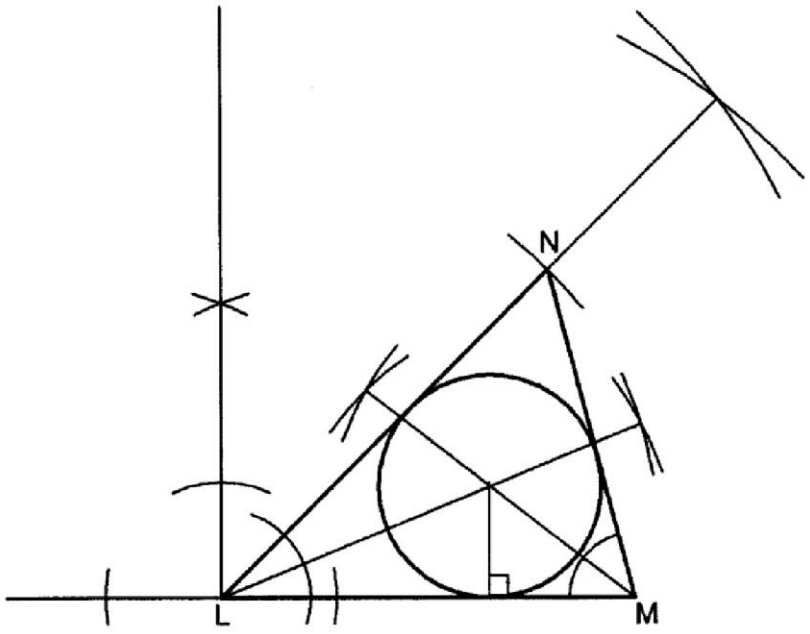
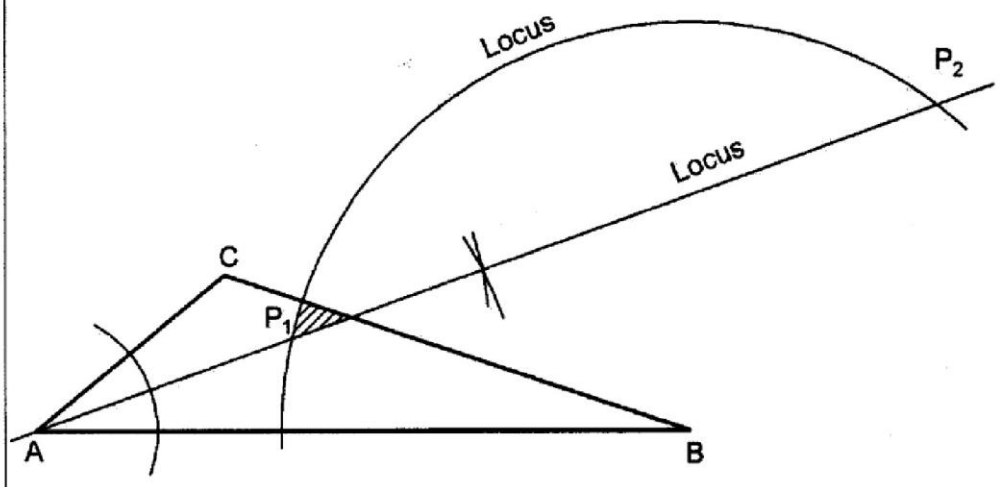
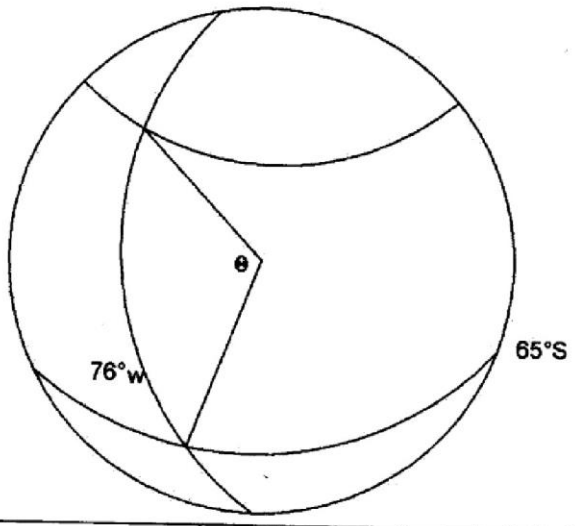
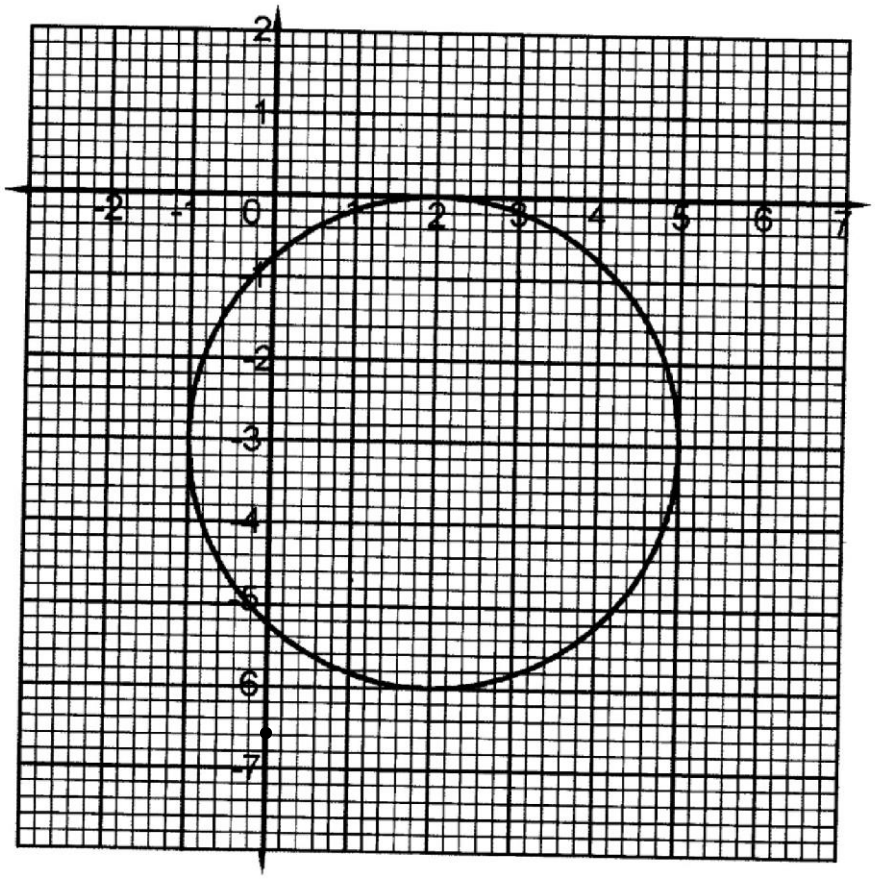
4.3.2 Mathematics Alternative A Paper 2 (121/2)

No.	Marking scheme	marks	comments
1.	$(x-1)(5x+3)=0$ $5x^2-5x+3x-3=0$ $5x^2-2x-3=0$	M1 A1 **2**	Accept $(x-1)\left(x+\frac{3}{5}\right)=0$
2.	$\lvert\text{Error}\rvert=\frac{1}{7}-\frac{14}{100}$ $=\frac{1}{350}$ % Error $=\frac{1}{350}\div\frac{1}{7}\times100$ $=\frac{1}{350}\times\frac{7}{1}\times100$ $=2\%$	M1 M1 A1 **3**	$\left(\frac{\frac{1}{7}-0.14}{\frac{1}{7}}\right)\times100\%=2\%$ M1M1A1
3. (a)	M:S:M:O = 1:2:5:1 Cost of 1kg of mixture $=\frac{90+2(120)+5(30)+150}{9}$ $=\frac{630}{9}$ $=$ Ksh 70	 M1 A1	
(b)	$\frac{130}{100}\times70$ $=$ Ksh 91	M1 A1 **4**	

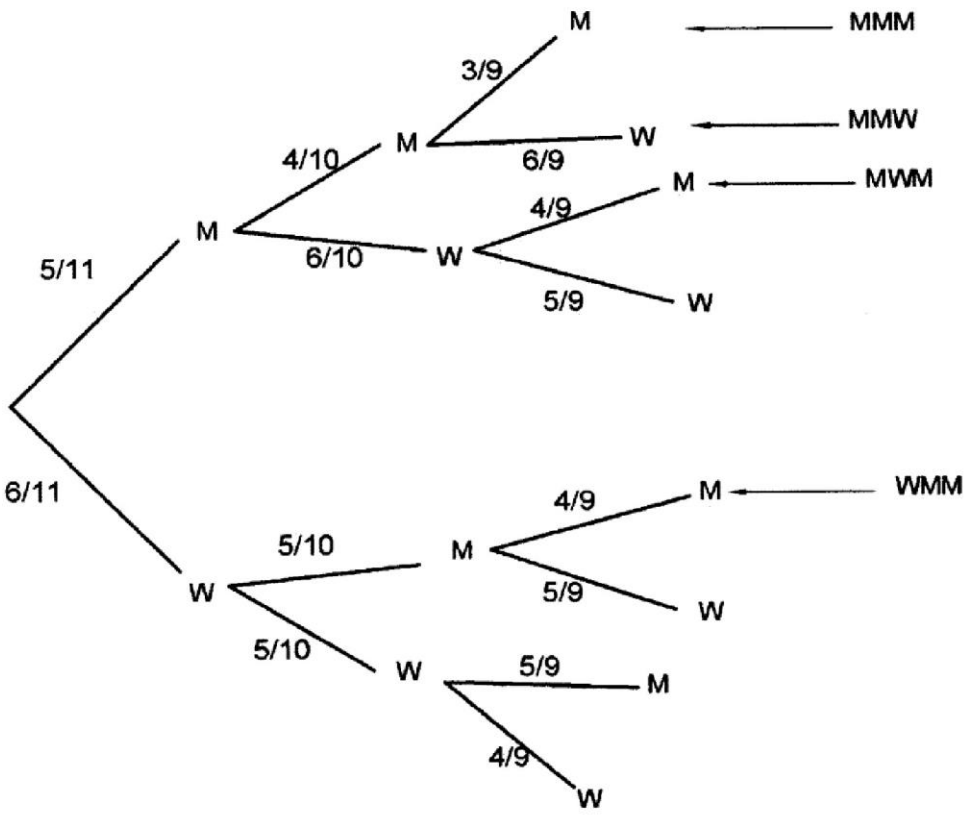
4.	$\frac{5}{6}\log_{10}64+\log_{10}50-4\log_{10}2$ $\log_{10}(2^6)^{5/6}+\log_{10}50-\log_{10}2^4$ $=\log_{10}\left(\frac{2^5\times50}{2^4}\right)$ $=\log_{10}(100)$ $=2$	M1 M1 A1 **3**	For an expression that can be combined as a single log Single log
5. (a)	$\angle PSR=180-105=75°$	B1	
(b)	$\angle PQS=\angle SRP$ $\angle SRP=180-(37.5+75)$ $=67.5°$	M1 A1 **3**	or equivalent
6.	$S^2=\frac{3d(t-d)}{8}$ $8S^2=3dt-3d^2$ $t=\frac{8S^2+3d^2}{3d}$	M1 M1 A1 **3**	Removal of $\sqrt{}$ Removal of brackets and fractions or equivalent
7.	$\frac{3}{3-\sqrt{7}}\times\frac{3+\sqrt{7}}{3+\sqrt{7}}=$ $=\frac{3\left(3+\sqrt{7}\right)}{9-7}$ $=\frac{9+3\sqrt{7}}{2}$	M1 A1 **2**	

8.		B1 B1 B1 B1 **4**	For ∠ NLM correctly constructed. Complete √ Δ 2 Angle bisectors to give the centre ⊥ to any side from the centre and the circle
9.		B1 B1 B1 **3**	For bisector of ∠A For arc r = 5cm centre B Arc P_1 P_2 Shaded region

10.	$d = 60 \times \theta$ $5400 = 60 \times \theta$ $\frac{5400}{60} = \theta$ $\theta = 90°$ Position of Q is (25°N, 76°W) ALT $(65 - x)60 = 5400$ M1 $x = -25$ A1 $Q(25°N, 70°W)$ B1	M1 A1 B1 **3**	Or equivalent 
11.	$x^2 - 4x + (-2)^2 + y^2 + 6y + (3)^2 = -4 + (-2)^2 + (3)^2$ $(x-2)^2 + (y+3)^2 = 3^2$ Centre (2,-3), r = 3 	M1 A1 B1 B1 **4**	For r Centre stated or used Correct circle

12.	$y = \frac{5}{2}\sin(4\theta + 60^0)$ Amplitude = 2 ½ Period = 90° Phase angle = 60°	B1 B1 B1 **3**	
13.	<table><tr><th>Score</th><th>d = x - a</th><th>d^2</th></tr><tr><td>10</td><td>-5</td><td>25</td></tr><tr><td>12</td><td>-3</td><td>9</td></tr><tr><td>14</td><td>-1</td><td>1</td></tr><tr><td>16</td><td>1</td><td>1</td></tr><tr><td>28</td><td>13</td><td>169</td></tr><tr><td>30</td><td>15</td><td>225</td></tr><tr><td>n = 6</td><td>$\Sigma d = 20$</td><td>$\Sigma d^2 = 430$</td></tr></table> s.d = $\sqrt{\frac{430}{6} - \left(\frac{20}{6}\right)^2}$ = $\sqrt{60.56}$ = 7.78	B1 M1 M1 A1 **4**	For correct d^2 column

14.



P (more men than women)

P(more men than women)

$= P(\text{MMW or MWM or WMM})$	B1	√ identification
$= \left(\frac{5}{11}\times\frac{4}{10}\times\frac{6}{9}\right)+\left(\frac{5}{11}\times\frac{6}{10}\times\frac{4}{9}\right)+\left(\frac{6}{11}\times\frac{5}{10}\times\frac{4}{9}\right)$	M1	√ substitution
$= \frac{4}{33}+\frac{4}{33}+\frac{4}{33}$	M1	√ addition
$= \frac{12}{33}$ *or* $\frac{4}{11}$	A1	
	4	

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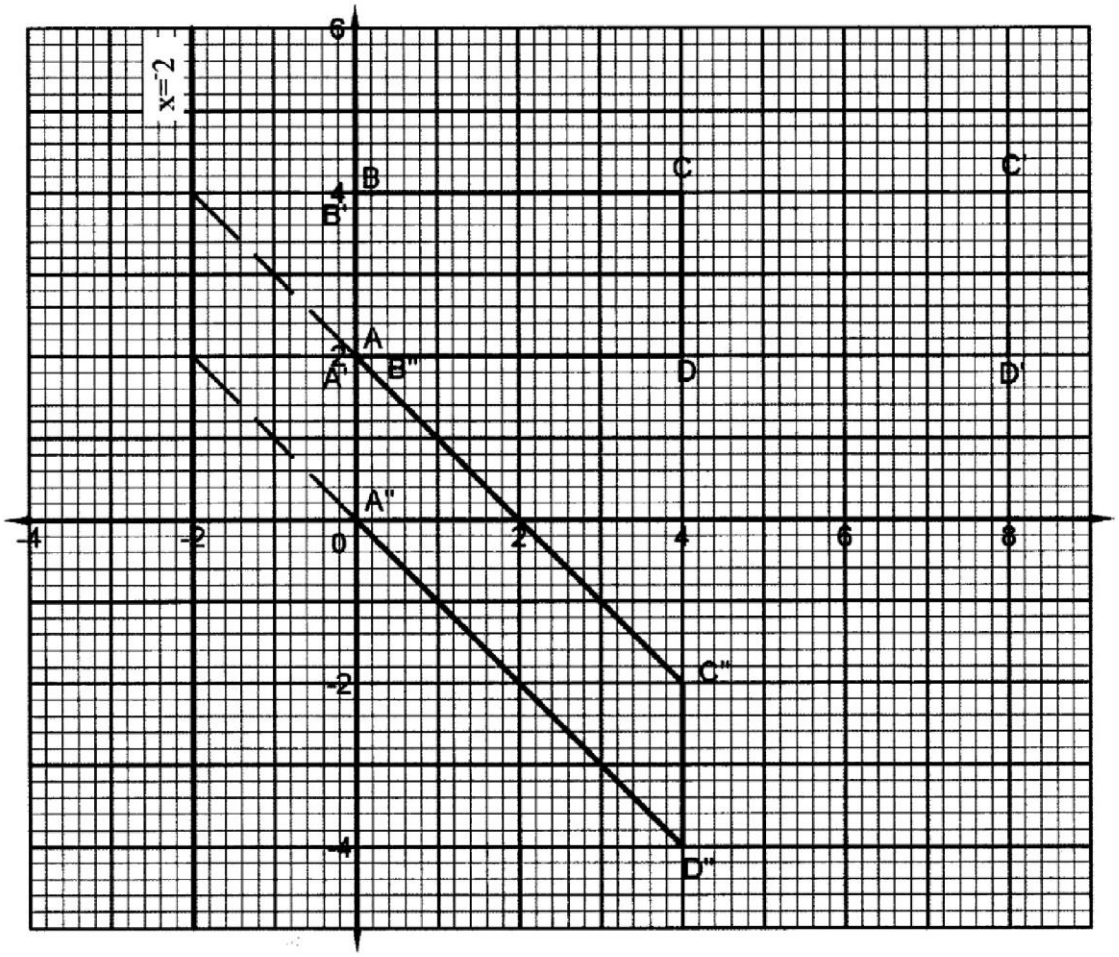
15.	$\det \begin{pmatrix} 6 & 5 \\ 3 & 4 \end{pmatrix} = 24 - 15 = 9$ Area of image $= 9 \times 42$ $= 216$ sq units	M1 A1 **2**	Or $\frac{\text{Area of image}}{24} = 9$
16.	$\mathbf{AB} = \begin{pmatrix} 4 \\ 3 \\ 9 \end{pmatrix} - \begin{pmatrix} 3 \\ 4 \\ 7 \end{pmatrix} = \begin{pmatrix} 1 \\ -1 \\ 2 \end{pmatrix}$ $\mathbf{AC} = \begin{pmatrix} 1 \\ 6 \\ 3 \end{pmatrix} - \begin{pmatrix} 3 \\ 4 \\ 7 \end{pmatrix} = \begin{pmatrix} -2 \\ 2 \\ -4 \end{pmatrix}$ $\mathbf{AC} = -2\,\mathbf{AB}$ **AB** // **AC** and A is a common point A, B and C are collinear	B1 B1 B1 **3**	For **AB** or **AC** or **BC**

17. (a)	Total earning/Taxable income		
	= Ksh (28600 + 15000 +3200 +540)	M1	
	= Ksh 47340	A1	
	Tax charged:		
	Up to 9680 → 9680 × 10% = Ksh 968 9681 – 18800 → 9120 × 15% = Ksh 1 368 18801 – 27920 → 9120 × 20% = Ksh 1 824 27924 – 37040 → 9120 × 25% = Ksh 2 280	M1	1st 4 slabs
	Above 37040 → 10300 × 30% = Ksh 3 090	M1	5th slab
	Total tax less relief:		
	(968 +1 368+1 824 +2 280+3 090) – 1 056	M1	
	= Ksh 8 474	A1	
(b)	Monthly deductions:		
	2% of Ksh 28 600 = Ksh 572	M1	for 2% basic salary
	Total deductions		
	Ksh (8 474 + 500 + 1 200 + 572)	M1	
	= Ksh 10 746		
	Net income = Ksh (47 340 – 10 746)	M1	
	= Ksh 36 594	A1	
		10	

18. (i)		
	ABCD correctly drawn and labelled	B1
	A′B′C′D′ correctly drawn and labelled	B1
(ii)	T is a stretch	B1
	S.F. = 2	B1
	x = 0 or y- axis invariant	B1
(iii)	$T = \begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$	M1 A1
(b)	Invariant line identified and used	B1
	A″,B″,C″ and D″ plotted	B1
	A″B″C″D″ drawn correctly	B1
		10

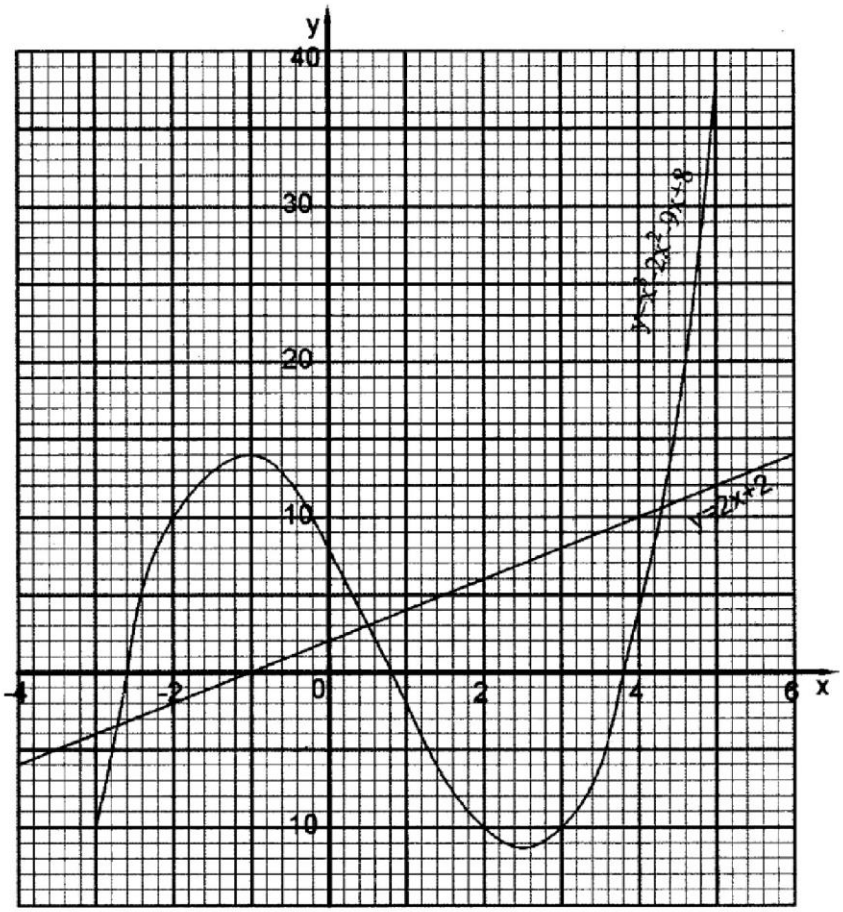
19. (a)

x	-3	-2	-1	0	1	2	3	4	5
$y = x^3 - 2x^2 - 9x + 8$	-10	10	14	8	-2	-10	-10	4	38

B2 For all correct

B1 for 3 correct

(b)



S1

P1

C1 Allow through $(0, 0)$

(c) (i) Roots x = -2.6, 0.8, 3.8 Or for $(0, 0)$, $x = -2.6, 0, 3.8$

B1

(ii) $y = x^3 - 2x^2 - 9x + 8$

$o = x^3 - 2x^2 - 11x + 6$

$y = 2x + 2$

M1

A1

$y = 2x + 2$ drawn

L1

Roots are -2.7, 0.5, 4.3

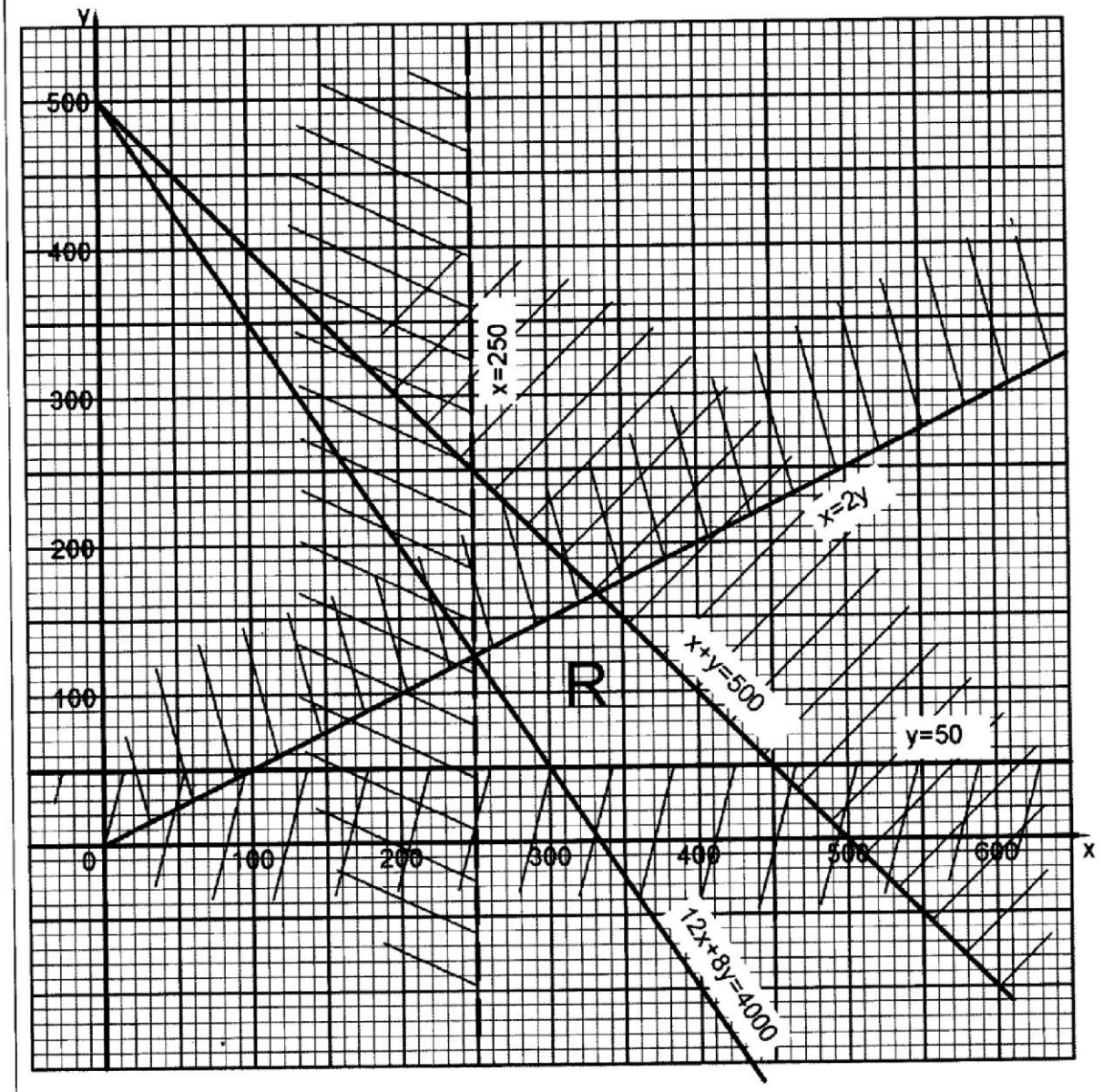
B1

For $(0, 0)$; $x = -2.7, -0.1$ and 4.3

10

20. (a)	Projection of BE is BD	B1	
(b)(i)	Angle between line AD and BF		
	$= \tan^{-1}\left(\frac{6}{12}\right)$	M1	
	$= 26.6°$	A1	
(ii)	Angle between line BE and plane ABCD		
	$BD = \sqrt{12^2 + 16^2}$		
	$= 20$	B1	
	$\text{Tan (DBE)} = \frac{6}{20}$	M1	
	$\angle DBE = \tan^{-1}\frac{6}{20}$		
	$= 16.7°$	A1	
(iii)	Angle between HBCE and BCFG.		
	$= \tan^{-1}\frac{16}{6}$	M1	
	$= 69.4°$	A1	
(c)	$BF = \sqrt{12^2 + 6^2}$		
	$= \sqrt{180}$		
	$BN = \sqrt{180 + 8^2}$	M1	Or $\sqrt{12^2 + 6^2 + 8^2}$
	$= 15.6\text{cm}$	A1	
		10	

21. (a)	$X = \dfrac{k\sqrt{Y}}{\sqrt[4]{Z}}$	B1	
	$64 = \dfrac{k\sqrt{16}}{\sqrt[4]{625}}$	M1	
	$k = 64 \times \dfrac{5}{4}$	A1	
	$= 80$		
	$X = \dfrac{80\sqrt{Y}}{\sqrt[4]{Z}}$	B1	
(b)	$160 = \dfrac{80\sqrt{36}}{\sqrt[4]{Z}}$	M1	
	$\sqrt[4]{Z} = \dfrac{80 \times 6}{160} = 3$	A1	
	$Z = 3^4 = 81$		
(c)	New $X = \dfrac{80\sqrt{1.44Y}}{\sqrt[4]{Z}}$	M1	
	$= X = \dfrac{80 \times 1.2\sqrt{Y}}{\sqrt[4]{Z}}$	M1	
	% change $= \dfrac{\dfrac{80 \times 1.2\sqrt{Y}}{\sqrt[4]{Z}} - \dfrac{80\sqrt{Y}}{\sqrt[4]{Z}}}{\dfrac{80\sqrt{Y}}{\sqrt[4]{Z}}} \times 100\%$	M1	
	$= 20\%$	A1	
		10	

22. (a)	$x + y \leq 500$ $x \geq 2y$ $y \geq 50$ $x > 250$	B1 B1 B1 B1	
(b)			
	$x + y \leq 500$ $x > 2y$ $y \geq 50$ $x > 250$	B1 B1 B1 B1	

(c)	Search line $12x+8y=4000$ For maximum profit $x=450, y=50$ Maximum profit $=12\times450+50\times8$ $=$ Ksh 5800	 B1 B1 **10**	Inspection Method At least two points from the correct region
23. (a) (i)	$a_n=a+(n-1)d$ $a_5=a+4d=82$ $a_{12}=a+11d=103$ $7d=21$ $d=3$ $a+4(3)=82$ $a=70$	 M1 A1 B1	
(ii)	$S_n=\frac{n}{2}(2a+(n-1)d$ $S_{21}=\frac{21}{2}(2(70)+20(3))$ $=2100$	 M1 A1	
(b)	$a+5d=85$ $a+9d=145$ $4d=60$ $d=15cm$ $a+5(15)=85$ $a=.10\ cm$	M1 M1 A1	For any one of the two equations For both d and a
(c)	$S_n=\frac{n}{2}(2a+(n-1)d)$ $S_{11}=\frac{11}{2}(2(10)+10(15))$ $=935$ cm	 M1 A1 **10**	

24. (a)	Let x be the width		
	$(3x-3)x=60$	M1	
	$3x^2-3x-60=0$		
	$x^2-x-20=0$		
	$(x-5)(x+4)=0$	M1	
	$x = 5$ *or* $x = -4$	A1	
	$\therefore$ width $x = 5$m	B1	A1 can be implied in B1
	Length = 12m Height = 3m	B1	For correct length and height
(b)	$60-(12-2y)(5-2y)=1.69$	M1	Or equivalent $10y+(12-2y)\times y\times 2$
(i)	$34y-4y^2=1.69$		
	$4y^2-34y+1.69=0$		
	$y=\dfrac{34\pm\sqrt{(-34)^2-4(4)(1.69)}}{8}$	M1	
	$y=8.45$ or $y=0.05$	A1	
	$\therefore\ y=0.05$m	B1	A1 can be implied in B1
(ii)	Dimensions or tiled area		
	Length = 12 – 0.1 = 11.9 m Width = 5 – 0.1 = 4.9 m	B1	
		10	