

FORM IV JOINT EVALUATION TEST 2017
Kenya Certificate of Secondary Education
121/1
Paper 1
MATHEMATICS

121/1
MATHEMATICS
 Paper
Time: 2½hours

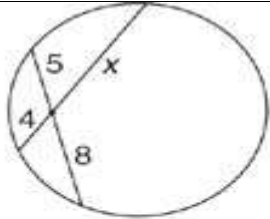
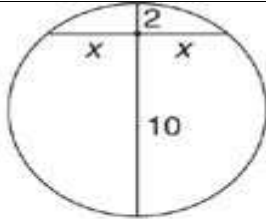
MARKING SCHEME

1	$\frac{54.17}{\tan 24.8 \times \cos 78}$ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">No.</th> <th style="width: 50%;">Log.</th> </tr> </thead> <tbody> <tr> <td>54.17</td> <td>1.7338</td> </tr> <tr> <td>Tan 24.8</td> <td>$\bar{1}.6647$</td> </tr> <tr> <td>Cos 78</td> <td>$\bar{1}.3179$</td> </tr> <tr> <td></td> <td style="text-align: center;">} $\bar{2}.9826 \div 2$ </td> </tr> <tr> <td><u>23.75</u></td> <td>=1.3756</td> </tr> </tbody> </table>	No.	Log.	54.17	1.7338	Tan 24.8	$\bar{1}.6647$	Cos 78	$\bar{1}.3179$		} $\bar{2}.9826 \div 2$	<u>23.75</u>	=1.3756	M1 B1 B1 A1	All correct logs Correct operations (addition, subtraction) Attempt to divide by 2 Correct answer
No.	Log.														
54.17	1.7338														
Tan 24.8	$\bar{1}.6647$														
Cos 78	$\bar{1}.3179$														
	} $\bar{2}.9826 \div 2$														
<u>23.75</u>	=1.3756														
2.	Solve for x and y $3^{2x-y} = 27$ $4^x \div 16^y = 1$ Solu: $3^{2x-y} = 3^3$ $2^{2x} \div 2^{4y} = 2^0$ $2x - y = 3$ $2x - 4y = 0 \qquad 2x - y = 3$ $3y = 3 \qquad 2x - 1 = 3$	M1 M1 B1													

	$y = 1$	$2x = 4$ $x = 2$	(Both answers)	A1	
3.					
	Point B (x,y) =				
	$\frac{2 + 4}{2} = 4 \quad \frac{3 + y}{2} = 2$			M1	
	$2 + x = 8 \quad 3 + y = 4$				
	$x = 6 \quad y = 1$				
	Point B = (6,1)				
	Gradient of $y = \frac{5}{2}x - 8$ $M = \frac{5}{2}$				B1
	$\therefore \frac{y - 1}{x - 6} = \frac{5}{2}$				
	$2y - 2 = 5x - 30$ $2y = 5x - 28$ $y = \frac{5}{2}x - 14$				A1
4	VLS= 4:3 ASF=16:9 $\frac{16 \times 810}{9}$ $= 1440cm^2$			M1 M1 A1	

5	$\bar{X} = \frac{8+12+4+1+6+5}{6} = 6$ <table border="1" data-bbox="239 280 670 627"> <thead> <tr> <th>X</th> <th>d = x - \bar{X}</th> <th>d²</th> </tr> </thead> <tbody> <tr><td>1</td><td>-5</td><td>25</td></tr> <tr><td>4</td><td>-2</td><td>4</td></tr> <tr><td>5</td><td>-1</td><td>1</td></tr> <tr><td>6</td><td>0</td><td>0</td></tr> <tr><td>8</td><td>2</td><td>4</td></tr> <tr><td>12</td><td>6</td><td>36</td></tr> </tbody> </table> <p style="text-align: center;">M1 for all correct deviation</p> $S = \sqrt{\frac{Ed^2}{Et}}$ $= \sqrt{\frac{70}{6}} = 3.4157$ <p style="text-align: right;">✓</p> <p style="text-align: center;">$Ed^2 = 70$ S.D=8.366. A1</p>	X	d = x - \bar{X}	d ²	1	-5	25	4	-2	4	5	-1	1	6	0	0	8	2	4	12	6	36	B1 M1 M1 A1	correct deviations eviations For correct Variance and correct S.D
X	d = x - \bar{X}	d ²																						
1	-5	25																						
4	-2	4																						
5	-1	1																						
6	0	0																						
8	2	4																						
12	6	36																						
6.	<p>Food = $\frac{1}{9}$</p> <p>Water & electricity = $\frac{1}{4} \times \frac{8}{9} = \frac{2}{9}$</p> <p>Fees = $\frac{1}{5}$</p> <p>Total = $\frac{1}{9} + \frac{2}{9} + \frac{1}{5} = \frac{8}{15}$</p> <p>$\frac{16}{100} \times \frac{7}{15} = \frac{28}{375}$</p> <p>$\frac{8}{15} + \frac{28}{375} = \frac{228}{375}$</p> <p>Game drive and saves = sh 7350</p> <p>$147 = \frac{7350}{375}$</p> <p>$\therefore \frac{375}{375} = \frac{375}{375} \times \frac{375}{147} \times 7350$</p> <p>= sh 18,750</p>	M1 M1 M1 A1																						
7	$A = P \left(1 + \frac{r}{100} \right)^n$ <p>A = 14 x 1875 = 26,250 $26250 = 22500 \left[1 + \frac{r}{100} \right]^{14}$</p> <p>P = 30,000 - 7500 = 22,500</p> $\left[\frac{26250}{22500} \right]^{\frac{1}{14}} = \left[1 + \frac{r}{100} \right]$ <p>R = 1.107%</p>	B1 M1 M1 A1																						
8.	<p>Let the number be XY</p> <p>$10X + Y = 5(X + Y)$ $5X - 4Y = 0$(I)</p>	M1																						

	$(10Y + X) - (10X + 10Y) = 9. .$ $9Y - 9X = 9..... Y - X= 1.....(ii)$ substituting (ii) in (I) $5X - 4(1+ X) =0.....X=4$ $Y=1 + 4.....Y=5$ Hence the number XY= 45	M1	
9.	Total quantity = $(p + b)$ Total cost = $40P + 20b$ $\therefore \frac{40P + 20b}{(P + b)} = 30$ $40p + 20 b = 30p + 30b$ $10p = 10b$ $\therefore P:b = 1:1$	M1	
10	$3x - 30 + 7x + 50 = 90$ $10x = 70$ $x = 7^0$	M1	
11	$(2x)^4 - (1/x)^0 + 4. (2x)^3 (1/x) + 6)2x)^2. (1/x)^2 + 4 (2x)^1. (1/x)^3 + (2x)^0 . (1/x)^4$ M1 $(16x^4 + 32x^2 + 24 + \frac{8}{x^2} + \frac{1}{x^4}) (16x^4 + 32x^2 + 24 + \frac{8}{x^2} + \frac{1}{x^4})$ M1 $32x^4 + 48 + \frac{2}{x^4}$	M1	
12	$\text{Log } \frac{1}{4} + \text{log } 64$ $\text{Log } 32 - \text{log } 1/8$ $= -2 \text{log}2 + 6\text{log}2$ $5 \text{log}2 + 3 \text{log } 2$ $= 4 \text{log}2$ $8 \text{log } 2$ $= \frac{1}{2}$	M1	

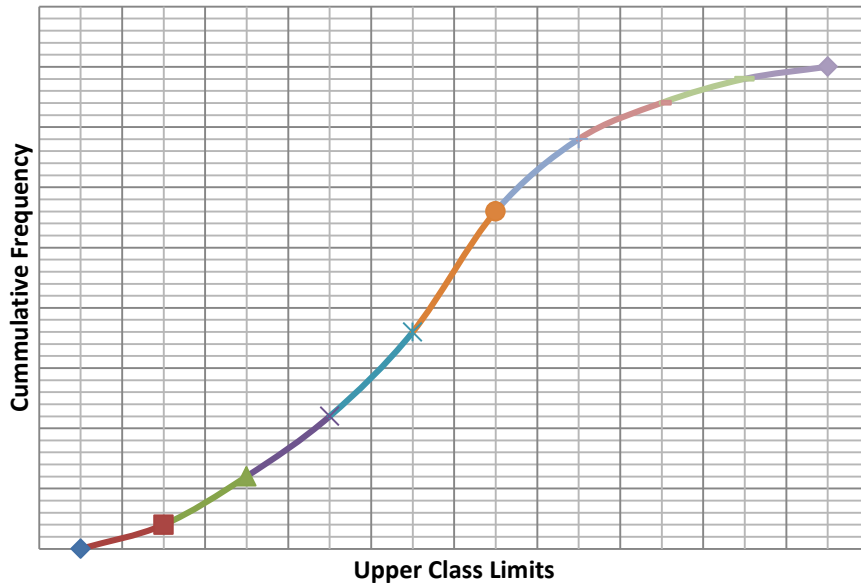
13	$3x \leq 9$ $x \leq 3$ $-12 < 4x$ $-3 < x$ $-3 < x \leq 3$ $-2, -1, 0, 1, 2, 3$	B ₁	
14	$S = KE + M\sqrt{t}$ $(16 = 4K + 2m)2$ $48 = 16K + 4m$	B ₁	
15.	<div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p style="text-align: center;">(a) (b)</p> <p>(a) By <i>Theorem 83</i>, $4(x) = (5)(8)$ $4x = 40$ $x = 10$</p> <p>(b) By <i>Theorem 83</i>, $(x)(x) = (2)(10)$ $x^2 = 20$ $x = \sqrt{20}$ $x = 2\sqrt{5}$</p>	M ₁ A ₁	A ₁

16	<p>$\sin \Theta = \frac{8}{10}$ $\Theta = 53.13^\circ$ hence $2\Theta = 106.26^\circ$</p> <p>Area of sector = $\frac{106.26}{360} \times \pi \times 10^2 = 92.77 \text{ cm}^2$</p> <p>Area of the triangle = $\frac{1}{2} \times 10 \times 10 \times \sin 106.26^\circ = 48 \text{ cm}^2$</p> <p>Area of shaded region = $92.77 \text{ cm}^2 - 48 \text{ cm}^2 = 44.77 \text{ cm}^2$</p>	B ₁																																																													
17	<p>(a)</p> <table border="1" data-bbox="244 566 651 680"> <tbody> <tr> <td>Ratio</td> <td>5:</td> <td>2:</td> <td>1</td> <td>=8</td> </tr> <tr> <td>Cost.</td> <td>25:</td> <td>30:</td> <td>45</td> <td></td> </tr> <tr> <td>Total</td> <td>125:</td> <td>60:</td> <td>45.</td> <td>= 230</td> </tr> </tbody> </table> <p>Cost of 1Kg = $\frac{230}{8} = 28.75$ shillings</p> <p>Selling price = $28.75 \times \frac{120}{100} = 34.50$ shillings</p> <p>Profit = $34.50 - 28.75 = 5.75$ shillings</p> <p>(b) Cost price after 12% increase</p> <p>(i) $230 \times \frac{112}{100} = 257.60$ shillings</p> <p>Cost per Kg = $\frac{257.6}{8} = 32.20$ shillings</p> <p>After 20% increase = 38.60 shillings</p> <p>(ii) Profit = $40.25 - 32.2 = 8.05$</p> <p>% Profit = $\frac{8.05}{32.2} \times 100 = 25\%$ profit.</p>	Ratio	5:	2:	1	=8	Cost.	25:	30:	45		Total	125:	60:	45.	= 230	M1 M1 M1 A1 M1 M1 A1 M1 M1 A1																																														
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18	<table border="1" data-bbox="336 1451 963 1910"> <thead> <tr> <th>Marks</th> <th>Freq, f</th> <th>X(mp)</th> <th>fx</th> <th>cu</th> </tr> </thead> <tbody> <tr> <td>10-19</td> <td>2</td> <td>14.5</td> <td>29</td> <td>2</td> </tr> <tr> <td>20-29</td> <td>4</td> <td>24.5</td> <td>98</td> <td>6</td> </tr> <tr> <td>30-39</td> <td>5</td> <td>34.5</td> <td>172.5</td> <td>11</td> </tr> <tr> <td>40-49</td> <td>7</td> <td>44.5</td> <td>311.5</td> <td>18</td> </tr> <tr> <td>50-59</td> <td>10</td> <td>54.5</td> <td>545</td> <td>28</td> </tr> <tr> <td>60-69</td> <td>6</td> <td>64.5</td> <td>387</td> <td>34</td> </tr> <tr> <td>70-79</td> <td>3</td> <td>74.5</td> <td>223.5</td> <td>37</td> </tr> <tr> <td>80-89</td> <td>2</td> <td>84.5</td> <td>169</td> <td>39</td> </tr> <tr> <td>90-99</td> <td>1</td> <td>94.5</td> <td>94.5</td> <td>40</td> </tr> <tr> <td></td> <td>$\Sigma f = 40$</td> <td></td> <td>$\Sigma fx = 2030$</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td>0</td> <td></td> </tr> </tbody> </table> <p>i) Mean = $\frac{\Sigma fx}{\Sigma f} = \frac{2030}{40} = 50.75$</p>	Marks	Freq, f	X(mp)	fx	cu	10-19	2	14.5	29	2	20-29	4	24.5	98	6	30-39	5	34.5	172.5	11	40-49	7	44.5	311.5	18	50-59	10	54.5	545	28	60-69	6	64.5	387	34	70-79	3	74.5	223.5	37	80-89	2	84.5	169	39	90-99	1	94.5	94.5	40		$\Sigma f = 40$		$\Sigma fx = 2030$					0		M1 M1 A1	(for correct midpoints)
Marks	Freq, f	X(mp)	fx	cu																																																											
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			0																																																												

ii) $Q_1 = \frac{1}{4} \times 40 = \text{average of 10th and 11th}$
 $10^{\text{th}} = 29.5 + \left(\frac{10-6}{5}\right) 10$
 $= 29.5 + 8$
 $= 37.5$
 $11^{\text{th}} = 39.5$ (Upper class limit)
 $Q_1 = \frac{37.5+39.5}{2} = \frac{77}{2} = 38.5$ (accept use of formula)
 A1

M1

b) Graph




P1
S1
C1

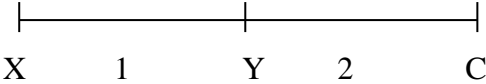
a) i) $4^{\text{th}} \text{decile } \frac{4}{10} \times 40 = 16^{\text{th}} = 46.6$
 ii) Range of means between $15^{\text{th}} - 85^{\text{th}}$
 $\frac{15}{100} \times 40 = 6 = 29.5$
 $\frac{85}{100} \times 40 = 34 = 69.5$
 Marks range between 29.5- 69.5

A1

B1

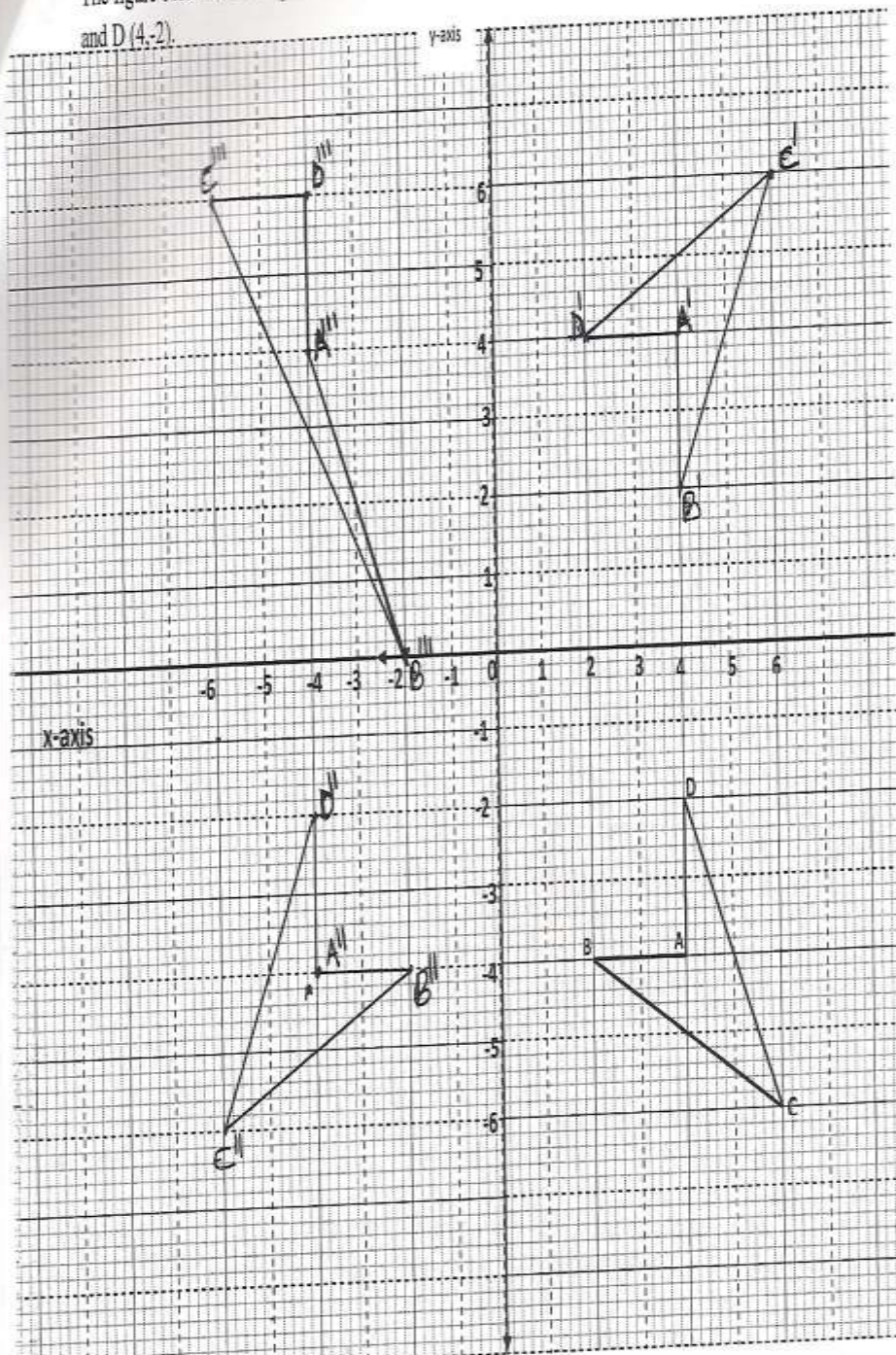
A1

<p>19</p> <p>(a)</p> <p>(b)</p> <p>(i)</p> <p>(ii)</p> <p>(iii)</p> <p>(iv)</p>	 <p>.....<i>diagram well labeled</i>B1</p> <p><i>Probability space = (WW, WL, WD, LW, LL, LD, DW, DL, DD)</i>B1</p> <p><i>P(WW)</i></p> <p><i>= 0.6 x 0.6</i> M1</p> <p><i>= 0.36</i> A1</p> <p><i>P(WW) or P(LL)</i></p> <p><i>= 0.6X0.6 + 0.3X0.3</i> M1</p> <p><i>= 0.36 + 0.09</i></p> <p><i>= 0.45</i> A1</p> <p><i>P(WL) or P(LW)</i></p> <p><i>= 0.6X0.3 + 0.3X0.6</i> M1</p> <p><i>= 0.36</i> A1</p> <p><i>P(WD) or P(LD) or P(DW) or P(DL)</i></p> <p><i>= 0.6X0.1 + 0.3X0.1 = 0.1X0.6 + 0.1X0.3</i> M1</p> <p><i>= 0.18</i> A1</p>		
<p>20</p>	<p>Original price = sh 340,000</p> <p>No of radios = x</p> <p>Cost of each radio = $\frac{\text{sh}340,000}{x}$</p> <p>New no of radios = x - 30</p> <p>New price of each radio = $\frac{\text{sh } 340000}{x} + \text{bo or}$</p> <p style="text-align: center;">$\frac{340,000}{x - 30}$</p> <p>$\therefore \frac{340,000}{x} + 300 = \frac{340,000}{x-30}$</p> <p>$340000 + 300x = \frac{340,000}{x-30}$</p> <p>$340,000(x - 30) + 300(x - 30) = 340,000x$</p> <p>$3400x - 102,000 + 3x^2 - 90x = 3400x$</p> <p>$3x^2 - 90x - 102,000 = 0$</p> <p>$x^2 - 30x - 34000 = 0$</p> <p style="padding-left: 40px;">$p = 3400$</p> <p style="padding-left: 40px;">$s = -30$</p> <p style="padding-left: 40px;">$-200,170$</p>	<p>B1</p> <p>B1</p> <p>M1</p> <p>B1</p> <p>B1</p> <p>M1</p>	

	$x^2 - 200x + 170x - 3400 = 0$ $x(x - 200) + 170(x - 200) = 0$ $(x + 170)(x - 200) = 0$ $x = -170 \text{ or } x = 200$ <p>\therefore no of radios = 200</p> $\text{New price} = \frac{340000}{170} = \text{sh } 2000$	M1 B1 A1 A1	
21	<p>(a) (i) $\overrightarrow{AB} = -\mathbf{a} + \mathbf{b}$</p> <p>(ii) $\overrightarrow{XY} = \frac{-5}{2}\mathbf{a} + 2\mathbf{b}$</p> <p>(b) (i) $\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AC}$</p> $AC = 6\mathbf{b} - 6\mathbf{a}$ $\therefore \overrightarrow{OC} = 6\mathbf{b} - 6\mathbf{a} + \mathbf{a}$ $= 6\mathbf{b} - 5\mathbf{a}$ <p>(ii) $\overrightarrow{XC} = \overrightarrow{XA} + \overrightarrow{AC}$</p> $= \frac{-3\mathbf{a}}{2} + 6\mathbf{b} - 6\mathbf{a}$ $= \frac{15\mathbf{a}}{2} + 6\mathbf{b}$ <p>(c) $\overrightarrow{XC} = 3\left(\frac{-5}{2}\mathbf{a} + 2\mathbf{b}\right)$</p> $\therefore \overrightarrow{XC} = 3\overrightarrow{XY}$ <p>$XC \parallel XY$ X is common hence X, Y & C are collinear.</p> <p>(b) Ratio in which C divides XY</p>  <p style="text-align: center;">X 1 Y 2 C</p> <p style="text-align: center;">XC : CY</p>	B1 B1 B1 B1 B1 B1 B1 B1	

	3:-2	B1	
22	<p>a) $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 4 & 2 & 2(4) \\ -4 & -4 & 6(-2) \end{pmatrix} = \begin{pmatrix} A' B' C' D' \\ 4 & 4 & 6(2) \\ 4 & 2 & 6(4) \end{pmatrix} \checkmark$</p> <p>$A' B' C' D'$ on the grid</p> <p>(b) $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 4 & 2 & 2(4) \\ 4 & 4 & 6(2) \end{pmatrix} = \begin{pmatrix} A'' B'' C' D'' \\ -4 & -4 & 6(-2) \\ -4 & -2 & 6(-4) \end{pmatrix}$</p> <p>$A'' B'' C'' D''$ on the grid</p> <p>(c)(i) $\begin{pmatrix} 1 & 0 \\ k & 1 \end{pmatrix} \begin{pmatrix} -4 \\ -4 \end{pmatrix} = \begin{pmatrix} A''' \\ -4 \\ 4 \end{pmatrix}$</p> <p>$-4k - 4 = 4$ $k = -2$</p> <p>Shear matrix</p> $\begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix}$ <p>(ii) $\begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix} \begin{pmatrix} -4 & -2 & 6(-4) \\ -4 & -4 & 6(-2) \end{pmatrix} = \begin{pmatrix} A'''' B'''' C'''' D'''' \\ -4 & 2 & 6(-4) \\ 4 & 0 & 6(6) \end{pmatrix}$</p> <p>$A'''' B'''' C'''' D''''$ on the grid</p>	<p>M₁</p> <p>B₁</p> <p>B₁</p> <p>M₁</p> <p>B₁</p> <p>B₁</p> <p>M₁</p> <p>M₁</p> <p>B₁</p> <p>1</p>	

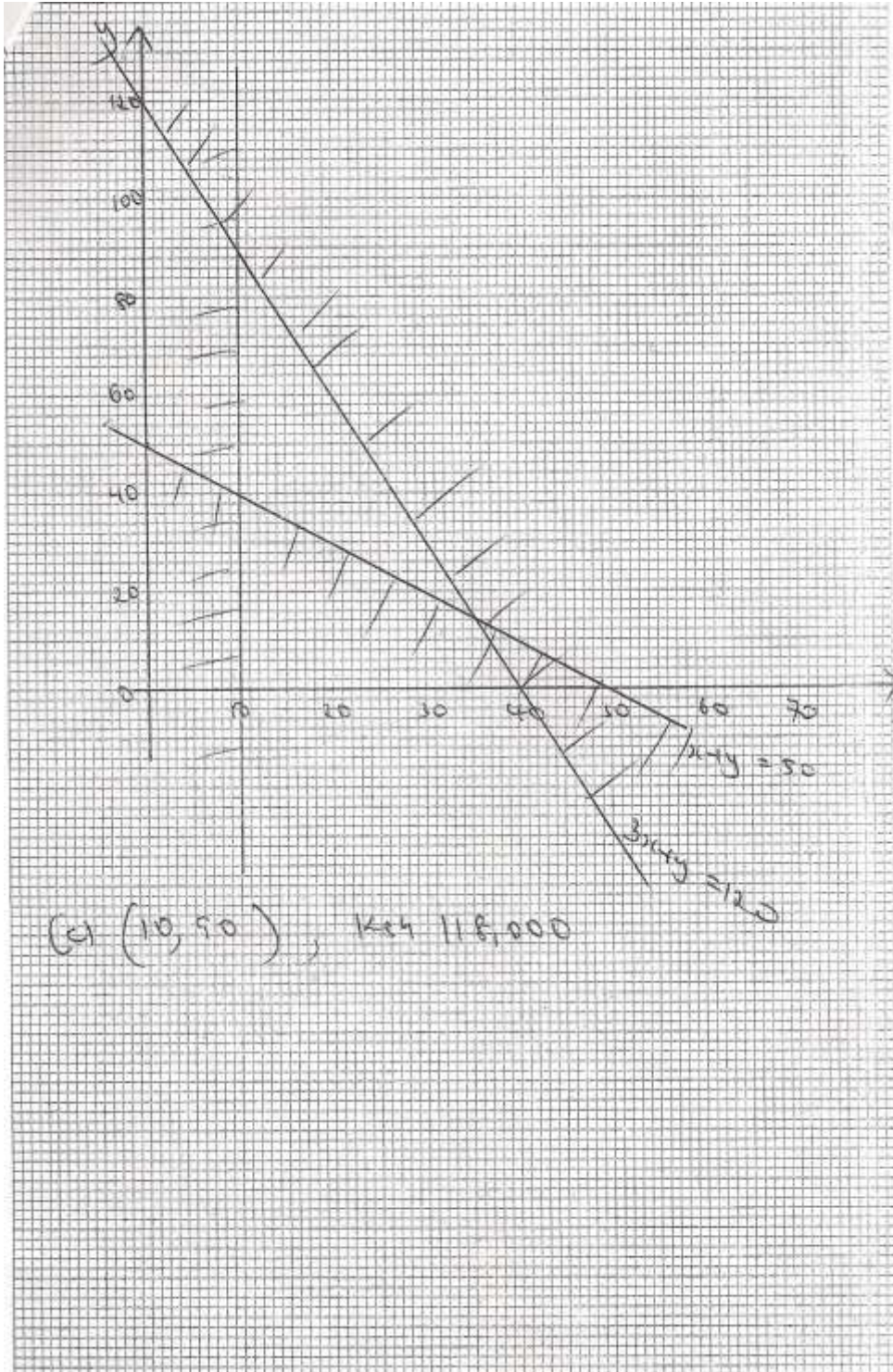
The figure below shows a quadrilateral ABCD whose vertices are A (4, -4), B (2, -4), C (6, -6) and D (4, -2).



- (a) $A'B'C'D'$ is the image of $ABCD$ under a positive quarter turn about the origin. On the same grid draw the image $A'B'C'D'$. (3mks)

23.

(a) $x + y \geq 50$
 $x \geq 10$
 $3x + y < 120$



B1
B1
B1

P1

S1

C1

M1
B1

c

shading
correctly

M1
A1

24.	<p>(i) $(AC)^2 = 23^2 + 14^2 - 2 \times 23 \times 14 \cos 134$ $AC^2 = 529 + 196 - (644 \times 0.6947)$ $AC^2 = 1172.39$ $AC = 34.24$</p> <p>(ii) $\tan \theta = \frac{12}{34.24} = 0.3505$</p> <p>$\theta = \tan^{-1} 0.3505 = 19.31^\circ$</p>	M1 A1 M1 A1	
(b)	<p>$180 - (73 + 55) = 52^\circ$</p> <p>(i) $\frac{PR}{\sin 73} = \frac{8}{\sin 52}$</p> <p>$PR = \frac{8 \times \sin 73}{\sin 52} = 9.709 \text{ km}$</p> <p>(ii) $2 PT = \frac{8}{\sin 52}$</p> <p>$PT = \frac{8}{2 \sin 52} = 5.076 \text{ km}$</p> <p>(iii) $\angle PTR = 2 \angle PQR$</p> <p>$\angle PTR = 73 \times 2 = 146$ angle at the centre of a circle is double the angle at the circumference</p>	M1 A1 M1 A1 B1 <u>B1</u>	