Name _____Adm. No_____ Index No. _____

Candidate's signature _____

Date _____

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

KIBWEZI SECONDARY SCHOOLS EXAMINATION
Kenya Certificate of Secondary Education
MATHEMATICS ALT. A
PAPER 1
2 ½ HOURS

INSTRUCTIONS TO CANDIDATES

(a) Write your name, admission no and index no in the spaces provided above.
(b) This paper consists of TWO sections 1 and section II.
(c) Answer ALL the questions in section I and any FIVE questions from section II.
(d) All answers and working must be written on the question paper in the spaces provided below each question.
(e) Show all the steps in your calculations giving your answers at each stage in the spaces below each question.
(f) Marks may be given for correct working even if the answer is wrong.
(g) Non-programmable silent electronic calculators and KNEC Mathematical tables may be used except where stated otherwise.
(h) This paper consists of 16 printed pages
(i) Candidates should check the question paper to ascertain that no missing questions.

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 16 printed pages

Turn Over

SECTION I (50 MARKS)

1. Use logarithm tables to evaluate:- (4 marks)

$$\sqrt[3]{\frac{12.3 \times 0.089}{7.654}}$$

2. Simplify the following: (3 marks)

$$\left(\frac{1\frac{1}{2} + 3\frac{1}{6}}{4\frac{1}{3} - 3\frac{2}{5}} \right) \div 1\frac{2}{3}$$

3. A boy cycled for 40 minutes at 30km/h. He then travelled for 2 hours in a mini bus at 70km/h. Find the average speed for the whole journey. (3 marks)

4. A water tank has a capacity of 70 litres. A similar model tank has a capacity of 0.25 litres. If the larger tank has a height of 150cm, calculate the height of the model tank. (3 marks)

5. Solve the following inequalities and represent the solutions on a single number line. (3 marks)

$2 - 2x < 4$

$-6 - 3x \geq -15$

6. If $4x^2 - 32x - 20 + k$ is a perfect square, find the value of k. (3 marks)

7. Solve for the values of x that satisfy the following equation.

$9^{x^2} = 27^{(2x + 12)}$ (3 marks)

8. The hire purchase terms of a T.V set is a deposit of Ksh. 4,500 and six monthly instalments of Ksh. 1000 each. The hire purchase price is 175% of the cost price while the cash price is 25% more than the cost price. What is the cash price of the T.V set? (3 marks)

9. Express in surd form and simplify by rationalizing the denominator. (3 marks)

$$\frac{1 + \cos 30^0}{1 - \sin 60^0}$$

10. The sides of a rectangle are given as 4.2cm and 2.8cm, each correct to one decimal place. Find the maximum percentage error in its area. (3 marks)

11. Three bells P, Q and R are programmed to ring after an interval of 15 minutes, 25 minutes and 50 minutes respectively. If they all rang together at 6.45 am, when will they next ring together. (3 marks)

12. Find the equation of the perpendicular bisector of the line AB where the co-ordinates of A and B are (-3, 2) and (6, 4) respectively. (4 marks)

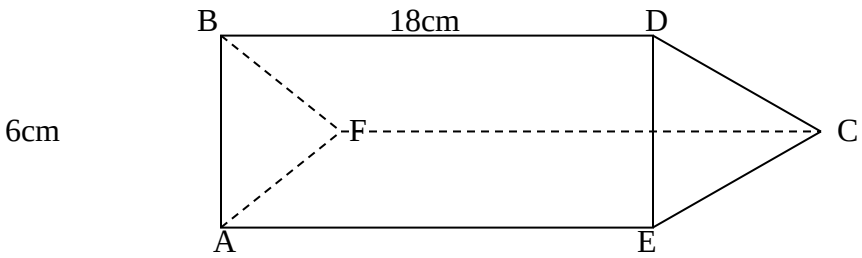
13. Simplify the following without using tables.
$\text{Log}_{10}(7x + 3) - \log_{10}(2 - x) = 1$ (3 marks)

14. Simplify the expression. (3 marks)

$$\frac{2a^2 - 3ab + b^2}{a^2 - b^2}$$

15. Given that $\sin (2x - 10)^0 = \cos 60^0$ and x is an acute angle, find x. (3 marks)

16. A prism of length 18cm is represented by the diagram below whose cross-section is an equilateral triangle of side 6cm.



(a) Draw a net of the prism and label it correctly. (1 mark)

(b) Calculate the total surface area of the prism. (2 marks)

SECTION II

Answer ONLY FIVE questions in this section.

17. Use a ruler and a compass only for all constructions in this question.

(a) Construct a triangle XYZ in which XY = 6cm, YZ = 5cm and angle XYZ = 120^0. (2 marks)

(b) Measure XZ and angle YXZ. (2 marks)

(c) Construct the perpendicular bisector of XZ and let it meet XZ at M. (1 mark)

(d) Locate a point W on the opposite side of XZ as Y and that XW = ZW and YW = 9cm and hence complete triangle XZW. (2 marks)

(e) Measure WM and hence calculate the area of triangle XZW. (3 marks)

18. A businesslady bought 50 rabbits and 40 chicks for Ksh. 12,800. If she had bought twice as many chicks and half as many rabbits she would have paid shs. 3,700 less. She sold each rabbit at a profit of 10% and each chick at a profit of 20%.

(a) Form two equations to show how much she bought the chicks and the rabbits. (2 marks)

(b) Find the cost of each. (3 marks)

(c) Calculate the profit she made from the sale of the chicks and the rabbits.. (2 marks)

(d) What percentage profit did she make from the sale of the 50 rabbits and the 40 chicks. (3 marks)

19. A swimming pool 20m long is 1m deep at its shallow end and 4m deep at its deep end. The pool is 10m wide.

(a) Find the volume of water in m^3 when the pool is full. (5 marks)

(b) A circular pipe of diameter 14cm is used to empty the swimming pool. Water flows through the pipe at a rate of 5m per second. Calculate the time it would take to the nearest minute to empty the pool. (5 marks)

20. The data below shows the marks scored by 36 students in a Maths test which was marked out of 100.

46	20	51	76	36	41
25	40	48	65	64	28
59	32	72	72	58	64
75	76	54	68	75	61
52	86	58	36	33	72
29	59	35	91	64	75

(a) Make a frequency distribution table using a class interval of 10, starting with 20-29. (2 marks)

(b) Draw a histogram to represent the information. (4 marks)

(c) Calculate the mean of the distribution. (4 marks)

21. The diagram above shows triangle OAB in which N is the mid-point of AB and M is a point on OA such that OM : MA = 2 :1. Lines ON and BM meet at X such that OX = hON and MX = kMB

.

(a) Given that OA = a and OB = b express in terms of a and b the following vectors.

(i) $\overrightarrow{AB}$ (1 mark)

(ii) $\overrightarrow{ON}$ (2 marks)

(iii) $\overrightarrow{BM}$ (1 mark)

(b) By expressing OX in two different ways determine the values of h and k. (6 marks)

22. The diagram below (not drawn to scale) shows the cross-section of a hexagonal solid metal prism length 40cm.

Calculate:-

(a) The area of the shaded region (Take the hexagon to be regular) (5 marks)

(b) The volume of the material used to make the metal in cm^3. (2 marks)

(c) If the density of the metal prism is $4.5g/cm^3$. Finds its mass in kgs. (3 mark)

23. Three boats X, Y and Z are approaching a harbour H. X is 14km from the harbour on a bearing of 090^0. Y is 12km from the harbour on a bearing of 130^0 and Z is 24.30km to the West of Y and on a bearing of 240^0 from the harbour.

(a) Draw a sketch diagram showing the position of the three boats and the Harbour. (1 mark)

(b) Calculate:-

(i) The distance between X and Y. (3 marks)

(ii) The distance of Z from the harbour. (3 marks)

(iii) The distance between X and Z. (3 marks)

24. A transformation T_1 maps ΔABC whose vertices are A(-2, 0), B(1, -2) and C(0, 1) onto $\Delta A^1B^1C^1$ whose vertices are $A^1(2, 4)$, $B^1(4, 1)$ and $C^1(1, 2)$. Another transformation T_2 maps the same ΔABC onto $\Delta A^{11}B^{11}C^{11}$ whose co-ordinates are $A^{11}(4, 2)$, $B^{11}(1, 4)$ and $C^{11}(2, 1)$.
Another transformation T_3 maps ΔABC onto $\Delta A^{111}B^{111}C^{111}$ such that $A^{111}(-4, 0)$, $B^{111}(2, -4)$ and $C^{111}(0, 2)$.

(a) On the same axis draw the triangle ABC, $A^1B^1C^1$, $A^{11}B^{11}C^{11}$ and $A^{111}B^{111}C^{111}$ (4 marks)

(b) Determine the transformations

(i) T_1 (2 marks)

(ii) T_2 (2 marks)

(iii) T_3 (2 marks)

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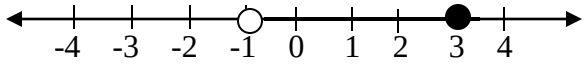
MARKING SCHEME

1. No: 12.3, 0.089, 7.654 → 5.6468×10^{-1} = 0.56468 = 0.5647 Log: $\bar{1}.0899$ + $\bar{2}.9494$ = $0.1393\ \bar{}$ 0.8839 $\bar{1}.25554 \times {}^{1}/_{3}$ $\frac{\bar{3} + 2.2554}{3}$ = $\bar{1}.7518$	M1 M1 M1 A1	all logs √ Add & sub. div. By 3
	4	
2. $N \Rightarrow 1\frac{1}{2} + 3{}^{1}/_{6} = {}^{3}/_{2} + {}^{19}/_{6} = \frac{9 + 19}{6} = {}^{28}/_{6}$ $D \Rightarrow 4{}^{1}/_{3} - 3{}^{2}/_{5} = {}^{13}/_{3} - {}^{17}/_{5} = \frac{65 - 51}{15} = \frac{14}{15}$ $\frac{28}{6} \div \frac{14}{15} \longrightarrow \frac{\cancel{28}^{\cancel{2}}}{\cancel{6}} \times \frac{15}{\cancel{14}\ 1} = 5 \div \frac{5}{3}$ $= \frac{\cancel{5}}{\cancel{5}} \times \frac{3}{1} = 3$	M1 M1 A1	
	03	
3. Dist = $\left(\frac{\cancel{40}^{\ 20} \times \cancel{30}^{\ 1}}{\cancel{60}^{\ 1}\ \cancel{2}^{\ 1}}\right) + (2 \times 70) = 160\text{km}$ Total time taken = ${}^{2}/_{3} + 2 = 2{}^{2}/_{3}\text{hrs}$ Av. Speed = $160 \times {}^{3}/_{8}$ = 60km/h	M1 M1 A1	
	03	

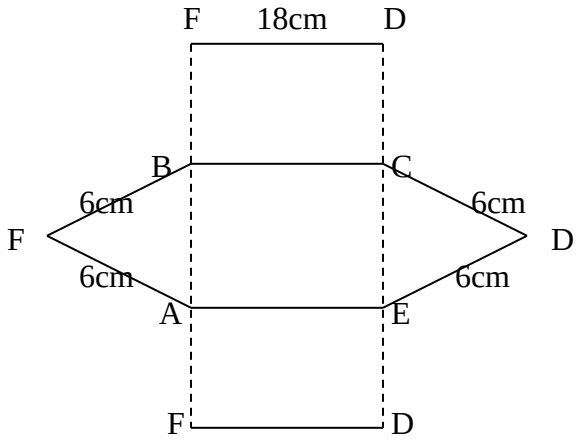
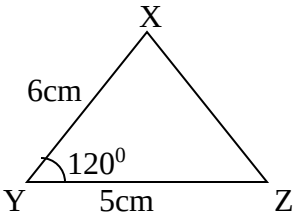
This paper consists of 11 printed pages

Turn Over

4.	V.S.F = $\frac{70}{0.25}$ = 280 L.S.F = $3\sqrt{280}$ = 6.542 Height of smaller tank = $\frac{150}{6.542}$ = 22.93cm = 22.93cm (2dp)	M1 M1 A1	
		03	
5.	2 -2x < 4 ⟶ -2x < 2 ⟶ x > -1 or -1 < x -6 – 3x ≥ -15 ⟶ -3x ≥ -9 ⟶ x ≤ 3 ∴ -1 < x ≤ 3  	B1 B1	
		03	
6.	$(2x – p)^2 = 4x^2 – 32x – 20 + k$ $4x^2 – 4px + p^2 = 4x^2 – 32x – 20 + k$ -4p = -32 p =8 $p^2 = -20 + k$ $8^2 = -20 + k$ 64 = -20 + k k = 84	M1 A1 A1	corr expression value of p value of k
		03	
7.	$9x^2 = 27^{(2x+12)}$ $3^{2(x2)} = 3^{3(2x+12)}$ $2x^2 = 3(2x + 12)$ $2x^2 = 6x + 36$ $2x^2 – 6x – 36 = 0$ $x^2 – 3x – 18 = 0$ Sum = -3 Numbers = -6, 3 Product -18 $x^2 + 3x - 6x – 18 = 0$ x (x + 3) -6 (x + 3) = 0 (x – 6) (x + 3) = 0 Either x – 6 = 0 ⟶ x = 6 Or x + 3 = 0⟶ x = -3	 M1 M1 A1	 equation √ factorization C.A.O both
		03	
8.	H.P = 4500 + (1000 x 6) = 10,500/= Cost price = $\frac{100}{175}$ x 10,500 = 6000/= Cash price = $\frac{125}{100}$ x 6000 = Ksh. 7,500	M1 M1 A1	
		03	

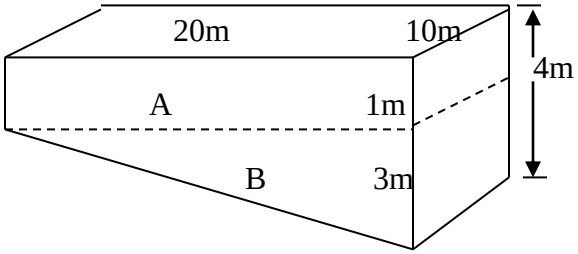
9.	$\cos 30^0 = \frac{\sqrt{3}}{2}$; $\sin 60^0 = \frac{\sqrt{3}}{2}$ $\frac{1 + \frac{\sqrt{3}}{2}}{1 - \frac{\sqrt{3}}{2}} = \frac{2 + \sqrt{3}}{2 - \sqrt{3}}$ $\frac{2 + \sqrt{3}}{2 - \sqrt{3}} \times \frac{2 + \sqrt{3}}{2 + \sqrt{3}} = \frac{4 + 2\sqrt{3} + 2\sqrt{3} + 3}{4 - 3}$ $= 7 + 4\sqrt{3}$	B1 M1 A1	sub. of tri values √mult. By conjugate Surd
		03	
10.	4.2cm 2.8cm Max length = 4.25 Max width = 2.85 Max area = (4.25 x 2.85)cm^2 = 12.11cm^2 Min length = 4.15cm Min width = 2.75cm Min area = (4.15 x 2.75)cm^2 = 11.41cm^2 Error = $\frac{\text{max area} - \text{min area}}{2}$ Error = $\frac{12.11 - 11.41}{2}$ = $\frac{0.7}{2}$ = 0.35 Actual area = (4.2 x 2.8)cm^2 = 11.76cm^2 % Error in area = $\frac{\text{error}}{\text{Actual}}$ x 100% = $\frac{0.35}{11.76}$ x 100 = 2.976%	M1 M1 A1	for both max and min Finding % error
		3	
11.	<table><tr><td></td><td>15</td><td>25</td><td>50</td></tr><tr><td>2</td><td>15</td><td>25</td><td>25</td></tr><tr><td>3</td><td>5</td><td>25</td><td>25</td></tr><tr><td>5</td><td>1</td><td>5</td><td>5</td></tr><tr><td>5</td><td></td><td>1</td><td>1</td></tr></table> L.C.M = 2 x 3 x 5^2 = 150min Time taken = 2hrs 30 min	=B1	corr. L.C.M

	Ring together next at 6.45 am + 2.30 9.15 am or 0915 hrs	M1 A1	
		03	
12.	Grad. AB = $\frac{4-2}{6-{}^{-}3}$ = $^{2}/_{9}$ product of $M_1 \times M_2 = -1$ $M1 = {}^{2}/_{9} \longrightarrow M_2 = -1 \times {}^{9}/_{2}$ $M_2 = {}^{-9}/_{2}$ Bisector = mid point $\left(\frac{-3+6}{2}, \frac{2+4}{2}\right)$ = (1.5, 3) General point (x , y) , (1.5, 3) Grad = $^{-9}/_{2}$ $\frac{y-3}{x-1.5} = {}^{-9}/_{2}$ $2(y-3) = -9(x-1.5)$ $2y - 6 = -9x + 13.5$ $2y = -9x + 19.5$ $y = {}^{-9}/_{2}x + {}^{19.5}/_{2}$ $y = 9{}^{3}/_{4} - 4\frac{1}{2}x$	 B1 B1 M1 A1	 √grad. mid pt eqn
		04	
13.	$\text{Log}_{10}\left(\frac{7x+3}{2-x}\right) = \text{Log}_{10}\,10$ $\frac{7x+3}{2-x} = 10$ $7x + 3 = 10(2 - x)$ $7x + 3 = 20 - 10x$ $17x = 17$ $x = 1$	M1 M1 A1	for single logs √ly dropping logs
		03	
14.	$\frac{2a^2 - 2ab - ab + b^2}{(a+b)(a-b)}$ = $2a(a-b) - b(a-b)$ $= (2a - b)(a - b)$ $\longrightarrow (a + b)(a - b)$ $\rightarrow \frac{(2a-b)\ \cancel{(a-b)}}{(a+b)\ \cancel{(a-b)}}$ $= \frac{2a-b}{a+b}$	 M1 M1 A1	 factorised Numerator factorised Denominator
		03	

15.	Sin 2x – 10 = 0.5 Acute angle = 30^0 $2x - 10 = 30^0, 150^0$ $2x = 40^0, 160^0$ $x = 20^0$ and 80^0	B1 B1 B1	 both 30^0 & 150^0 both values
		03	
16	(a) 	B1	
	(b) Total surface area = 3 x 18 x 6 + 2 x ½ x 6 x 6 sin 60^0 = 355.18 + 31.18 = 386.36cm^2	M1 A1	
		03	
17.	(a) Sketch 	 B1 B1	 for 120^0 construction complete construction of Δ XYZ

	(b)	Length of XZ = 9.6cm ± 0.1 $\angle$ YXZ = $26^0 \pm 1^0$	B1 B1	length x 2 angle YXZ
	(c)	Bisector of XZ to appoint M	B1	perp. Bise of XZ to M
	(d)	Location of point W Complete ΔXZW	B1 B1	Corr. location complete ΔXZW
	(e)	Measure WM = 6.4cm ± 0.1 Area = ½ x 6.4 x 9.6 = $30.72cm^2$	B1 M1 A1	
			10	
18.	(a)	Let the cost of each rabbit = sh. X And cost of each chick = sh. Y Then 50x + 40y = 12,800 … (i) 25x + 80y = 12,800 – 3700 = 9100 Or 50x + 160y = 18,200 …(ii)	 B1 B1	 equation equation
	(b)	50x + 40y = 12,800 50x + 160y = 18,200 -120y = -5,400 y = sh. 45	M1	elimination or substitution
		From equation (i) 50x + 40(45) = 12,800 50x + 1800 = 12,800 50x = 11,000 x = sh. 220	 M1 A1	 substitution value of x
		Sales of 50 rabbits 50 x 220 x $^{110}/_{100}$ = sh. 12,100		
		Sales of 40 chicks 40 x 45 x $120/_{100}$ = sh. 2160	M1	
		Total sales = 12,100 + 2,160 Sh. 14,260	 A1	
		Total purchase = 50 x 220 = 11,000 40 x 45 = 1,800 + Sh. 12,800	 M1	 simplification
		Total profit = 14,260 – 12,800 = sh. 1460	A1	profit
		Percentage profit = $\frac{1460}{12800}$ x 100% = 11.4% = 11.4%	 A1	
			10	

19. (a)



B1 Sketch diagram or implied

Volume A = 20 x 10 x 1 = $200m^3$ M1

Volume B = cross –section area x h

= ½ x 3 x 20 x 10 M1

= $300m^3$ A1

Total volume = 200 + 300 = $500m^3$ A1

(b) Pipe → Diameter 14cm → 0.14m

Length 5m

Vol per sec. → 3.142 x 0.07 x 0.07 x 5 M1

= $0.077m^3$ per sec.

= $4.62m^3$ per minute A1

Total vol. of pool = $500m^3$

Rate of empting = $4.62m^3$/min

∴ time taken → $\frac{500m^3}{4.62m^3}$ M1

= 108.23 minutes M1

≃ 108 minutes A1 C.A.O accept 1hr 48 min

10

20. (a)

Class	x	f	fx
20-29	24.5	4	98
30-39	34.5	5	172.5
40-49	44.5	4	178
50-59	54.5	7	381.5
60-69	64.5	6	387
70-79	74.5	8	596
80-89	84.5	1	84.5
90-99	94.5	1	94.5
		$\Sigma f = 36$	$\Sigma fx = 1992$

B1 √ classes

B1 √ column of mid pts

B1 √ frequencies

B1 √ for fx column

(b) See graph paper for histogram

B1 √ axes (both labeled)

B2 √ bars of same Width

B1 height or Frequencies

(c) $\overline{X} = \frac{\Sigma fx}{\Sigma f} = \frac{1992}{36}$ M1 √ expression seen

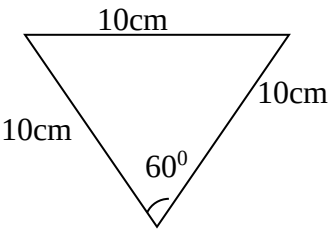
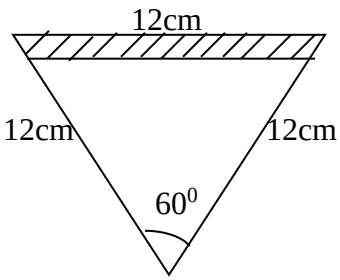
= 55.33 marks A1

10.

HISTOGRAM

21.	(a)	(i) AB = AO + OB = -a + b = b – a	B1	
		(ii) ON = OA + AN = a + ½ AB		
		= a + ½ (b – a)	M1	
		= ½ (a + b)	A1	accept ½ a + ½ b
		(iii) BM = BO + OM = -b + $^{2}/_{3}$ a		
		= $^{2}/_{3}$a – b	B1	
		(b) OX = how = h (½ a + ½ b) = $^{h}/_{2}$a + $^{h}/_{2}$b	B1	
		OX = OM + MX = $^{2}/_{3}$a + KMB		
		= $^{2}/_{3}$a + k(-BM)		

$= {}^2/_3a - k({}^2/_3a - b)$		
$= {}^2/_3a - {}^2/_3ka + kb$		
$= ({}^2/_3 - {}^2/_3k)\,a + kb$	B1	
$\therefore {}^h/_2a + {}^h/_2b = ({}^2/_3 - {}^2/_3k)\,a + b$	M1	
Comparing coefficients of a and b		
${}^h/_2 = {}^2/_3 - {}^2/_3k \longrightarrow h = {}^4/_3 - {}^4/_3k$ ….. (i)		
${}^h/_2 = k = h = 2k$ …….. (ii)	M1	
${}^4/_3 - {}^4/_3k = 2k \longrightarrow {}^4/_3 = 2k + {}^4/_3k$		
$= 4 = 6k + 4k$		
$= 4 = 10k \rightarrow k = {}^2/_5$	A1	
Sub for k in eqn (ii)		
$h = 2 \times {}^2/_5 = {}^4/_5 \quad = h = {}^4/_5$	A1	
	10	

22.	(a)	Hexagon six sides → centre angle $= \frac{360^0}{6} = 60^0$	B1	$\angle 60^0$
		 	B1	may be implied
		Shaded area $= 6(\frac{1}{2} \times 12^2 \sin 60^0 - \frac{1}{2} \times 10^2 \sin 60^0)$	M1	
		$= 6(72 \times 0.866 - 50 \times 0.866)$	M1	
		$= 6(62.352 - 43.3)$		
		$= 6(19.052)$		
		$= 114.312 cm^2$	A1	
		(b) Vol of material used = cross section area x length		
		$= 114.312 \times 40$	M1	
		$= 4572.48 cm^3$	A1	
	(c)	Mass = D x V		
		$= 4.5\ g/cm^3 \times 4572.48 cm^3$	M1	
		$= 20576.16\ gm \div 1000$	M1	
		$= 20.57616 kg$	A1	
		$= 20.58 kgs$ (2dp)		
			10	

23.	(a)	14km	B1	
	(b)	The dist. Btn X and Y => $a^2 = b^2 + c^2 - 2bc \cos A$		
		$XY^2 = 14^2 + 12^2 - 2 \times 14 \times 12 \cos 40^0$	M1	
		$= 196 + 144 - 336 \times 0.766$		
		$= 340 - 257.376$	M1	
		$XY^2 = 82.624 \longrightarrow XY = 9.09$km	A1	
		$\simeq 9.1$km (1 dp)		
	(c)	The dist of Z from the harbour => $\angle HYZ = 40^0$ (Alternate angles)		
		$\frac{HZ}{\text{Sin } 40^0} = \frac{24.30}{\text{sin } 110^0}$	M1	
		$HZ = \frac{24.30}{\text{Sin } 110^0} \times \sin 40^0$	M1	
		$= \frac{24.30 \times 0.6428}{0.9397} = 14.678$km $\simeq 14.7$km (1 dp)	A1	
	(d)	Dist btw X and Z $XZ^2 = HX^2 + HZ^2 - 2HX, (HZ) \text{ Cos } 150^0$		
		$XZ^2 = 14^2 + 14.7^2 - 2 \times 14 \times 14.7 \cos 150^0$	M1	
		$= 196 + 216.09 - 411.6 - 0.866$		
		$= 412.09 - (-356.45)$	M1	
		$= 412.09 + 356.45$		
		$XZ^2 = 768.54 \longrightarrow XZ = 27.723$	A1	
		$\simeq 27.7$km (1 dp)		
			10	

24. Mirror line T1 reflection y –axis 7 6 5 4 3 2 1 0 -1 -2 -3 -4 -5
-4 -3 -2 -1 0 1 2 3 4 5 6 x-axis $A^{11}B^{11}C^{11}$ $A^{1}B^{1}C^{1}$ $A^{111}B^{111}C^{111}$1 A B C

B1 ΔABC
B1 $\Delta A^{1}B^{1}C^{1}$
B1 $\Delta A^{11}B^{11}C^{11}$
B1 $\Delta A^{111}B^{111}C^{111}$

(b) (i) T_1 is a reflection mirror line B1
$y + x = 2$ or $y = 2 – x$ B1 corr. description of transformation

(ii) T_2 is a rotation B1
+ve 180^0 or +ve half turn about (1, 1) B1 corr. description of transformation

(iii) T_3 is an enlargement B1
Centre (0, 0), scale factor 2. B1 corr. description of transformation

10

Name _____Adm. No_____ Index No. _____

Candidate's signature _____

Date _____

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

KIBWEZI SECONDARY SCHOOLS EXAMINATION
Kenya Certificate of Secondary Education
MATHEMATICS ALT. A
PAPER 2
2 ½ HOURS

INSTRUCTIONS TO CANDIDATES

(a) Write your name, admission No. and index No. in the spaces provided above.
(b) This paper consists of TWO sections 1 and section II.
(c) Answer ALL the questions in section I and any FIVE questions from section II.
(d) All answers and working must be written on the question paper in the spaces provided below each question.
(e) Show all the steps in your calculations giving your answers at each stage in the spaces below each question.
(f) Marks may be given for correct working even if the answer is wrong.
(g) Non-programmable silent electronic calculators and KNEC Mathematical tables may be used except where stated otherwise.
(h) This paper consists of 18 printed pages
(i) Candidates should check the question paper to ascertain that no missing questions.

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 18 printed pages

SECTION II (50 MARKS)
Answer ALL the questions in this section.

1. Solve the simultaneous equations using matrix method. (3 marks)

$x + 2y = 21$
$2x = 34 - 2y$

2. A triangular flower garden has an area of $36m^2$. Two of its edges are 16m and 13.5m. Find the angle between these edges. (2 marks)

3. A mixed secondary school can accommodate 840 students. The number of girls must be at least 240 while the number of boys must exceed 300. Taking x to represent the number of girls and y to represent the number of boys, write down all the inequalities representing this information. (3 marks)

4. A two digit number is formed from the first four prime numbers.

(a) Draw the table to show all the possible outcomes. (2 marks)

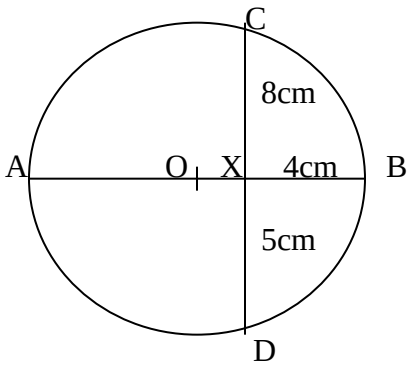
(b) Calculate the probability that a number chosen from the two digit numbers is an even number. (1 mark)

5. Make s the subject of the formula. (3 marks)

$$a = \sqrt{\frac{s^2 - p}{p^2}} - q$$

6. The sum of the first five terms of an AP is $^{65}/_{2}$ and five times the seventh term is equal to six times the second term. Find the first term and the common difference of the AP. (4 marks)

7. In the figure below, O is the center of the circle. Chords AB and CD intersect at X.
CX = 8cm, XD = 5cm and XB = 4cm

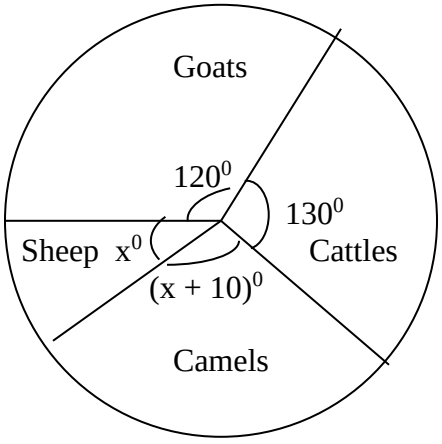


Calculate the length of AX and hence find the radius of the circle. (3 marks)

8. A map has a scale of 2cm to 40km. A forest in the region covers an area of $3505km^2$.
(a) State the scale of the map. (1 mark)

(b) What is the area of the forest on the map? (2 marks)

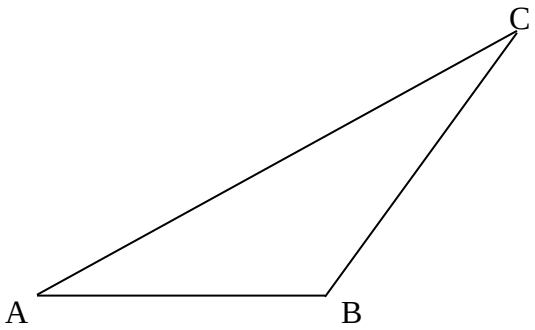
9. A farmer has four types of animals on his farm. The pie chart below represents the number of animals on the farm. If the number of goats were 30, calculate the number of camels on the farm. (4 marks)



10. A quantity P is partly constant and partly varies as the square of Q. When Q = 2, P = 40 and when Q = 3, P = 65. Determine the value of P when Q = 5. (3 marks)

11. Find the center and the radius of the circle whose equation is: $x^2 + y^2 - 6x - 10y - 66 = 0$ (3 marks)

12. The locus of a point P is such that $\angle APB \leq \angle ACB$. Locate and shade the region represented by point P. (3 marks)



13. A car was valued at Ksh. 500,000 in January 2010. Each year its value depreciates at 12% p.a. Find after how long would the value depreciate to Ksh. 250,000. (3 marks)

14. (a) Write down and simplify the first four terms of the expression $(2 + {}^{1}/_{4}\, x)^{10}$ in ascending powers of x . (1 mark)

(b) Hence find the value of $(2.025)^{10}$ correct to the nearest whole number. (2 marks)

15. Find the distance along the circle of latitude between A(40^0S, 20^0W) and B(40^0S, 100^0W) (3 marks)

16. Find the area enclosed by the curve $y = x^2 - 4$ and the x – axis , x = 0 and y = 4 (4 marks)

SECTION II (50 MARKS)

Answer only five from this section

17. A matatu left Kibwezi at 7.00 am and travelled towards Nairobi at an average speed of 60km/hr. A car left Nairobi at 9.00am and travelled towards Kibwezi at an average speed of 80km/hr. The distance between the two towns is 324km.

Find:-

(a) The time each vehicle arrived at their destination.

(i) Matatu (2 marks)

(ii) Car (2 marks)

(b) (i) The distance the matatu covered before the car started to move from Nairobi to Kibwezi. (1 mark)

(ii) The time the two vehicles met on the way. (3 marks)

(c) How far the car was from Kibwezi when they met. (2 marks)

18. The table below shows values of x and some values of y for the curve $y = x^3 - 9x$ for $-4 \leq x \leq 4$.

(a) Complete the table by filling in the missing values of y. (2 marks)

x	-4	-3	-2	-1	0	1	2	3	4
y	-28				0				28

(b) On the grid provided, draw the graph of $y = x^3 - 9x$ for $-4 \leq x \leq 4$.
Use the scale: Horizontal axis 1cm for I unit
Vertical axis 1cm for 5 units. (5 marks)

(c) By drawing a suitable straight line, on the same grid (b) above, solve the equation:
$x^3 - 13x - 12 = 0$ (3 marks)

19. In the figure below K, M and N are points on the circumference of a circle O. The points K, O, M and P are on a straight line. Find the values of the following angles stating the reason in each case.

(a) $\angle$MLN (1 mark)

(b) $\angle$OLN (2 marks)

(c) $\angle$ LNP (2 marks)

(d) $\angle$MPN (3 marks)

(e) Given that MP = 8cm and NP = 10cm calculate to 3 decimal places the length of KM. (2 marks)

20. (a) Complete the table below.

x^0	0^0	30^0	60^0	90^0	120^0	150^0	180^0	210^0	240^0	270^0	300^0	330^0	360^0
Sin x^0	0		0.87		0.87		0		-0.87	-1		-0.5	0
2sin $(x+30^0)$	1	1.73	2		1	0		-1.73	-2		-1		1

(b) (i) Draw the graphs of $y = \sin x$ and $y = 2 \sin (x + 30^0)$ on the same set of axes (5 marks)

20. (b) (ii) From your graph find the roots of $2\sin(x + 30^0) - \sin x = 0$. (1 mark)

(c) Describe fully the transformation that maps the graph of $y = \sin x$ onto that of $y = 2 \sin (x + 30^0)$. (2 marks)

21. The field book below gives measurements of a field. The distances are given in metres.
AF = 100M

	F	
	100	
E40	80	
	60	D50
C40	40	
	20	B30
	A	

(a) Using a scale of 1cm represents 10m draw a map of the field with straight boundary edges. (4 marks)

(b) (i) Find the area of the field in square metres. (5 marks)

(ii) Determine the area of the field in hectares. (1 mark)

22. The figure below is a right pyramid of rectangular base of length 12cm and width 9cm. The slanting edge has a length of 19.5cm

A B C D 12cm 9cm 19.5cm V

14.

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

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

(c) Find the angle VAD makes with VBC. (3 marks)

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

23. Two quantities P and n are connected by the equation $P = AK^n$ where A and K are constants.

n	2	4	6	8	10
p	9.8	19.4	37.4	74.0	144.4

(a) State the linear equation connecting P and n. (2 marks)

(b) On the grid provided draw a suitable straight line. (6 marks)

(c) Use your graph to estimate the value of A and K. (2 marks)

16. 17.

24. A curve has the equation $y = 2x + 3x^2$

(a) (i) Identify and state the stationary points of the curve. (4 marks)

(ii) Sketch the curve (2 marks)

(b) Evaluate $\int_{-2/3}^{2} (2x + 3x^2)\ dx$ (4 marks)

121/2
MATHEMATICS ALT. A
PAPER 2
JULY / AUGUST 2011

KIBWEZI SECONDARY SCHOOLS EXAMINATION
Kenya Certificate of Secondary Education
MATHEMATICS ALT. A
PAPER 2

MARKING SCHEME

1. $\begin{pmatrix}1 & 2\\2 & 2\end{pmatrix}\begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}21\\34\end{pmatrix}$		M1	√ matrix eqn
$-\frac{1}{2}\begin{pmatrix}2 & -2\\-2 & 1\end{pmatrix}\begin{pmatrix}1 & 2\\2 & 2\end{pmatrix}\begin{pmatrix}x\\y\end{pmatrix} = -\frac{1}{2}\begin{pmatrix}2 & -2\\-2 & 1\end{pmatrix}\begin{pmatrix}21\\34\end{pmatrix}$		M1	√ pre mult. By Inverse matrix
$\begin{pmatrix}1 & 0\\0 & 1\end{pmatrix}\begin{pmatrix}x\\y\end{pmatrix} = -\frac{1}{2}\begin{pmatrix}-26\\-8\end{pmatrix}$			
$\begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}13\\4\end{pmatrix}$			
x = 13 and y = 4		A1	both values √
		03	
2. A = ½ x 16 x 13.5 cos θ = 36		M1	
108 cos θ = 36			
Cos θ = $\frac{36}{108}$			
$\text{Cos}^{-1}\,\theta = 70.5^0$		A1	
		02	
3. x + y ≤ 840 ——— (i)		B1	
x ≥ 240 ——— (ii)		B1	
y > 300 ——— (iii)		B1	
		03	
4.			

	2	3	5	7
2	22	23	25	27
3	32	33	35	37
5	52	53	55	57
7	72	73	75	77

		B2	for all outcomes
		B1	for atleast 10 √
(b) $^4/_{16}$ or ¼ 0r 0.25		B1	
		03	

This paper consists of 12 printed pages

5.	$a = \sqrt{\frac{s^2 + p}{p^2}} - q$ $(a + q)^2 = \sqrt{\frac{s^2 + p}{p^2}}^{\,2}$ $(a + q)^2 = \frac{s^2 + p}{P^2}$ $p^2 (a + q)^2 = s^2 + p$ $s^2 = p^2 (a + q)^2 - p$ $s = p^2 (a + q)^2 - p$ $s = \sqrt{p^2 (a + q)^2 - p}$	M1 M1 A1	squaring both sides
		3	
6.	$^5/_2$ (2a + 4d) = $^{65}/_2$ ——— (i) 2a + 4d = 13 5 (a + 6d) = 6 (a + d) a = 24d ———————(ii) 2(24d) + 4d = 13 d = 0.25 a = 6	B1 M1 A1 A1	either eqn √ √ substitution or equivalent
		4	
7.	8 x 5 = AX. 4 ⟶ AX = $\frac{8 \times 5}{4}$ = 10cm Radius = ½ (10 + 4) = 7cm	M1 A1 B1	 √ radius
		3	
8.	2cm rep 40km 1cm rep 20km 1 : 2,000,000 (b) 1cm^2 rep 400km^2 ? - 3505km^2 $\frac{3505}{400}$ = 8.7625cm^2	 B1 M1 A1	
		3	
9.	$x + x + 10 + 120^0 + 130^0 = 360^0$ 2x + 260 =360 2x = 100 $x = 50^0$ Total no. of animals = y $\frac{120}{360}$ x y = 30 $\frac{360}{120}$ x 30 = y $y = 90^0$ Camels = $^{60}/_{360}$ x 90 = 15 camels	 B1 M1 A1 B1	
		4	

10.	$P = a + bQ^2$ $40 = a + 4b$ $65 = a + 9b$ $-25 = -5b$ $5 = b$ $L + 20 = 40$ $L = 20$ $P = 20 + 5Q^2$ When $Q = 5$ $P = 20 + 5(5^2)$ $P = 20 + 125$ $= 145$	B1 B1 A1	both eqn both values C.A.O
		3	
11.	$x^2 - 6x + (^6/_2)^2 + y^2 - 10y + (^{10}/_2)^2 = 66 + 9 + 25$ $x^2 - 6x + 9 + y^2 - 10y + 25 = 100$ $(x - 3)^2 + (y - 5)^2 = 10^2$ Center (3, 5) Radius = 10 units	M1 A1 A1	
		3	
12.	Locus of P A B C	B1 B1 B1	Bisecting any 2 lines major arc ABC √ shaded region P and labelled
		3	
13.	$250{,}000 = 500{,}000 (1 - {}^{12}/_{100})^n$ $0.5 = 0.88^n$ Log 0.5 = n log 0.88	M1	

$n = \frac{\log 0.88}{\log 0.5}$	M1	"n" made subject
n = 5.95 yrs	A1	acc. 6 yrs
	3	
14. (a) $(2 + ¼ x)^{10} = (2)^{10} (¼ x)^0 + 10 (2)^9 (¼ x)^1 + 45(2) (¼ x)^2 + 120 (2)^7 (¼ x)^3 + ….$		
$= 1024 + 1280x + 720x^2 + 240x^3 + …$	B1	√ expression
(b) $¼ x = 0.025 \longrightarrow x = 0.1$		
$(2.025)^{10} = 1024 + 1280(0.1) + 720 (0.1)^2 + 240 (0.1)^3$	M1	√ substitution
$= 1159.44$		
$\simeq 1159$	A1	C.A.O
	3	
15. Long diff = $40^0 + 40^0 = 80^0$	B1	
Dst btn A and B = $\frac{80^0}{360^0}$ x 2 x 3.14 x 6370 cos 40	M1	
= 6816km	A1	
	3	
16. $\int_0^2 (x^2 - 4)\, dx$		
$\left[\frac{x^3}{3} - 4x \right]_0^2$		
$(^8/_3 - 8) - 0$	M1	
$\frac{8 - 24}{3} - 0$		
$^{-16}/_3$		
$^{16}/_3$ sq. units	B1	
$\int_2^4 (x^2 - 4)\, dx$		
$\left[\frac{x^3}{3} - 4x \right]_2^4$		
$\left(\frac{64}{3} - 16 \right) - \left(\frac{8}{3} - 8 \right)$		
$\frac{64 - 48}{3} + \frac{16}{3}$		
$^{16}/_3 + ^{16}/_3$		
$^{32}/_3$ sq. units	B1	
Total area = $^{16}/_3 + ^{32}/_3 = ^{48}/_3 = 16$ sq. units.	A1	
	4	

17.	Time = $\frac{D}{S}$ = $\frac{324}{60}$ → 5 hrs 24 mins	B1	
	7.00 + 5hrs 24 min → 12.24pm	B1	
	Car		
	Time = $\frac{D}{S}$ → $\frac{324}{80}$ → 4hrs 3 mins	B1	
	9.00 + 4.03 → 1303 hrs or 1.03pm	B1	
	(b) (i) Distance covered = 60 x 2hrs = 120km	B1	
	(ii) Common dist to be covered 324 -120 = 204km		
	Relative speed = 60 + 80 = 140km/h	B1	
	Time taken to cover common dist = $\frac{204}{140}$ = 1.457hrs Or 1hr 27 min	M1	
	Time of meeting = 9.00 + 1.27 = 10.27 am	A1	
	(c) Distance from Kibwezi		
	120 + 60 x 1.457	M1	
	120 + 87.42 = 207.42km	A1	
		10	

18. (a)

x	-4	-3	-2	-1	0	1	2	3	4
y	-28	0	10	8	0	-8	-10	0	28

B2 allow B1 for 4 √

30 25 20 15 10 5 0 -5 -10 -15 -20 -25 -30
$y = 4x + 12$ $y = x^3 - 9x$ 1 2 3 4 5 6 -1 -2 -3 -4 -5 -6

SI √ Scale
P1 √ Plotting
C1 √ Smooth curve

	(c)	$y = x^3 - 9x$ $\underline{0 = x^3 - 13x - 12}$ $y = 4x + 12$	M1 A1	
			L1	√ line drawn
		$x = (-3, -1.1, 4)$	B1	allow B1 for 2√
19.	(a)	$\angle MLN = 40^0$ (Angles subtended by arc MN)	B1	
	(b)	OLK = $\frac{180 - 130}{2}$		
		$= 25^0$ (Base ∠s of isosceles Δ)	B1	
		$OLN = 90^0 - (40^0 + 25^0)$ ∠subtended by diameter	B1	
		$= 25^0$		
	(c)	$\angle LNP = \angle LKN = 40 + 25^0$ (Angle in alternate segment)	B1	
		$= 65^0$	B1	
	(d)	$\angle KNL = ½ \times 130^0$ (Subtended on centre and circumference)	B1	
		$= 65^0$		
		$\angle KNP = 65^0 + 65^0 = 130^0$	B1	
		$\angle MPN = 180 - (130 - 40)$ Angles of a Δ)		
		$= 10^0$	B1	
	(e)	$(KM + 8) \times 8 = 10^2$	M1	
		KM = 4.5cm	A1	
			10	

20. (a)

X	0	30	60	90	120	150	180	210	240	270	300	330	360
Sin x		0.5		1		0.5		-0.5			-0.87		
2 sin $(x + 30^0)$				1.73			-1			-1.73		0	

B2 all √
(allow B1 for any 6 √)

b (i)

2 1 0 -1 -2 60^0 120^0 180^0 240^0 300^0 360^0 x y

Y = $2\sin(x + 30^0)$ y = sin x

SI

P1

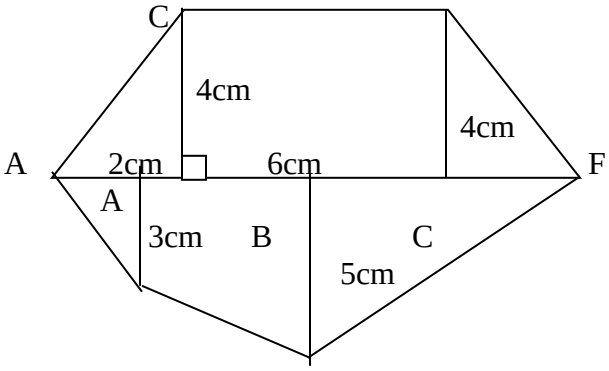
C1

P1

C1

(b) (ii) $2\sin(x + 30^0) = \sin x$ $x = 129^0$ or 309^0	B1	(allow ± 30) both values √
(c) Stretch parallel to y-axis s.f = 2,	B1	
Followed by a translation vector $\begin{pmatrix} -30^0 \\ 0 \end{pmatrix}$	B1	
	10	

21.



		B1	location of B
		B1	Location of C
		B1	location of D
		B1	Location of E

(b) Area of $\Delta A = \frac{1}{2} \times 20 \times 30$

$= 300m^2$ M1

Area of trapezium B $= \frac{1}{2}(30 + 50)\,40$

$= 1600m^2$

Area of $\Delta C = \frac{1}{2} \times 40 \times 50$ M1

$= 1000m^2$

Area of trapezium ACEF $= \frac{1}{2} \times (100 + 40)\,40$ M1

$= 2800m^2$

Total area $= 5700m^2$ A1

(ii) Area in hectares $= \frac{5700}{10000}$

$= 0.57ha$ B1

10

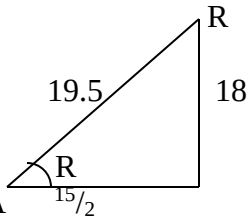
22. (a) $AC = \sqrt{12^2 + 9^2} = 15cm$

Height $= \sqrt{19.5^2 - 7.5^2}$ M1

$= \sqrt{324}$

$= 18cm$ A1

(b)



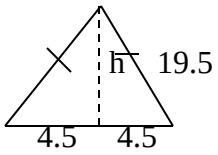
$\sin\theta = \frac{18}{19.5} = 0.9231$ M1

$\rightarrow \theta = \sin^{-1}(0.9231)$ M1

$= 67.38^0$ A1

(c) $h = \sqrt{19.5^2 - 4.5^2}$

$= 18.97cm$



$12^2 = 18.97^2 + 18.97^2 - 2(18.97)\cos\theta$ M1

$144 = 719.7218 - 719.7218\cos\theta$

$\cos\theta = 0.7999$

$\theta = \cos^{-1}(0.7999)$ M1

$= 36.88^0$ A1

(d) Vol $= \frac{1}{3}BA \times h$

$= \frac{1}{3}(12 \times 9) \times 18$ M1

$= 648cm^3$ A1

10

23.	(a)	Log P = n log K + log A	B2	
		n 2 A 6 8 10 log P 0.99 1.27 1.57 1.87 2.16	B2 B1	for all values at least 3 values
	(c)	Log K = $\frac{1.57 - 0.99}{6 - 2}$ = 0.145	M1	
		K = 1.4	B1	
		A = 0.7	B1	
			10	

2.5 2.0 1.5 1.0 0.5 0 2 4 6 8 10 n Log P

Scale

y axis 1cm rep. 0.25units

x –axis 1cm rep. 1 unit

S1

P1

L1

24. (a)	$\frac{dy}{dx} = 2 + 6x$		
	At stationary point $\frac{dy}{dx} = 0$		
	$2 + 6x = 0$	M1	
	$6x = -2$		
	$x = {}^{-2}/_{6}$ or ${}^{-1}/_{3}$		
	$y = 2({}^{-1}/_{3}) + 3({}^{-1}/_{3})^2$		
	$= {}^{-2}/_{3} + {}^{1}/_{3}$		
	$= {}^{-1}/_{3}$		
	The pt $({}^{-1}/_{3}, {}^{-1}/_{3})$	B1	
	At x = 0 $\frac{dy}{dx} = 2$	B1	for both
	At x = -1 $\frac{dy}{dx} = -4$		
	$\therefore ({}^{-1}/_{3}, {}^{-1}/_{3})$ is a minimum pt	A1	
(b)	y 5 4 3 2 1 0 -1 -2 -3 -4 -3 -2 -1 1 2 3 4 5		
	$Y = 2x + 3x^2$		

(c) $\int_{-2/3}^{2} (2x + 3x^2)\,dx$		
$\left[\frac{2x^2}{2} + \frac{3x^3}{3} \right]_{-2/3}^{2}$	M1	
$\left[x^2 + 3x^2 \right]_{-2/3}^{2}$		
$(2^2 + 2^3) - ({}^{-2}/_{3}{}^2 + {}^{-2}/_{3}{}^3)$	M1	
$12 - ({}^{4}/_{9} - {}^{8}/_{27})$	M1	
$12 - {}^{4}/_{27}$		
$= 11{}^{23}/_{27}$	A1	
	10	

12.