Mose Benard
2724

121/1 MS
MATHEMATICS (Alt. A)
Paper 1
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MARKING SCHEME

THE KENYA NATIONAL EXAMINATIONS COUNCIL

Kenya Certificate of Secondary Education

MATHEMATICS (Alt. A)

PAPER 1

MARKING SCHEME
(CONFIDENTIAL)

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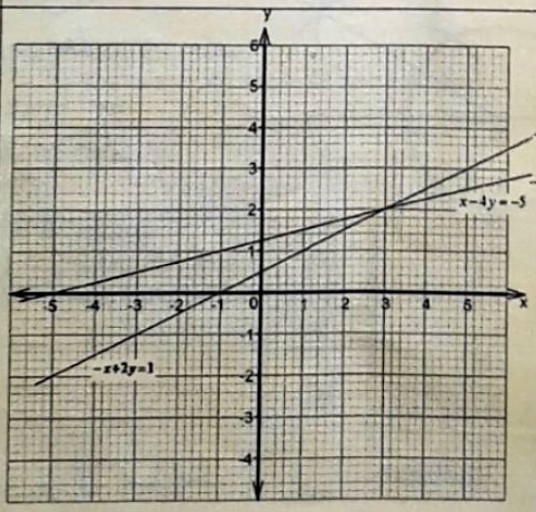
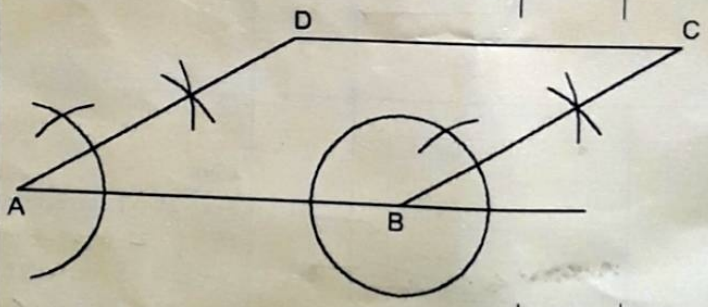
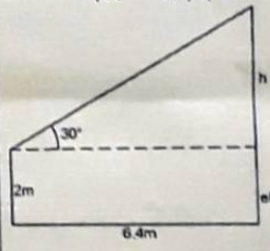
This marking scheme consists of 14 printed pages

MATHEMATICS ALT. A 121/1 PAPER 1 MARKING SCHEME

No.	Marking Scheme	Marks	Comments
1.	$\frac{-3(6+-2)--12\div4+5}{-4\times-6+-3\times5}=\frac{-3\times4--3+5}{24+-15}$ $\frac{-12+3+5}{24-15}$ $=\frac{-3\times4+3+5}{24-15}$ $=-\frac{4}{9}$	M1 M1 A1 3	$-12+3+5$ or $-12+8$ only one operation req Simplification of Numerator Simplification of Denominator
2.	Let $x=5.555.....$ $10x=55.55.....$ $10x-x=50$ $9x=50$ $x=\frac{50}{9}$ $=5\frac{5}{9}$	M1 M1 A1 3	or equivalent Substraction on both sides
3.	$49^{\frac{3}{2}}\times\left(\frac{256}{2401}\right)^{\frac{3}{4}}=\left(7^2\right)^{\frac{3}{2}}\times\left(\frac{2^8}{7^4}\right)^{\frac{3}{4}}$ $=7^3\times\frac{2^6}{7^3}$ $=64$	M1 M1 A1 3	evidence of factorization and all combined. Fractional indices removed Deny 2^6
4.	$540=2\times2\times3\times3\times3\times5$ $420=2\times2\times3\times5\times7$ G.C.D $=2^2\times3\times5$ → M1 $=60$ → A1 Number of tiles $=\frac{540}{60}\times\frac{420}{60}$ → M1 $=63$ → A1 4		process of getting the GCD Incase of use of M $2\times3\times0.1=0.6$ M1 A1 GCD = 60 process of getting no of tiles eg: $\frac{5.4\times4.2}{0.6}$ M1 $=63$ A1

No.	Marking Scheme	Marks	Comments
5.	$\frac{2x^2 - xy - 6y^2}{x^2 - 4xy + 4y^2} = \frac{(2x+3y)(x-2y)}{(x-2y)(x-2y)}$ $= \frac{2x+3y}{x-2y}$	M1 M1 A1 3	Factorizing Numerator Correct factorization Factorizing Denominator (Correct factorization accept $(x-2y)^2$
6.	Gradient of L = 2 → B1 Equation of L $\frac{y+1}{x-2} = 2$ → M1 $y = 2x - 5$ → A1 3		Or equivalent $\frac{y--1}{x-2} = 2$ ✓ ALT ✓ $-1 = 2(2)+c$ M1 $c = -5$ $y = 2x - 5$ A1
7.	Let n = No. of sides $(2n-4)\times 90^\circ = 1260^\circ$ → M1 $n = 9$ Size of each exterior angle $= \frac{360}{9}$ → M1 $= 40^\circ$ → A1 3		Or equivalent $(n-2)180^\circ$ $\frac{1260}{n} + \frac{360}{n} = 180^\circ$ $ext = \frac{1260}{9}$ $= 140$ $180 - 140$ M1 $e = 40^\circ$ A1
8.	 B1 B1 x = 3, y = 2 → B1 3		Line $-x+2y=1$ correctly drawn ✓ any 2 pts on the line seen $x-4y=-5$ correctly drawn ✓ any 2 ✓ pts on the line For both values

No.	Marking Scheme	Marks	Comments
9.	If $\sin(\theta+30^\circ) = \cos 2\theta$, then		
	$\theta + 30 + 2\theta = 90^\circ$	M1	
	$3\theta = 60^\circ$		
	$\theta = 20^\circ$	A1	
	$\cos(\theta + 40^\circ) = \cos 60^\circ$		
	$= 0.5$	B1	Accept $\cos 60^\circ = 1/2$
		3	
10.	Let $OA = x$		
	$\frac{1}{6}\times\frac{22}{7}\times 2x + \frac{1}{6}\times\frac{22}{7}\times(2x+14)+14 = 28\frac{2}{3}$	M1	$\frac{1}{6}$ represents $\frac{60}{360}$ total perimeter
	$(2x+2x+14) = \left(28\frac{2}{3}-14\right)\times\frac{42}{22}$		
	$4x = 28-14 = 14$	M1	Inner radius.
	$x = 3.5\,\text{cm}$	A1	Accept 3.502 for π: 3.142, 3.503 for calculator π
		3	
11.			30° at A or C, 150° at D or B; angles ±1°, Lengths ±0.1 cm; for broken lines loses but scores the complete parallelogram
	150° constructed at B or D or 30° at A or at C	B1	
	Lines AB and BC √ (6cm & 5cm)	B1	
	√ Complete parallelogram	B1	
		3	Follow tho' acc. angles ± 1°, lengths ± 0.1 cm for broken lines
12.	(a) Amount received by NGO (In Ksh)		
	$= 200000\times 102.40 = \text{Ksh } 20\,480\,000$	B1	
	(b) Cost of machine (Ksh) $= \frac{90}{100}\times 20480000$	M1	check also for first conversion then then
	$= 18\,432\,000$		
	Cost of machine (JY) $= \frac{18\,432\,000}{93.30}\times 100$	M1	
	$= 19\,755\,627$	A1	
		4	

No.	Marking Scheme	Marks	Comments
13.	Radius of circle $= \frac{3.5}{\sin 30°} = 7$ cm Area of major sector $= \frac{300}{360} \times 7 \times 7 \times \frac{22}{7}$ $= 128\frac{1}{3}$ cm^2 Area of triangle $= \frac{1}{2} \times 7 \times 7 \sin 60$ $= 21.22$cm^2 Area of major segment $= 128\frac{1}{3} + 21.22$ $= 149.55$cm^2	B1 M1 M1 A1 4	Radius of a circle 7 cm seen (diagram) B1 calculated or used. follow through. Alt Area of circle − Area of the minor segment πr^2 − $\frac{22}{7} \times 7^2 = 154$ $\frac{60}{360} \frac{22}{7} \times 7^2 - \frac{1}{2} \times 7 \times 7 \times \sin 60$ $154 - 4.387$ M1 M1 $= 149.55$ for π accept 3.142 accept 149.50 149.52
14.	$h = 6.4 \tan 30° = 3.7$ m Height of Electric pole $= 3.7 + 2$ $= 5.7$ m	M1 A1 2	 $\tan 30° = \frac{x}{6.4}$ M1 Accept Scale drawing Sin rule
15.	Total time for relay $= 45$ sec $+ 43$ sec $+ 44$ sec $+ 45$ sec $=$ 2 min 57 sec Time race completed 1 : 35 : 31 + 2 : 57 1 : 38 : 28 pm	M1 M1 A1 3	

(14) ALT 2 Sine rule ✓

$\frac{6.4}{\sin 60} = \frac{h}{\sin 30°}$ M1

$h = 3.695 + 2$

$= 5.7$ A1

ALT 3

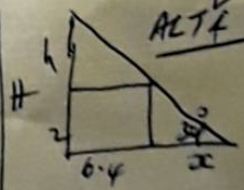
Scale drawing ✓

B1 Correct construction

B1 accuracy.

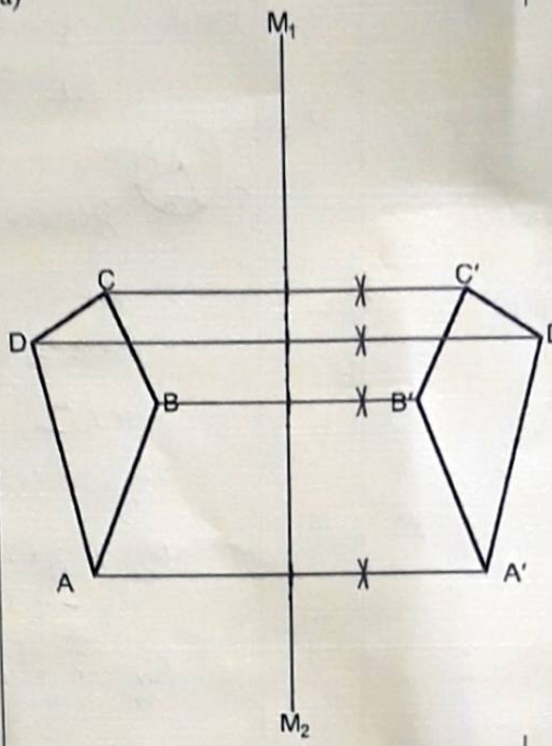
$\pm 1°$, ± 0.1 length

ALT 4



$\tan 30 = \frac{h}{6.4 + x}$ M1

Page 15 5.7 M A1

No.	Marking Scheme	Marks	Comments
16.	(a) 		Award for the implied lines for correct image.
		B1	For at least 2 correct CM = MC', BM = MB' DM = MD', AM = MA' (all at 90° to the mirror)
		B1	Correct image A'B'C'D' and labelled
	(b) Oppositely congruent	B1	Accept Indirectly congruent laterally inverted
		3	

if lost 2 B1 B1 for image but states the congruence it is B1

No.	Marking Scheme	Marks	Comments
17.	(a)(i) Kimani's contribution		A
	$= \frac{3}{8} \times \left(\frac{80}{100} \times 1\,750\,000 \right)$	M1	
	= Ksh. 525 000	A1	
	(ii) Ratio of contribution		
	Koskei : Kimani : Atieno		
	= 350 000 : 525 000 : 875 000	M1	ALT2 20% : 30% : 50%
	= 2 : 3 : 5	A1	2 : 3 : 5
			ALT3 : 2/10 : 3/10 : 5/10
	(b) Compound interest earned		2 : 3 : 5
	$= 1750000 \times 1.08^3 - 1750000$	M1	
	= Ksh 454 496	A1	Compound interest earned ✓ 455,000 (1.08^3 to 4 s.f.)
	Share received by each		
	Koskei $= \frac{2}{10} \times \frac{90}{100} \times 454\,496$	M1	For $\frac{90}{100} \times 454496$
	= Ksh 81809	A1	Accept 81900
	Kimani $= \frac{3}{10} \times \frac{90}{100} \times 454\,496$	B1	Accept 122850
	= Ksh 122714		
	Atieno $= \frac{5}{10} \times \frac{90}{100} \times 454\,496$	B1	
	= Ksh 204 523		Accept 204750
		10	

if ii) A_1 is lost due to not simplified in ratio the other A_s is A_1 ✓

No.	Marking Scheme	Marks	Comments
18.	(a) height of cone $= \sqrt{(10^2 - 6^2)}$		
	$= 8$ cm	B1	
	Total height of solid $= 8 + 15 + 6$		
	$= 29$ cm	B1	
	(b) Surface area of solid $= \pi rl + 2\pi rh + 2\pi r^2$		
	$= 3.142\times6\times10 + 2\times3.142\times6\times15 + 2\times3.1432\times6^2$ (m1, m1, A1)	M1 M1 M1	Curved part of cone Curved part of cylinder hemisphere (m1 m1 m1)
	$= 188.52 + 565.56 + 226.224$		if 3.142 is not used A0 i.e M1M1
	$= 980.3$ cm^2	A1	
	(c) Volume of solid $= \frac{1}{3}\pi r^2h + \pi r^2h + \frac{2}{3}\pi r^3$		
	$= \frac{1}{3}\times3.142\times6^2\times8 + 3.142\times6^2\times15 + \frac{2}{3}\times3.142\times6^2$ (m1, m1, m1)	M1 M1 M1	Volume of cone Volume of cylinder Volume of hemisphere (m1 m1 m1)
	301.632 $= \sout{301.71} + 1696.68 + 452.448$		Accept 2450.7 values to 4 s.f.
	$= \sout{2450.8}$ cm^3 2450.8 cm^3	A1	loose A mark if 3.142 is not used.
		10	

No.	Marking Scheme	Marks	Comments
19.	(a) (i) Time taken by lorry $= \left(\frac{180}{x}\right)$ hours	B1	
	Time taken by pickup $= \left(\frac{180}{x+20}\right)$ hours	B1	$\frac{180}{x} - \frac{3}{4}$ Hrs. Accept
	(ii) $\frac{180}{x} - \frac{180}{x+20} = \frac{45}{60}$ $\frac{180}{x} - \frac{180}{x+20} = \frac{3}{4}$	M1	
	$180(x + 20) - 180x = \frac{3}{4}(x^2 + 20x)$		
	$x^2 + 20x - 4800 = 0$	M1	
	$(x + 80)(x - 60) = 0$	M1	$x = \frac{(-20 \pm 140)}{2}$ m1 Must be equated to zero
	$x = 60$ or -80		Ao if this is given
	$x = 60$	A1	60 must be discriminated.
	Speed of lorry = 60km / h Speed of pick up = 80km / h	B1	
	(b) Relative speed = 80 + 60 = 140 km/h		
	Time to meet $= \frac{240}{140}$ hours	M1	
	= 1hr 43 min	A1	Accept 1hr 42 min 51 sec 1.71667 Hrs. 1.714285714 Hrs.
	Time the vehicles met = 8.30am + 1hr 43 min = 10.13 am	B1	Accept 10:12:51 am
		10	

ALT 2

b) $\frac{d}{80} = \frac{240-d}{60}$

$d = 137.14$

$T = \frac{137.14}{80}$ m1 $= 1h\ 43\ min$ A1

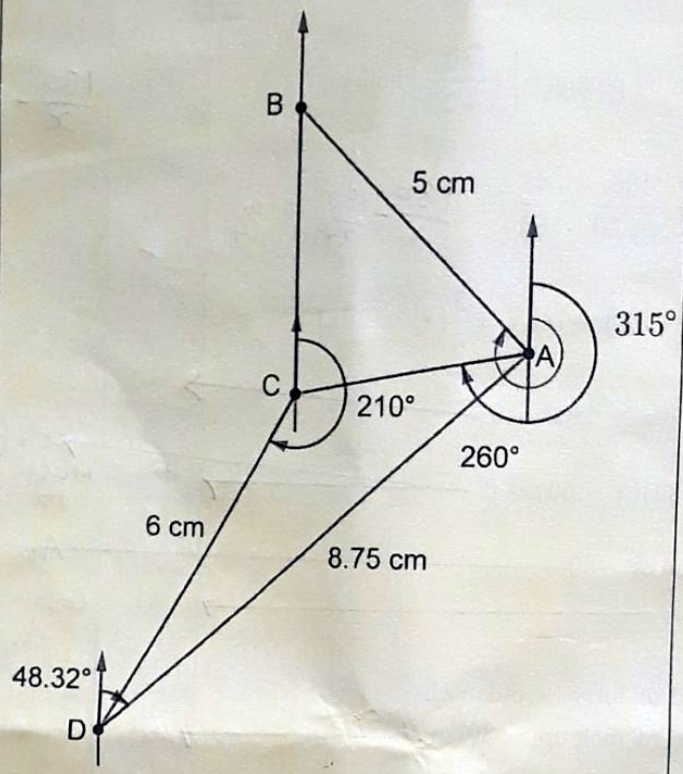
10.13 am B1

$t - 8.30$

$80(t-8.30) + 60(t-8.30) = 240\ km$

$80x + 60x = 240$

$\frac{140x}{140} = \frac{240}{140}$.

No.	Marking Scheme	Marks	Comments
20.	(a) 1 cm represents 5 km		
		B1 ✓ B1 ✓ B1 ✓	Location B Location C Location D
			if a different scale is used Mark and Penalize MR – 2
	(b)(i) Distance DA = (8.8 ± 0.1) cm		
	$= (8.8 \pm 0.1) \times 5$ km	M1	Conversion to km
	$= 44 \pm 0.5$ km	A1	44.5, 43.5 km
	(ii) Bearing of A from D = ~~48°~~ $\pm 1°$ 048°	B1	Accept N48° E
	(c) AC = $(3.6 \pm 0.1) \times 5$ km = 18 ± 0.5 km		
	Area of the forest		
	$= \frac{1}{2} \times 18 \times 25 \sin 55° + \frac{1}{2} \times 30 \times 18 \times \sin 130°$ m1 m1	M1 M1	Area of ACB Area of ADC (m1 m1)
	$= 184.3 + 206.8$ m1		
	$= 391.1$ km^2	A1	Follow tho'
		10	

c) if AB, BC are dotted / boundaries of the forest / any of the AD, DC the A Mark is lost. boundary.

No.	Marking Scheme	Marks	Comments
21.	(a)(i) $\mathbf{AB} = \begin{pmatrix}12\\-4\end{pmatrix} - \begin{pmatrix}2\\4\end{pmatrix}$	M1	Accept $\begin{pmatrix}-2\\-4\end{pmatrix} + \begin{pmatrix}12\\-4\end{pmatrix}$ M1
	$= \begin{pmatrix}10\\-8\end{pmatrix}$	A1	$\begin{pmatrix}10\\-8\end{pmatrix}$ A1
	(ii) $\mathbf{ON} = \frac{1}{4}\mathrm{OB} = \frac{1}{4}\begin{pmatrix}12\\-4\end{pmatrix} = \begin{pmatrix}3\\-1\end{pmatrix}$	B1	~~AB~~
	$\mathrm{M}\left(\frac{2+12}{2}, \frac{4+-4}{2}\right) = \mathrm{M}(7,0)$	~~B1~~ ~~OR1~~	
	$\mathbf{NM} = \begin{pmatrix}7\\0\end{pmatrix} - \begin{pmatrix}3\\-1\end{pmatrix}$	m1	ALT for NM NB + BM
		~~B1~~	$\frac{3}{4}\begin{pmatrix}12\\-4\end{pmatrix}$ B1 $+ \frac{1}{2}\begin{pmatrix}-10\\8\end{pmatrix}$
	$= \begin{pmatrix}4\\1\end{pmatrix}$	A1	$\begin{pmatrix}9\\-3\end{pmatrix} - \begin{pmatrix}5\\-4\end{pmatrix}$ M1 $= \begin{pmatrix}4\\1\end{pmatrix}$ A1
	(iii) $\lvert\mathbf{NM}\rvert = \sqrt{(4^2+1^2)}$	M1	
		~~A1~~	
	$= \sqrt{17} = 4.1$	A1	
		~~M1~~	
	(b) $\begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}5\\-1\end{pmatrix} - \begin{pmatrix}2\\4\end{pmatrix}$	m1	$\begin{pmatrix}x\\y\end{pmatrix} + \begin{pmatrix}2\\4\end{pmatrix} = \begin{pmatrix}5\\-1\end{pmatrix}$
	$\begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}3\\-5\end{pmatrix}$		
	$\mathrm{OB}' = \begin{pmatrix}12\\-4\end{pmatrix} + \begin{pmatrix}3\\-5\end{pmatrix}$	M1	
	$= \begin{pmatrix}15\\-9\end{pmatrix}$		
	Coordinates of B' = (15, −9)	A1	MUST be ordered Pair of coordinates
		10	

No.	Marking Scheme	Marks	Comments
22	(a)		

No. of Students	100-199	200-249	250-399	400-599	600-799	800-849
No. of schools	4	6	12	10	6	2

B1 Any 4 √ or 5

B2 All √

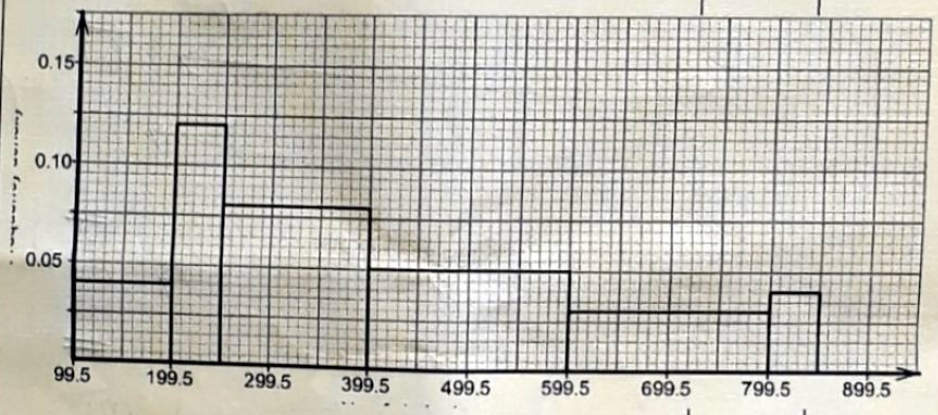
(b)

No. of Students	100-199	200-249	250-399	400-599	600-799	800-849
No. of schools	4	6	12	10	6	2
Class Width	100	50	150	200	200	50
Frequency Density	0.04	0.12	0.08	0.05	0.03	0.04

$FD = \frac{F}{CW}$

B2 All 6 FD √

B1 Any 4 FD √ or 5



if fd is not used but the correct histogram is seen the fd is implied.

B2 All 6 bars √ drawn

B1 Any 4 bars √ or 5

(c)(i) Median class = 250 – 399

Let x = point where a vertical line dividing the area of histogram into two equal parts intersects the x axis

Then,

$$4+6+(x-249.5)\times\frac{12}{150}=\frac{1}{2}\times 40$$

$x = 374.5$

M1 $\frac{10}{0.08} + 249.5$ m1

= 374.5 A1

A1

(ii) No, of schools with more than 350 students

= $2+6+10+(399.5-350)\times 0.08$

= 21.96

= 21 schools

m1 $50 \times 0.08 + 10 + 6 + 2$ m1

~~B1~~

A1 = 21 A1

10

ALT at 350 = 4 + 6 + 8 = 18

above 350 = 40 − 18 = 22 m1

> = 21 B1

No.	Marking Scheme	Marks	Comments
23.	(a) $2p^2 - p - 6 = 0$	M1	$3 - p(p - \frac{1}{2}) = 0$
	$(2p+3)(p-2)=0$	M1	Complete factorization equated to 0
	$p = -1.5$ or $p = 2$	A1	Quad formula not obtained. both values.
	(b)(i) $x + 30y = 70\,000$ ⟶	B1	$12x + 400y = 880000$
	$1.2x + 40y = 88\,000$ ⟶	B1	
	(ii) $\begin{pmatrix} 1 & 30 \\ 1.2 & 40 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 70\,000 \\ 88\,000 \end{pmatrix}$ ⟶	B1	Matrix equation
	Determinant of coeeficient matrix $= (40 - 36) = 4$	~~M1~~	
	Inverse of coeeficient matrix $= \frac{1}{4}\begin{pmatrix} 40 & -30 \\ -1.2 & 1 \end{pmatrix}$	B1 ~~A1~~	Accept equivalent
	$\frac{1}{4}\begin{pmatrix} 40 & -30 \\ -1.2 & 1 \end{pmatrix}\begin{pmatrix} 1 & 30 \\ 1.2 & 40 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{4}\begin{pmatrix} 40 & -30 \\ -1.2 & 1 \end{pmatrix}\begin{pmatrix} 70000 \\ 88000 \end{pmatrix}$	M1	Premultiplication by Inverse both sides
	$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{4}\begin{pmatrix} 160000 \\ 4000 \end{pmatrix} = \begin{pmatrix} 40000 \\ 1000 \end{pmatrix}$	M1	Process of multiplying
	x = Ksh 40 000 y = Ksh 1 000	A1	extracted from the brackets.
	Accept use of Cramer's rule		
	$\begin{pmatrix} 1 & 30 \\ 1.2 & 40 \end{pmatrix} = \begin{pmatrix} 70,000 \\ 88000 \end{pmatrix}$		
		10	

No.	Marking Scheme	Marks	Comments
24.	(a) $\frac{ds}{dt} = 2t^2 - 7t - 6$	M1	
	When $t = 5$		
	$v = 2(5)^2 - 7(5) - 6$	M1	Correct substitution
	$= 9\ m/s$	A1	
	(b) $v = 0$ when particle is at rest		
	$2t^2 - 7t - 6 = 0$	M1	
	$t = \frac{7 \pm \sqrt{(49 - 4\times2\times-6)}}{4}$		
	$t = \frac{7 \pm 9.849}{4}$	M1	
	$t = \frac{7 + 9.849}{4}$ or $t = \frac{7 - 9.849}{4}$		
	$t = 4.212$ sec or $t = -0.7123$ ~~-1.425 sec~~		
	$t = 4.212$ sec	A1	should be discriminated
	(c) Displacement of particle at $t = 4.212$ sec		
	$s = \frac{2}{3}\times4.212^3 - \frac{7}{2}\times4.212^2 - 6\times4.212 + 8$	M1	✓ substitution
	$s = -29.55\ m$	A1	Accept -29.54 (A9)
	(d) $a = \frac{dv}{dt} = 4t - 7$		
	At $t = 4$ sec		
	$a = 4(4) - 7$	M1	correct derivative and substitution
	$= 9\ m/s^2$	A1	
		10	

if b A mark is lost, ~~#~~ c) MOAO