $5n^4 = 80$ $n = 16$ $n = 2$	M1 M1 A1	
		3	
15.	Centre $\left(\frac{-3 + 5}{2} \quad \frac{2 + 4}{2} \right)$ (1, 3) Eqn. $(x – 1)^2 + (y – 3)^2 = (\sqrt{18})^2$ $(x – 1)^2 + (y – 3)^2 = 18$	 B1 A1 A1	midpoint of diameter
		3	
16.	Overtaking speed = (60 – 28) km/hr = 32km/hr Distance covered = 86 + 10m = 96m Or $\frac{96}{100}$ km Time = $\frac{96}{1000} \times \frac{1}{32}$ hrs = $\frac{96}{1000} \times \frac{60}{32}$ x 60 seconds = 10.8 seconds	 B1 M1 A1	relative speed
		3	
17.	Let the amount of sugar required be x kg The amount of tea required be y kg Amount spent last year 36x + 150y = 15800 6x + 25y = 2500 …. (i) Cost this year Sugar increase by ${}^{110}/_{100}$ x 36 = sh. 39.60 Tea increase by ${}^{120}/_{100}$ x 150 = sh. 180	 M1 A1	
		3	

Amount spent this year $39.60x + 180y = 17100$ $396x + 1800y = 171000$	M1	
Divide through by 36 $\frac{396x}{36} + \frac{1800y}{36} = 171000$ $11x + 50y = 4750$ …. (ii)	M1	
$6x + 25y = 2500$ … x 2 $11x + 50y = 4750$ … x 1	M1	
$12x + 50y = 5000$ $11x + 50y = 4750$ $x = 250$	M1	
$\therefore 1500 + 25y = 2500$ $25y = 1000$ $y = 40$	M1	
Sugar 250kg Tea 40kg	A1	
(b) Percentage increase in Cost = $\frac{2100}{15000} \times 100$	M1	
= 14%	A1	

18. (a)

X	0	30	60	90	120	150	180	210	240	270	300	330	360
3 cos ($x/2$)	3	2.90	2.60	2.12	1.50	0.78	0	-0.78	-1.50	-2.12	-2.60	-2.90	-3.00
5 sin ($x/2$ +30)	2.50	3.54	4.33	4.83	5.00	4.83	4.33	3.54	2.50	1.29	0	-1.29	-2.50

	B1 B1	cosine table correct sine table correct
(b) Plotting the cosine wave Plotting the sine wave For smooth cosine wave For smooth sine wave	P1 P1 C1 C1	
(c) Amplitude = 3 Period = 720	B1 B1	
(d) $x = 12^0 \pm 3$	B2	
	10	

18. (a)

	8	6	4	2	0	-2	-4	30	60	90	120	150	180	210	240	270	300	330	360
$Y = 5 \sin ({}^{x}/_{2} + 30^{0})$																			
$y = 3 \cos ({}^{x}/_{2})$																			

19.	(a) Total monthly income =			
		22600 + 13400 + 2640 + 1360	M1	
		= 40,000/=	A1	
	(b)	1^{st} 9680 x 10% = 968	M1	
		2^{nd} 9680 x 15% = 1368	M1	
		3^{rd} 9680 x 20% = 1824	M1	
		4^{th} 9680 x 25% = 2420	M1	
		5^{th} 2960 x 30% = 888	M1	
		Total tax 7468		
		Less relief 1325		
		Tax payable 6143	A1	
	(c)	Insurance tax relief		
		7468 x $^{8}/_{100}$	M1	
		597/=	M1	
		Total relief = (1325 + 597) = 1925		
		Tax payable = 7468		
		- 1925		
		5546	1	
		Amount earned 40000		
		5546		
		34454	A1	
			10	
20.	(a) (i)	OP = ½ $\sqrt{3^2 + 4^2}$ or $\sqrt{1.5 + 2^2}$	M1	
		= 2.5cm	M1	
		VP = $\sqrt{2.5 + 6^2}$	M1	
		= 6.5cm	A1	
	(ii)	Tan $\alpha = {}^{6}/_{2} = 3$	M1	
		Tan $^{-1}\alpha = 71.56$	A1	
	(b) (i)	Slant height Vms $\sqrt{6^2 \times 2^2}$		
		= 6.32cm	M1	
		VN = $\sqrt{6^2 + 1.5^2}$		
		= 6.18cm	M1	
	(ii)	S.A = Area of { PQRS + 2(PQV) + 2 (VQR)}		
		= 3 x 4 + ½ x 2 x 6.32 x 3 + 2 x ½ x 6.18 x 4	M1	
		= 12 + 18.96 + 24.72	M1	
		= 55.68cm^2	A1	
			10	

21. $x - A = d$

d/c

Class / interval	Mid point (x)	Frequency (f)	d $X - A$	t $\frac{X - A}{C}$	d^2	df	d^2f
470 – 479	474.5	1	-30	-3	9	-3	9
480 – 489	484.5	3	-20	-2	4	-6	12
490 – 499	494.5	11	-10	-1	1	-11	11
500 – 509	504.5	21	0	0	0	0	0
510 – 519	514.5	8	10	1	1	8	8
520 – 529	524.5	4	20	2	4	8	16
530 - 539	534.5	2	30	3	9	6	18
		$\Sigma f = 50$				$\Sigma fdf = 2$	$\Sigma fd^2 = 74$

B2

(a) Mean $= A + C \frac{\Sigma fd}{\Sigma f}$ $C = 10$

$= 504.5 + {}^{2}/_{50} \times 10$ M1

$= 504.5 + 0.4$ M1

$= 504.9$ grams A1

(b) Standard deviation

$= C\sqrt{\left\{\frac{fd^2}{\Sigma f} - \left(\frac{\Sigma fd}{\Sigma f}\right)^2\right\}}$

$= 10\sqrt{\left\{\frac{74}{50} - \left(\frac{2}{50}\right)^2\right\}}$ M1M1

$= 10\sqrt{\frac{74}{50} - \frac{4}{2500}}$

$= 10\sqrt{\left(\frac{3700 - 4}{2500}\right)}$ M1

$= 10\ \frac{\sqrt{3696}}{50}$

$= {}^{1}/_{5} \times 60.79$ M1

$= 12.16$ grams A1

10

22. (a) $A = KB^n$

$\text{Log } A = \log KB^n$

$\text{Log } A = \text{Log } K + n\log B$

$\text{Log } A = n\log B + \log K$ B2

(b)

Log A	0.18	0.29	0.40	0.51	0.65
Log B	0.20	0.40	0.60	0.80	1.06

B2

S1
P1 √
L1 √

(c) Gradient of the line

$= \frac{0.65 - 0.18}{1.06 - 0.2}$ M1

$= \frac{0.47}{0.86}$

$= 0.5465$

$\therefore n = 0.5$ A1

$\text{Log } K = 0.07$

$K = 10^{0.07}$

$= 1.2$ B1

10

23. (a) Construction of angle JKL = 105^0 or

KLM = 75^0 B1

Complete 11 gram B1 dev. ± 0.1cm

Construction of loci JP ≤ 3 B1

Construction of loci KQ ≤ 5 B1

Area of 11gram 7 x 8 sin 105^0 = 54.09cm^2 A1

Area of sectors = $^{75}/_{360}$ x $^{22}/_{7}$ x 3^2 + $^{105}/_{360}$ x $^{22}/_{7}$ x 5^2 M1 5.89 x 22.92 = 28.81cm^2		A1	
Area returned 54.09 – 28.81 = 25.28cm^2		A1	
(b) Percentage area covered by loci $\frac{28.81}{54.09}$ x 100		M1	
53.26%			
		10	
24. (a) $x + y \leq 400$		M1	
$x > y$, $x > 0$		M1	
$x \leq 300$, $y \geq 80$		M1	
(b) All inequalities drawn and shaded		B4	
(c) (i) $x = 300$, $y = 100$		M1	
(ii) 300 x 450 + 100 x 350		M1	
= 170,000		A1	
		10	