

4.3.2 Mathematics Alternative A Paper 2 (121/2)

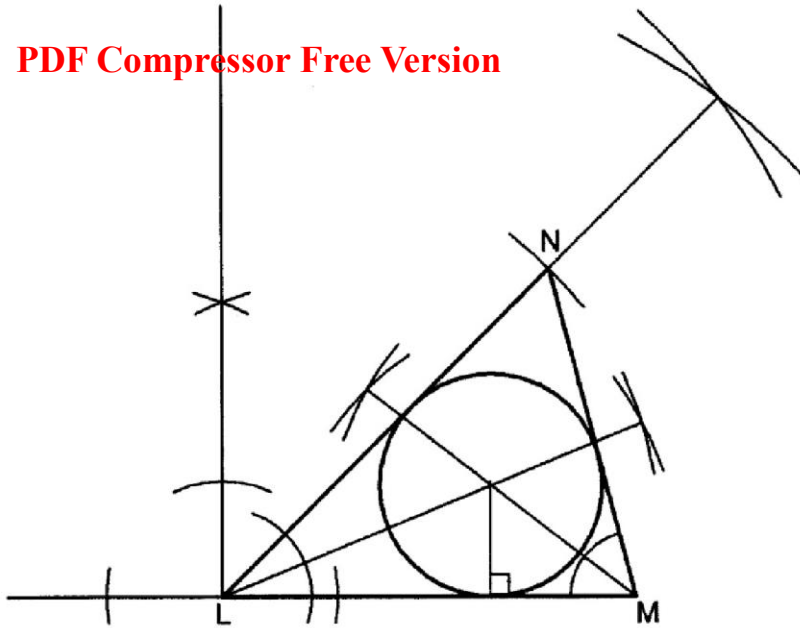
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No.	Marking scheme	marks	comments
1.	$(x-1)(5x+3) = 0$	M1	Accept $(x-1)\left(x+\frac{3}{5}\right) = 0$
	$5x^2 - 5x + 3x - 3 = 0$	A1	
	$5x^2 - 2x - 3 = 0$	2	
2.	$ \text{Error} = \frac{1}{7} - \frac{14}{100}$	M1	$\left(\frac{\frac{1}{7} - 0.14}{\frac{1}{7}}\right)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

4.	$\frac{5}{6} \log_{10} 64 + \log_{10} 50 - 4 \log_{10} 2$ <p style="text-align: center;">PDF Compressor Free Version</p> $\log_{10} (2^6)^{\frac{5}{6}} + \log_{10} 50 - \log_{10} 2^4$ $= \log_{10} \left(\frac{2^5 \times 50}{2^4} \right)$ $= \log_{10} (100)$ $= 2$	M1 M1 A1	For an expression that can be combined as a single log Single log
5. (a)	$\angle PSR = 180 - 105 = 75^\circ$	B1	or equivalent
(b)	$\angle PQS = \angle SRP$ $\angle SRP = 180 - (37.5 + 75)$ $= 67.5^\circ$	M1 A1	
		3	
6.	$S^2 = \frac{3d(t-d)}{8}$ $8S^2 = 3dt - 3d^2$ $t = \frac{8S^2 + 3d^2}{3d}$	M1 M1 A1	Removal of $\sqrt{\quad}$ Removal of brackets and fractions or equivalent
7.	$\frac{3}{3-\sqrt{7}} \times \frac{3+\sqrt{7}}{3+\sqrt{7}} =$ $= \frac{3(3+\sqrt{7})}{9-7}$ $= \frac{9+3\sqrt{7}}{2}$	M1 A1	
		2	

8.

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B1 For $\angle NLM$ correctly constructed.

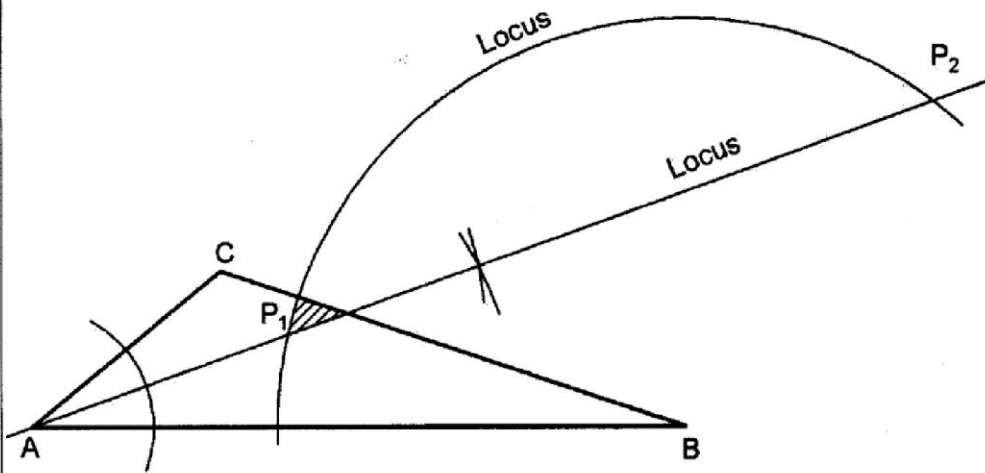
B1 Complete $\surd \Delta$

B1 2 Angle bisectors to give the centre

B1 \perp to any side from the centre and the circle

4

9.

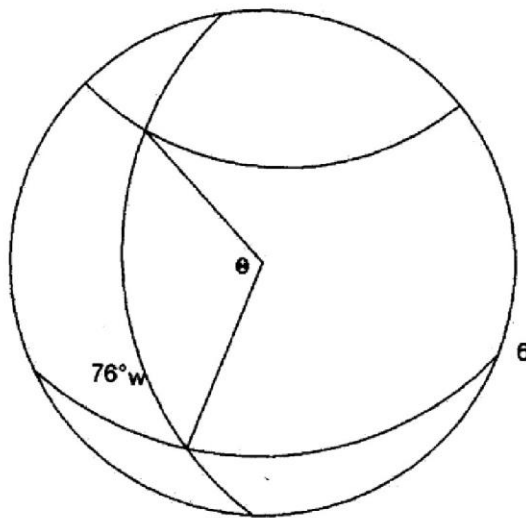
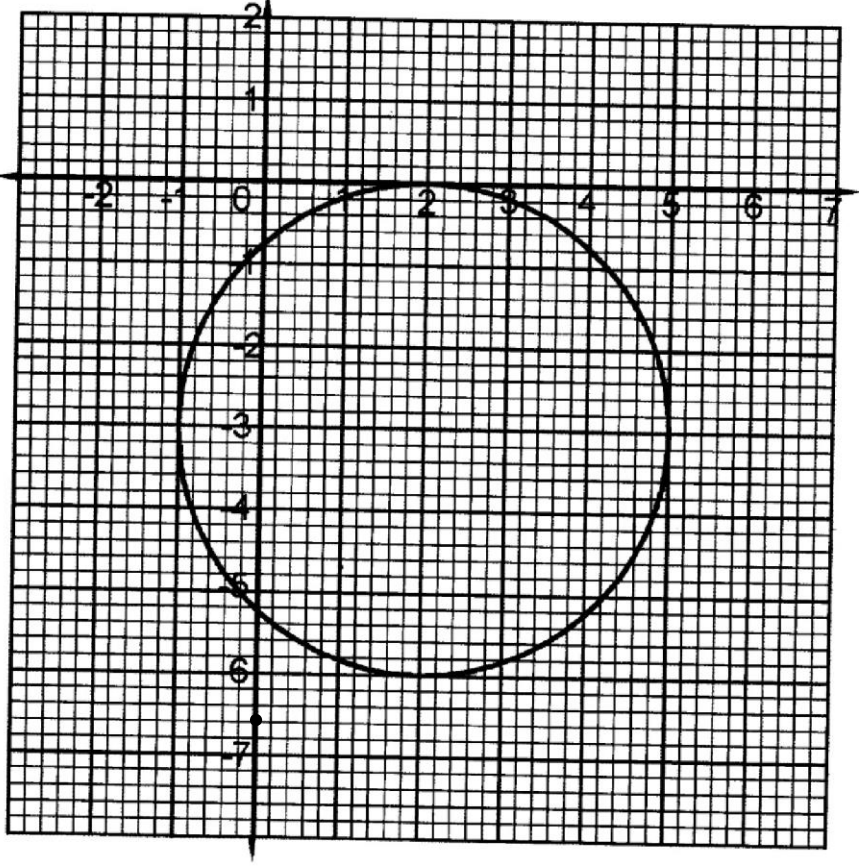


B1 For bisector of $\angle A$

B1 For arc $r = 5\text{cm}$ centre B Arc $P_1 P_2$

B1 Shaded region

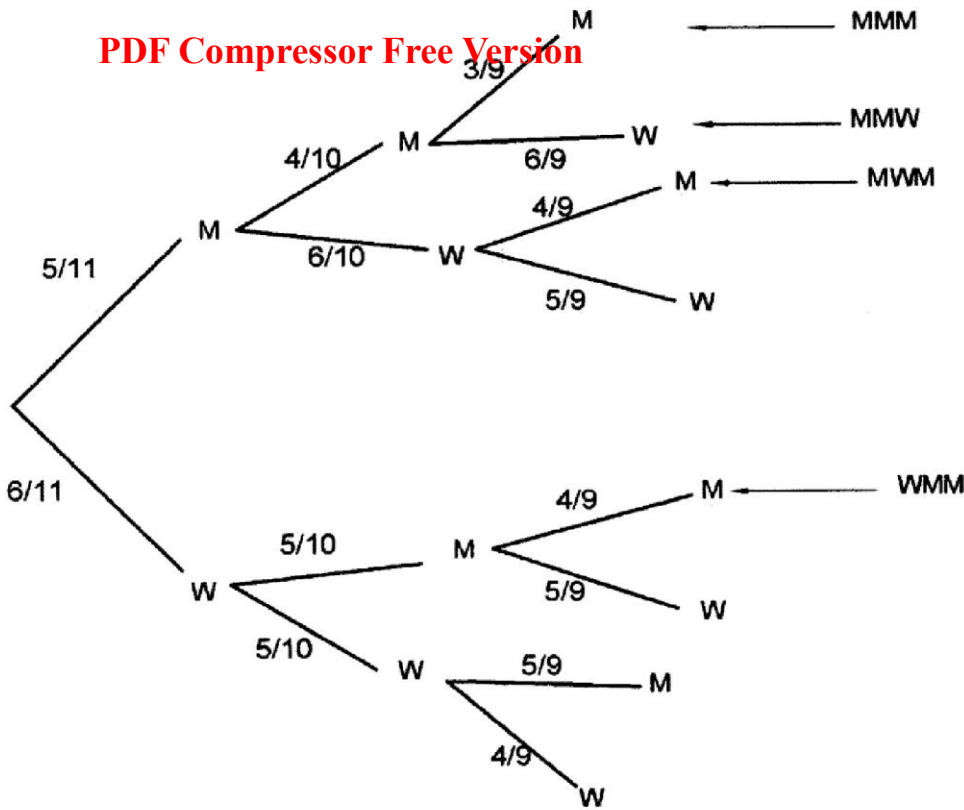
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10.	$d = 60 \times \theta$ 5400 = 60 \times \theta $\frac{5400}{60} = \theta$ $\theta = 90^\circ$ Position of Q is $(25^\circ\text{N}, 76^\circ\text{W})$ ALT $(65 - x)60 = 5400$ M1 $x = -25$ A1 $Q(25^\circ\text{N}, 70^\circ\text{W})$ B1	M1 A1 B1 <hr/> 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 For r B1 Centre stated or used B1 Correct circle <hr/> 4	

12.	$y = \frac{5}{2} \sin(4\theta + 60^\circ)$ PDF Compressor Free Version Amplitude = $2\frac{1}{2}$ Period = 90° Phase angle = 60°	B1 B1 B1																									
		3																									
13.	<table border="1"> <thead> <tr> <th>Score</th> <th>d = x - a</th> <th>d²</th> </tr> </thead> <tbody> <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> </tbody> </table> $\text{s.d} = \sqrt{\frac{430}{6} - \left(\frac{20}{6}\right)^2}$ $= \sqrt{60.56}$ $= 7.78$	Score	d = x - a	d ²	10	-5	25	12	-3	9	14	-1	1	16	1	1	28	13	169	30	15	225	n = 6	$\Sigma d = 20$	$\Sigma d^2 = 430$	B1 M1 M1 A1	For correct d ² column
Score	d = x - a	d ²																									
10	-5	25																									
12	-3	9																									
14	-1	1																									
16	1	1																									
28	13	169																									
30	15	225																									
n = 6	$\Sigma d = 20$	$\Sigma d^2 = 430$																									
		4																									

14.

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P (more men than women)

P(more men than women)

$$= P(\text{MMW or MWM or WMM})$$

$$= \left(\frac{5}{11} \times \frac{4}{10} \times \frac{6}{9}\right) + \left(\frac{5}{11} \times \frac{6}{10} \times \frac{4}{9}\right) + \left(\frac{6}{11} \times \frac{5}{10} \times \frac{4}{9}\right)$$

$$= \frac{4}{33} + \frac{4}{33} + \frac{4}{33}$$

$$= \frac{12}{33} \text{ or } \frac{4}{11}$$

B1 ✓ identification

M1 ✓ substitution

M1 ✓ addition

A1

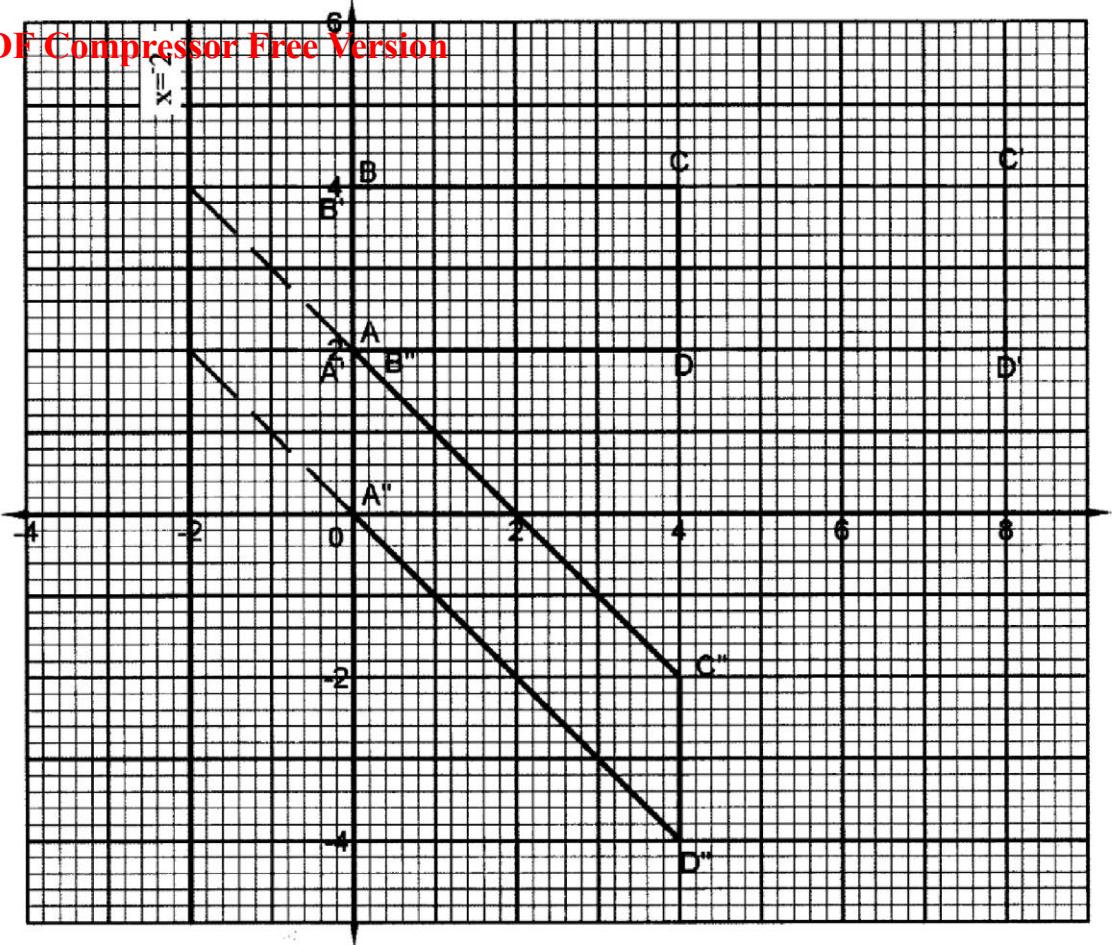
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15.	$\det \begin{pmatrix} 6 & 5 \\ 3 & 4 \end{pmatrix} = 24 - 15 = 9$ <p>PDF Compressor Free Version</p> $\text{Area of image} = 9 \times 42$ $= 216 \text{ sq units}$	M1 A1 2	Or $\frac{\text{Area of image}}{24} = 9$
16.	$\mathbf{AB} = \begin{pmatrix}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

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

18. (i)

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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

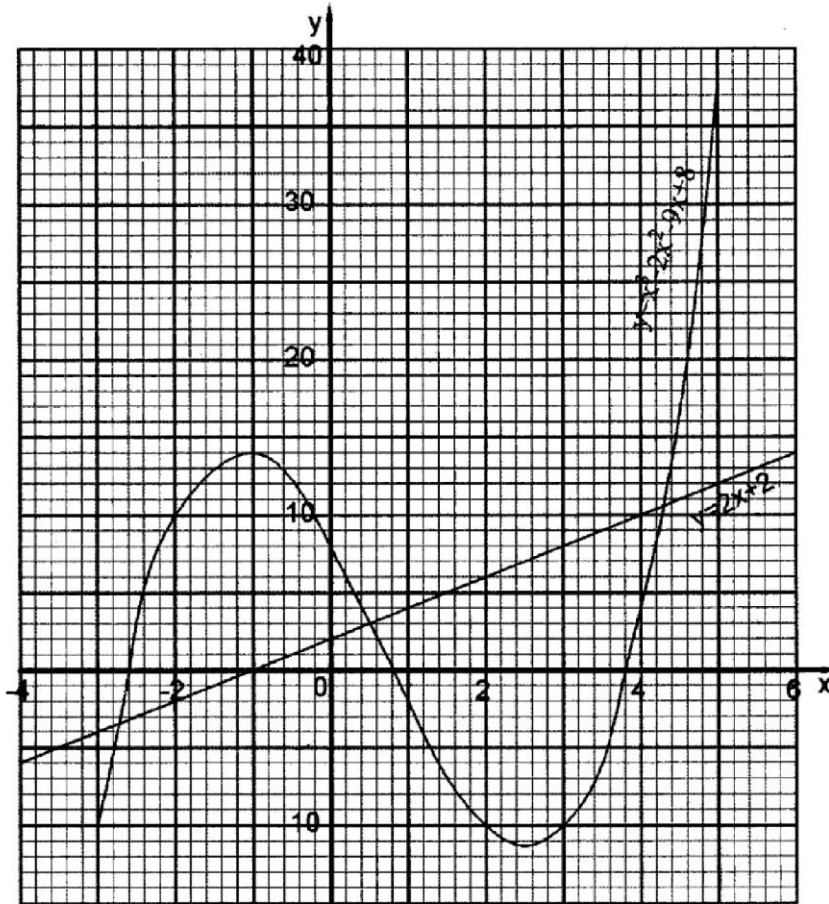
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19. (a)

PDF Compressor Free Version	x^3	x^2	x							
$y = x^3 - 2x^2 - 9x + 8$	-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
M1

(ii)

$$y = x^3 - 2x^2 - 9x + 8$$

$$0 = x^3 - 2x^2 - 11x + 6$$

$$y = \frac{2x + 2}{2x + 2}$$

$$y = 2x + 2 \text{ drawn}$$

Roots are $-2.7, 0.5, 4.3$

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

A1
L1
B1

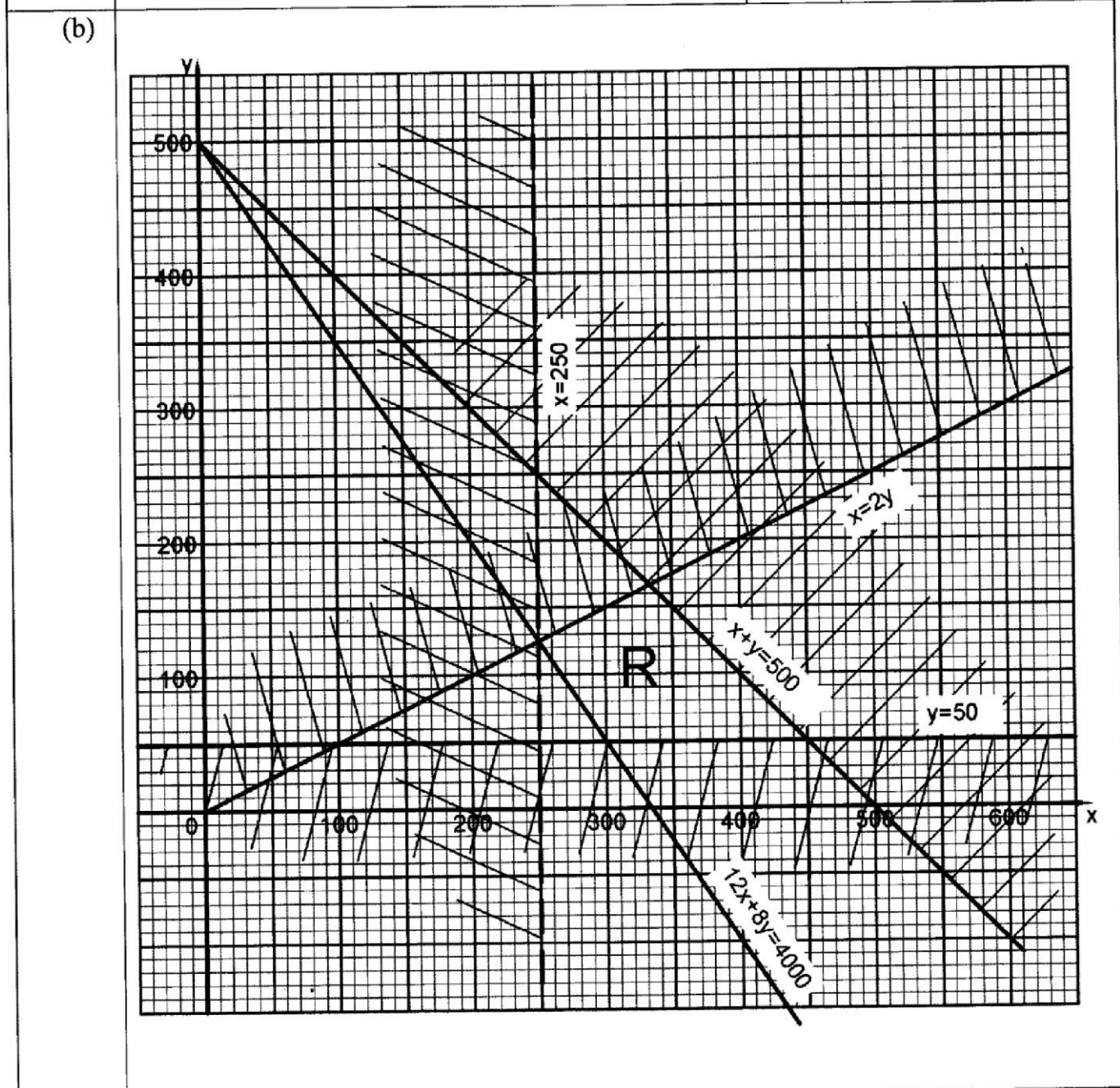
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20. (a)	Projection of BE is BD	B1	
PDF Compressor Free Version (b)(i)	Angle between line AD and BF		
	$= \tan^{-1} \left(\frac{6}{12} \right)$	M1	
	$= 26.6^\circ$	A1	
(ii)	Angle between line BE and plane ABCD		
	$BD = \sqrt{12^2 + 16^2}$ $= 20$	B1	
	$\tan (\text{DBE}) = \frac{6}{20}$	M1	
	$\angle \text{DBE} = \tan^{-1} \frac{6}{20}$ $= 16.7^\circ$	A1	
(iii)	Angle between HBCE and BCFG.		
	$= \tan^{-1} \frac{16}{6}$	M1	
	$= 69.4^\circ$	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)	$X = \frac{k\sqrt{Y}}{\sqrt[4]{Z}}$ <p style="text-align: center; color: red; font-weight: bold;">PDF Compressor Free Version</p> $64 = \frac{k\sqrt{16}}{\sqrt[4]{625}}$ $k = 64 \times \frac{5}{4}$ $= 80$ $X = \frac{80\sqrt{Y}}{\sqrt[4]{Z}}$	B1	
		M1	
		A1	
		B1	
(b)	$160 = \frac{80\sqrt{36}}{\sqrt[4]{Z}}$ $\sqrt[4]{Z} = \frac{80 \times 6}{160} = 3$ $Z = 3^4 = 81$	M1	
		A1	
(c)	<p>New $X = \frac{80\sqrt{1.44Y}}{\sqrt[4]{Z}}$</p> $= X = \frac{80 \times 1.2\sqrt{Y}}{\sqrt[4]{Z}}$ $\% \text{ change} = \frac{\frac{80 \times 1.2\sqrt{Y}}{\sqrt[4]{Z}} - \frac{80\sqrt{Y}}{\sqrt[4]{Z}}}{\frac{80\sqrt{Y}}{\sqrt[4]{Z}}} \times 100\%$ <p style="text-align: center;">•</p> $= 20\%$	M1	
		M1	
		M1	
		A1	
		10	

22. (a)	$x + y \leq 500$ $x \geq 2y$ $y \geq 50$ $x > 250$	B1	
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$x + y \leq 500$ $x > 2y$ $y \geq 50$ $x > 250$	B1	
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(c)	Search line $12x + 8y = 4000$ For maximum profit $x = 450, y = 50$ Maximum profit = $12 \times 450 + 50 \times 8$ $= \text{Ksh } 5800$	B1 B1 10	<u>Inspection Method</u> At least two points from the correct region
23. (a)	(i) $a_n = a + (n-1)d$ $a_5 = a + 4d = 82$ $a_{12} = a + 11d = 103$ $\frac{a_{12} - a_5}{12 - 5} = \frac{103 - 82}{7} = \frac{21}{7} = 3$ $d = 3$ $a + 4(3) = 82$ $a = 70$ (ii) $S_n = \frac{n}{2}(2a + (n-1)d)$ $S_{21} = \frac{21}{2}(2(70) + 20(3))$ $= 2100$ (b) $\left. \begin{array}{l} a + 5d = 85 \\ a + 9d = 145 \end{array} \right\}$ $\frac{a + 9d = 145}{a + 5d = 85} \quad -$ $4d = 60$ $d = 15 \text{ cm}$ $a + 5(15) = 85$ $a = 10 \text{ cm}$ (c) $S_n = \frac{n}{2}(2a + (n-1)d)$ $S_{11} = \frac{11}{2}(2(10) + 10(15))$ $= 935 \text{ cm}$	M1 A1 B1 M1 A1 M1 M1 A1 M1 A1 10	For any one of the two equations For both d and a

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