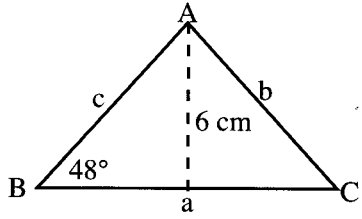
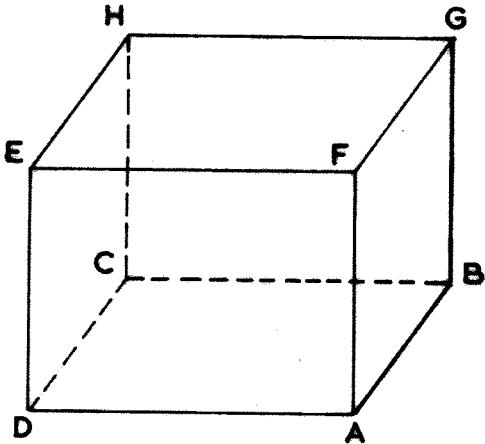


4.3 MATHEMATICS ALTERNATIVE A (121)

4.3.1 Mathematics Alternative A Paper 1 (121/1)

1.	<p>(a) $540396 - 726450 \div 3$</p> $= 540396 - 242150$ $= 298246$ <p>(b) Total value of digit in the thousands place = 8000</p>	<p>B1</p> <p>B1</p> <p>2</p>																			
2.	$6\frac{2}{3} - (\frac{7}{8} + 1\frac{1}{2})$ $= \frac{103}{24}$ <p>Son/daughters share = $\frac{1}{2} \times \frac{103}{24}$</p> $= 2\frac{7}{48} \text{ ha}$	<p>M1</p> <p>M1</p> <p>A1</p> <p>3</p>																			
3.	$S = \sqrt[3]{1728} = 12$ <p>let the diagonal be d cm</p> $\therefore d = \sqrt{12^2 + 12^2}$ $= 16.97$	<p>M1</p> <p>M1</p> <p>A1</p> <p>3</p>																			
4.	<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>72.56</td> <td>1.8607</td> </tr> <tr> <td>0.64</td> <td>1.8062 or -0.1938</td> </tr> <tr> <td></td> <td>1.6669</td> </tr> <tr> <td>1.845</td> <td>0.2660</td> </tr> <tr> <td></td> <td>x 2</td> </tr> <tr> <td></td> <td>0.5320</td> </tr> <tr> <td></td> <td style="text-align: right;">1.6669 - 0.5320 1.1349 ÷ 2</td> </tr> <tr> <td>3.694</td> <td style="text-align: right;">0.5675</td> </tr> </tbody> </table>	No	Log	72.56	1.8607	0.64	1.8062 or -0.1938		1.6669	1.845	0.2660		x 2		0.5320		1.6669 - 0.5320 1.1349 ÷ 2	3.694	0.5675	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>4</p>	<p>√ logs</p> <p>√ addition and subtraction</p> <p>√ division and multiplication</p>
No	Log																				
72.56	1.8607																				
0.64	1.8062 or -0.1938																				
	1.6669																				
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	x 2																				
	0.5320																				
	1.6669 - 0.5320 1.1349 ÷ 2																				
3.694	0.5675																				

5.	$\frac{\frac{1}{2}a}{6} = \tan 42^\circ$ $a = 12 \tan 42^\circ$ $= 10.8$ $\frac{6}{\sin 48} = c \text{ or } b$ $= 8.07$ $\therefore \text{length} = 10.8 + 2 \times 8.07$ $= 26.9 \text{ cm}$	M1 M1 A1 3	
6.	Mass of A = 50×13.6 $= 680 \text{ g}$ Volume of B = $\frac{680}{11.3}$ $= 60.2 \text{ cm}^3$	M1 M1 A1 3	
7.		B1 B1 2	B1 transfer of all lines ✓ B1 hidden lines and labelling of cuboid ✓

8.	Commission amount = 28875 - 15375 $= 13500$ $\therefore \frac{4.5}{100}x = 13500$ $x = 13500 \times \frac{100}{4.5}$ $= 300\ 000$	M1	
		M1	
		A1	
		3	

9.	(a) $(2n - 4) 90^\circ = \frac{360}{n} \times 24$ $n^2 - 2n - 48 = 0$ $(n - 8)(n + 6) = 0$ $n = 8$ (b) Octagon	M1	
		M1	
		A1	
		B1	

10.		S1	$\sqrt{\quad}$ scale
		B2	All bars $\sqrt{\quad}$ (B1 for 4 - 6 bars $\sqrt{\quad}$)
		B1	frequency polygon
		4	

11.	$\mathbf{P} = 5\begin{pmatrix} 3 \\ 2 \end{pmatrix} - 2\begin{pmatrix} 4 \\ 1 \end{pmatrix} = \begin{pmatrix} 15 \\ 10 \end{pmatrix} - \begin{pmatrix} 8 \\ 2 \end{pmatrix}$ $= \begin{pmatrix} 7 \\ 8 \end{pmatrix}$ $\mathbf{P}' = \begin{pmatrix} 7 \\ 8 \end{pmatrix} + \begin{pmatrix} -6 \\ 4 \end{pmatrix} = \begin{pmatrix} 1 \\ 12 \end{pmatrix}$	M1 A1 B1	
		3	
12.	$\frac{4a^2 + 2b - 4c}{\frac{1}{4}(b^2 - 3a)} = \frac{4 \times 3^2 + 2 \times 5 - 4 \times \frac{-1}{2}}{\frac{1}{4}(5^2 - 3 \times 3)}$ $= \frac{4 \times 9 + 10 + 2}{\frac{1}{4}(25 - 9)}$ $= \frac{48}{4} = 12$	M1 M1 A1	√ substitution
		3	
13.	<p>Area under the curve:</p> <p>Ordinates: 6, 2, 6 and 18</p> <p>∴ area = 2 (6 + 2 + 6 + 18)</p> <p>= 64</p>	B1 M1 A1	
		3	
14.	$2j + 3s = 1800$ $7.2j + 2.4s = 4800$ $7.2j + 10.8s = 6480$ $7.2j + 2.4s = 4800$ $8.4s = 1680$ $s = 200$ $j = 600$ <p>New costs: Shirt - 200 × 1.2 = 240</p> <p>jacket - 600 × 1.2 = 720</p>	M1 M1 A1 B1	Formation of the 2 simultaneous equations Attempt to solve for j or s for both values for both new costs
		4	

15.

Trapezium:

$$\frac{1}{2} \times 30 \times (36 + 60)$$

$$= 1440$$

Semi circle:

$$\frac{1}{2} \times \frac{22}{7} \times 14 \times 14$$

$$= 308$$

Remaining part:

$$1440 - 308 = 1132 \text{ cm}^2$$

M1

M1

A1

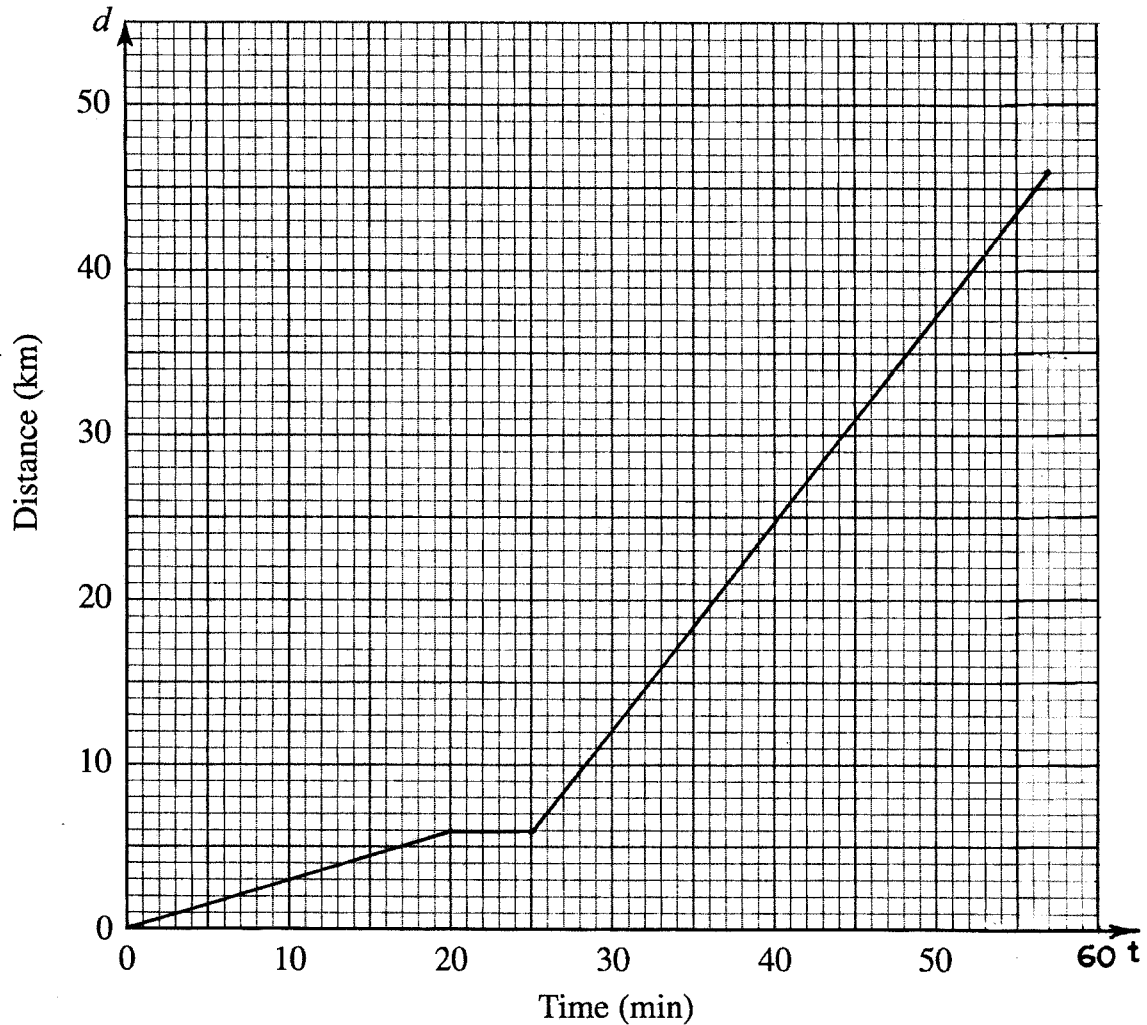
3

16.

Time of motorbike

$$= \frac{40}{75} \times 60 = 32 \text{ min.}$$

B1



Graph for cycling and stopping
Graph for motorbike

B1

B1

3

17.	<p>(a) (i) $sh \frac{7}{16} \times 4\,800\,000$ $= 2\,100\,000$</p> <p>(ii) $\frac{\frac{3}{4} \times 8 \times 10\,000 \text{ m}^2}{15 \times 25}$ $= 160$</p> <p>(b) (i) Profit</p> <p>$50\,000 \times 160 - 4\,800\,000$ $= 3\,200\,000$</p> <p>$\therefore \text{Net profit} = \frac{70}{100} \times 3\,200\,000$ $= 2\,240\,000$</p> <p>(ii) Amount earned by A and B</p> <p>$= \frac{5-4}{16} \times 2\,240\,000$ $= 140\,000$</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>10</p>	<p>Conversion Division by Area</p>
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18.

(a) $\begin{pmatrix} 18 & 40 & 5 \\ 15 & 30 & 6 \end{pmatrix}$

$\begin{pmatrix} 45 \\ 50 \\ 150 \end{pmatrix}$

(b) $\begin{pmatrix} 18 & 40 & 5 \\ 15 & 30 & 6 \end{pmatrix} \begin{pmatrix} 45 \\ 50 \\ 150 \end{pmatrix}$

$$= \begin{pmatrix} 18 \times 45 + 40 \times 50 + 5 \times 150 \\ 15 \times 45 + 30 \times 50 + 6 \times 150 \end{pmatrix}$$

$$\begin{pmatrix} j \\ w \end{pmatrix} = \begin{pmatrix} 3560 \\ 3075 \end{pmatrix}$$

Difference = $3560 - 3075 = 485$

(c) Let price of rice be x and that of sugar by y

$$\begin{pmatrix} 36 & 23 \\ 50 & 32 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 8160 \\ 11340 \end{pmatrix}$$

inverse of $\begin{pmatrix} 36 & 23 \\ 50 & 32 \end{pmatrix} = \frac{1}{2} \begin{pmatrix} 32 & -23 \\ -50 & 36 \end{pmatrix}$

$$= \begin{pmatrix} 16 & -11.5 \\ -25 & 18 \end{pmatrix}$$

$$\begin{pmatrix} 16 & -11.5 \\ -25 & 18 \end{pmatrix} \begin{pmatrix} 36 & 23 \\ 50 & 32 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 16 & -11.5 \\ -25 & 18 \end{pmatrix} \begin{pmatrix} 8160 \\ 11340 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 150 \\ 120 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 150 \\ 120 \end{pmatrix}$$

1 kg rice costs Sh150
 1 kg sugar costs Sh120

B1

B1

M1

A1

B1

B1 matrix equation

B1

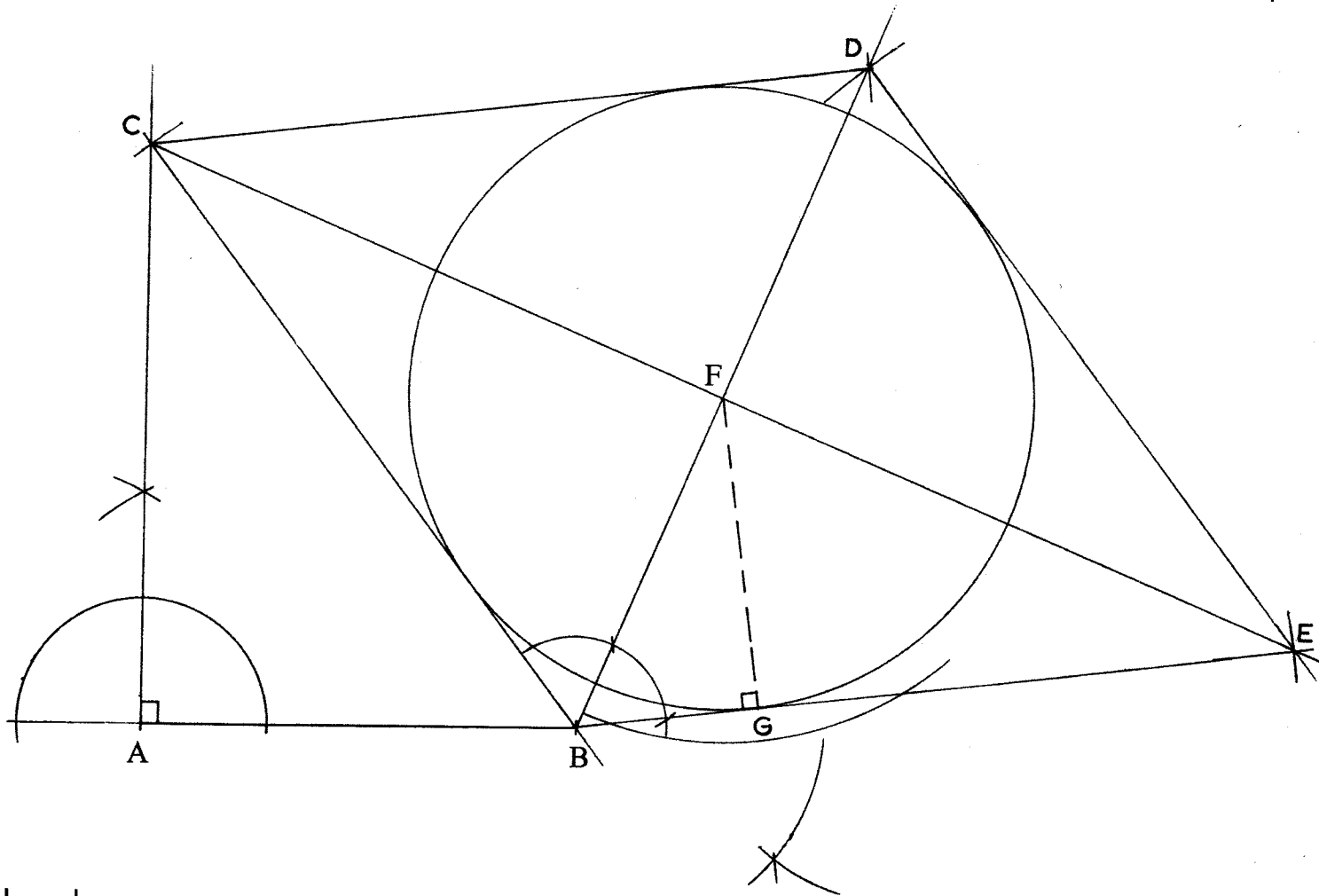
√ inverse matrix

M1

M1

A1

10



(a) (i) Construction of 90° at A
completion of triangle ABC

B1

B1

(ii) Construction of 120°
completion of rhombus

B1

B1

(iii) Dropping perpendicular from F to BE
length of perpendicular = 4.3 ± 0.1 cm

B1

B1

(iv) Construction of circle touching sides of
rhombus

B1

circle constructed

(b) area of rhombus outside the circle

$$2\left(\frac{1}{2} \times 10 \times 10 \sin 60\right) - \pi \times 4.3^2$$

M1

area of rhombus area of circle
(radius = 4.3 ± 0.1)

$$86.6 - 58.1$$

M1

Subtraction

$$= 28.5 \text{ cm}^2$$

A1

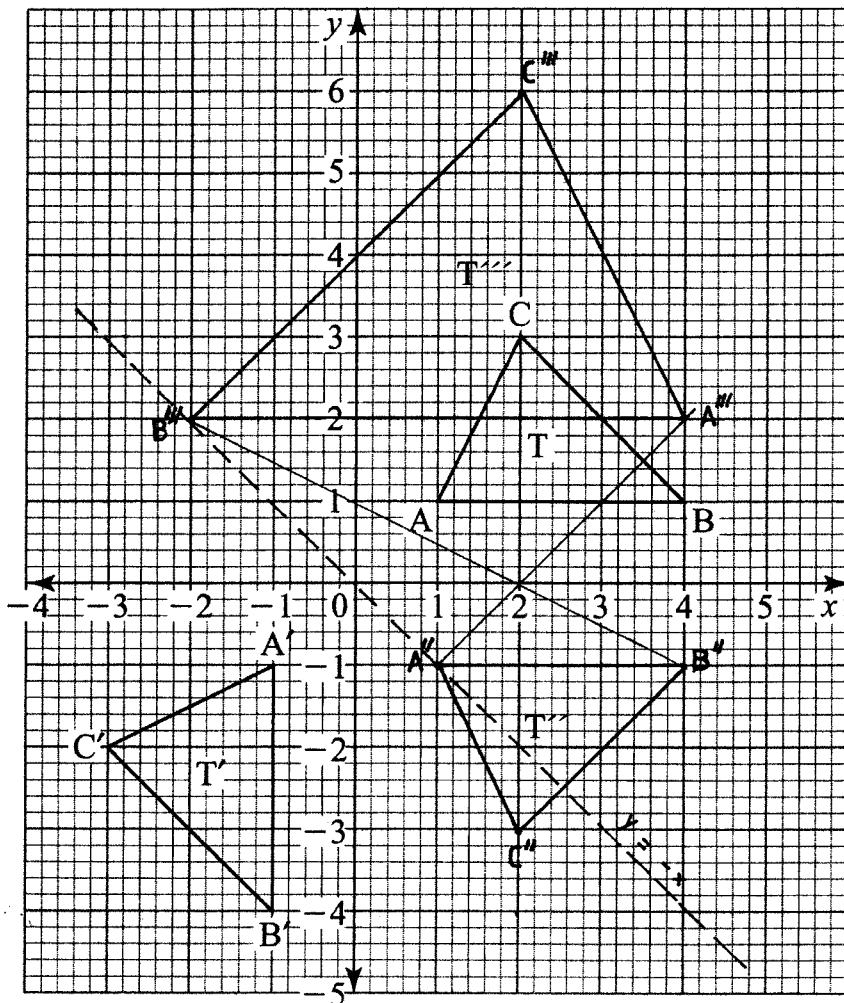
10

20.	<p>(a) $CD^2 = 12^2 + 15^2 - 2 \times 12 \times 15 \cos 30^\circ$</p> $= 144 + 225 - 311.8$ $= 57.2$ $CD = \sqrt{57.2} = 7.6 \text{ cm}$ <p>(b) $\frac{AB}{\sin 30} = \frac{15}{\sin 120}$</p> $\Rightarrow AB = \frac{15 \sin 30}{\sin 120}$ $= 8.7 \text{ cm}$ <p>(c) $\angle DBC = 60^\circ$, $BC = 12 - 8.7 = 3.3$ and $BD = 8.7$</p> $\therefore \text{area} = \frac{1}{2} \times 3.3 \times 8.7 \sin 60$ $= 12.4 \text{ cm}^2$ <p>(d) angle BDC:</p> $\frac{3.3}{\sin \theta} = \frac{7.6}{\sin 60} \Rightarrow \sin \theta = \frac{3.3 \sin 60}{7.6}$ $\theta = 22.1^\circ$	<p>M1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>	
		10	

21.	<p>(a) At x-axis $y = 0 \Rightarrow x = 1$</p> <p>coordinates of R is (1,0)</p> <p>(b) Gradient of $L_1 = \frac{2}{3}$; Grad $L_2 = -\frac{3}{2}$</p> <p>Equation of L_2: $\frac{y-0}{x-1} = -\frac{3}{2}$</p> $y = -\frac{3}{2}x + 1\frac{1}{2}$ <p>(c) (i) Equation L_3: $\frac{y-1}{x+4} = \frac{2}{3}$</p> $3y - 3 = 2x + 8$ $\Rightarrow y = \frac{2}{3}x + 3\frac{2}{3}$ <p>(ii) $\frac{2}{3}x + 3\frac{2}{3} = -\frac{3}{2}x + \frac{3}{2}$</p> $\frac{2}{3}x + \frac{3}{2}x = \frac{3}{2} - \frac{11}{3}$ $13x = -13 \Rightarrow x = -1$ <p>subst for y: $y = \frac{2}{3}(-1) + \frac{11}{3}$</p> $= -\frac{2}{3} + \frac{11}{3} = 3$ <p>coordinates of S (-1,3)</p>	<p>M1</p> <p>A1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>10</p>
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22. (a) mirror line - $y = -x$

B1



(b) (i)

B1 points A'', B'' and C''
B1 drawing A'' B'' C''

(ii) reflection
on line $y = 0$

B1
B1

(c)

B1 points A''', B''' and C'''
B1 drawing A''' B''' C'''

(d) area scale factor $(-2)^2 = 4$

B1

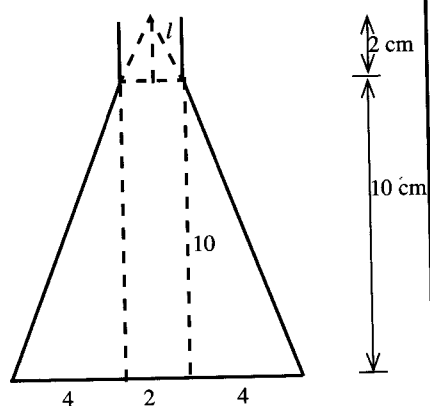
$$\therefore \text{area of object} = \frac{12}{4}$$

$$= 3 \text{ cm}^2$$

M1

A1

10

<p>23.</p> <p>(a) slant height = $\sqrt{4^2 + 10^2}$ = 10.8</p> <p>(b) slant height of small cone (l)</p> $\frac{l}{1} = \frac{l+10.8}{5}$ $5l = l + 10.8 \Rightarrow l = 2.7$ <p>(c) circular bottom: $3.142 \times 5^2 = 78.6$</p> <p>cylindrical neck : $3.142 \times 2 \times 2 = 12.6$</p> <p>conical part:</p> $3.142 \times 5 \times 13.5 - 3.142 \times 1 \times 2.7$ $212.1 - 8.5 = 203.6$ <p>External surface area =</p> $78.6 + 12.6 + 203.6$ $= 294.8$		M1	
		A1	
		M1	
		A1	
		B1	
		B1	
		M1	
		M1	
		M1	
		A1	
10			

24.

$$(a) (i) \frac{dy}{dx} = 6x^2 - 18x + p$$

$$\therefore \text{at } x = 4 : \frac{dy}{dx} = 6 \times 16 - 18 \times 4 + p = 36$$

$$96 - 72 + p = 36$$

$$p = 12$$

(ii) At $x = 0.5$

$$\frac{dy}{dx} = 6 \times (0.5)^2 - 18 \times 0.5 + 12$$

$$= 4.5$$

At $x = 0.5$

$$y = 2(0.5)^3 - 9 \times 0.5^2 + 12 \times 0.5 - 1$$

$$= 3$$

$$\text{Equation } \frac{y-3}{x-\frac{1}{2}} = \frac{9}{2}$$

$$9\left(x - \frac{1}{2}\right) = 2(y - 3)$$

$$9x - \frac{9}{2} = 2y - 6$$

$$2y - 9x = \frac{3}{2}$$

$$4y - 18x = 3$$

(b) At turning point $\frac{dy}{dx} = 0$

$$\text{i.e. } 6x^2 - 18x + 12 = 0$$

$$(x - 1)(x - 2) = 0$$

$$x = 1 \text{ or } x = 2$$

$$\text{coordinates } \left. \begin{matrix} (1, 4) \\ (2, 3) \end{matrix} \right\}$$

B1

M1

A1

B1

B1

M1

A1

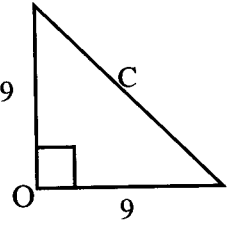
M1

A1

B1

10

4.3.2 Mathematics Alternative A Paper 2 (121/2)

1.	<p>Actual area = 60×12</p> <p>$= 720 \text{ cm}^2$</p> <p>Absolute error</p> <p>$= \frac{1}{2}[(60.5 \times 12.5) - (59.5 \times 11.5)]$</p> <p>$= 36$</p> <p>Relative error = $\frac{36}{720}$</p> <p>$= 0.05$</p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p>	
4			
2.	$\frac{\sqrt{11}}{\sqrt{11} - \sqrt{7}} = \frac{\sqrt{11}(\sqrt{11} + \sqrt{7})}{(\sqrt{11} - \sqrt{7})(\sqrt{11} + \sqrt{7})}$ $= \frac{11 + \sqrt{77}}{4}$	<p>M1</p> <p>A1</p>	Rationalizing denominator
2			
3.	$\frac{70}{360} \times 2 \times r \times \frac{22}{7} = 11$ $r = \frac{11 \times 360 \times 7}{2 \times 22 \times 70}$ <p>$= 9$</p> <p>Length of chord</p>  $C = \sqrt{9^2 + 9^2}$ <p>$= 12.7$</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>	Or equivalent
4			

4.	$\text{Angle ACD} = 180 - (90 + 55)$ $= 35^\circ$ $\text{Angle ACB} = 180 - (90 + 35 + 35)$ $= 20^\circ$	M1 M1 A1 <hr/> 3	
5.	<p>1 person takes $24 \times 11 = 264$ h to do $\frac{3}{5}$ of the job.</p> <p>In 1 hour one person does $\frac{1}{264} \times \frac{3}{5} = \frac{3}{1320}$</p> <p>$\therefore$ 7 persons can do $\frac{3 \times 7}{1320}$ of the job in 1 hour</p> <p>Time 7 persons take to complete $\frac{2}{5}$ of the job = $\frac{2}{5} \times \frac{1320}{21}$</p> $= 25.14 \text{ hours}$	M1 M1 A1 <hr/> 3	
6.	$(3x + 12)^2 + (x - 4)^2 = 200^2$ $9x^2 + 72x + 144 + x^2 - 8x + 16 = 40000$ $10x^2 + 64x - 39840 = 0$ $(x - 60)(5x + 332) = 0$ $x = 60$ $\text{Area} = 56 \times 192 = 10752 \text{ cm}^2$	M1 M1 A1 B1 <hr/> 4	

7.	$\text{Log}(x - 1) + \text{log } 100 = \text{log}(3x + 2) + \text{log } 25$ $\text{Log } 100(x - 1) = \text{Log } 25(3x + 2)$ $(x - 1)100 = (3x + 2) 25$ $100x - 100 = 75x + 50$ $25x = 150$ $x = 6$	M1 M1 A1	
		3	
8.	$(x - y)^5 = x^5 - 5x^4y + 10x^3y^2 - 10x^2y^3 + 5xy^4 - y^5$ $9.8^5 = (10 - 0.2)^5$ $= 10^5 - 5(10)^4 \times 0.2 + 10 \times 10^3 \times 0.2^2 -$ $10 \times 10^2 \times 0.2^3 + 5 \times 10 \times 0.2^4 - 0.2^5$ $= 90392.0797$	B1 M1 A1	
		3	

9.	Centre of circle = $\left(\frac{-1+5}{2}, \frac{6+-2}{2}\right)$	M1
	= (2,2)	
	Radius = $\frac{\sqrt{(-1-5)^2 + (6+2)^2}}{2}$	M1
	= $\frac{\sqrt{36+64}}{2} = 5$	
	Equation of circle =	
	$(x-2)^2 + (y-2)^2 = 5^2$	M1
	$x^2 - 4x + 4 + y^2 - 4y + 4 = 25$	
	$x^2 + y^2 - 4x - 4y = 17$	A1
		4

10.		
	⊥ ar bisector of AB	B1
	Drawing circle centre x, radius 4 cm	B1
	Locating P ₁ and P ₂ (P ₁ P ₂ = 6 ± 0.1 cm)	B1
		3

11.	$\frac{3}{8} \times \frac{5}{7} + \frac{5}{7} \times \frac{3}{7}$ $= \frac{15}{28}$	M1	
		A1	
		2	
12.	$m + b \geq 32$ $m > 20$ $b \geq 6$ $2500m + 3500b \leq 100000$ $5m + 7b \leq 200$	B1	
		B1	
		B1	
		B1	
		4	
13.	$\int_2^4 (x^2 + 2x - 15) dx = \left[\frac{x^3}{3} + \frac{2x^2}{2} - 15x \right]_2^4$ $= \left[\frac{4^3}{3} + 4^2 - 15(4) \right] - \left[\frac{2^3}{3} + 2^2 - 15(2) \right]$ $= -22\frac{2}{3} - -23\frac{1}{3}$ $= \frac{2}{3}$	M1	
		M1	
		A1	
		3	

14.	<p>Longitude difference = $71 - 36 = 35^\circ$</p> <p>Distance in nautical miles</p> $= 35 \times 60 \cos 45^\circ$ $= 1484.9 \text{ nm}$	B1	
		M1	
		A1	
		3	
15.	$\sin\left(\frac{1}{2}x - 30\right) = \sin(90 - x)$ $\frac{1}{2}x - 30 = 90 - x$ $x = 80^\circ$	M1	
		A1	
		2	
16.	$\mathbf{PQ} = \begin{pmatrix} 3 \\ -6 \end{pmatrix} + \begin{pmatrix} 2 \\ 1 \end{pmatrix} = \begin{pmatrix} 5 \\ -5 \end{pmatrix}$ $\mathbf{QR} = \begin{pmatrix} 4 \\ -1 \end{pmatrix} - \begin{pmatrix} 2 \\ 1 \end{pmatrix} = \begin{pmatrix} 2 \\ -2 \end{pmatrix}$ $\mathbf{PQ} = \frac{5}{2} \mathbf{QR} \text{ and Q is a common point}$ $\therefore \text{P, Q and R are collinear}$	B1	
		B1	
		B1	
		3	

17.	(a) (i) $6400 + 1750 \times 20$	M1	
	$= \text{Ksh } 41\,400$	A1	
	(ii) $41\,400 - 36\,000 = \text{Ksh } 5400$	B1	
	(b) $36000 \left(1 + \frac{r}{100}\right)^{\frac{20}{12}} = 41\,400$	M1	
	$\left(1 + \frac{r}{100}\right)^{\frac{5}{3}} = 1.15$	M1	
	$\left(1 + \frac{r}{100}\right) = 1.15^{\frac{3}{5}}$		
	$\frac{r}{100} = 0.087473554$	M1	
	$r = 8.7473554$		
	$\approx 8.7\%$	A1	
	(c) 36000×1.087^2	M1	
	$= 42536.484$	A1	
	$42536.484 - 36000$		
	$= 6536.484 \approx \text{Ksh } 6536$	B1	
	10		

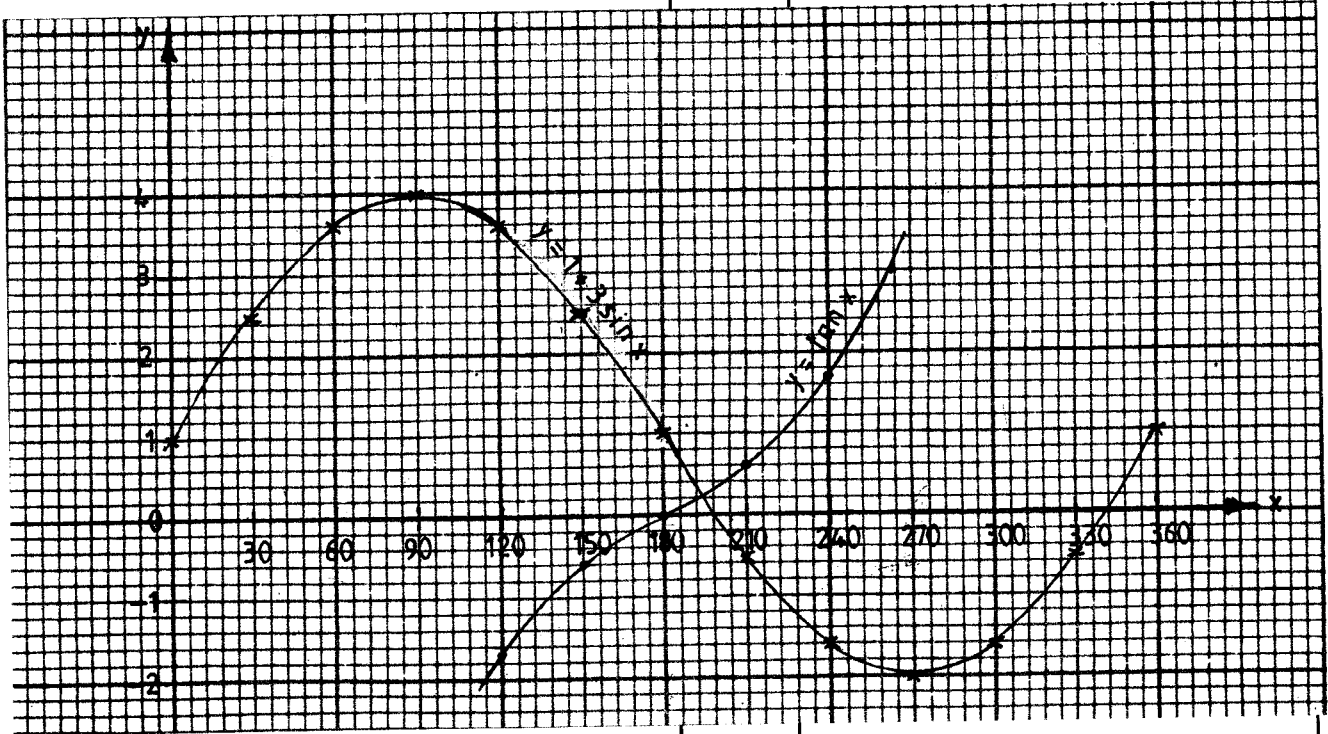
18.	(a) (i) $40 + (10 - 1)(-3)$	M1	
	$= 40 - 27 = 13 \text{ km}$	A1	
	(ii) First term after 10 days		
	$= 13 - 2 = 11$	B1	
	16 th day: $11 + 5 \times -2$	M1	
	$= 1 \text{ km}$	A1	
	(b) $S_{10} = \frac{10}{2}(2 \times 40 + 9 \times -3)$	M1	
	$= 5(80 - 27) = 265$		
	$S_6 = \frac{6}{2}(2 \times 11 + 5 \times -2)$	M1	
	$= 3(22 - 10) = 36$		
	Total distance travelled		
	$= 265 + 36 = 301$	A1	
	Amount of money raised		
$= \text{Ksh } 301 \times 200$	M1		
$= \text{Ksh } 60\,200$	A1		
		10	

19. (a)

x°	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
$y = 1 + 3\sin x$	1	2.5	3.6	4	3.6	2.5	1	-0.5	-1.6	-2	-1.6	-0.5	1

B2 Allow B1 for at least 5 \sqrt

(b) (i)



(ii) Amplitude of curve = 3

(c) $\tan x$ values

x	90	120	150	180	210	240	270
$\tan x$		-1.7	-0.6	0	0.6	1.7	

Plotting $y = \tan x$

$\tan x$ curve

(d) $1 + 3 \sin x = \tan x$

$x = 195^\circ$

S1
P1
C1
B1

B1

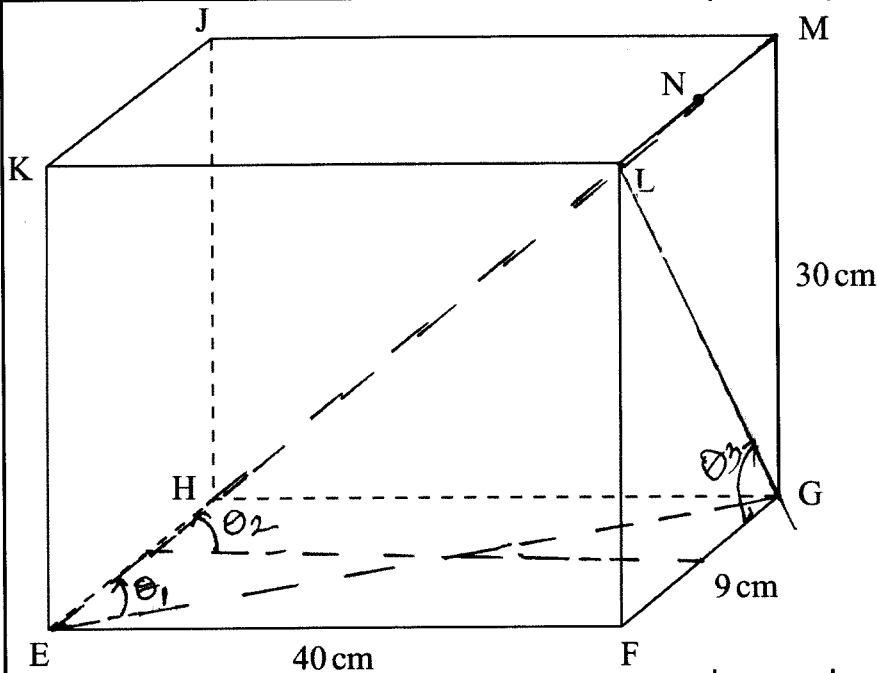
P1

C1

B1

10

20.



(a) Length $GL = \sqrt{30^2 + 9^2} = 31.32$

B1

(b) Length $FJ = \sqrt{41^2 + 900}$

M1

$= 50.80$

A1

(c) angle between EM and plane EFGH

$EG = \sqrt{40^2 + 9^2} = 41$

B1

$\theta_1 = \tan^{-1} \frac{30}{41}$

M1

$= 36.19^\circ$

A1

(d) angle between the plane EFGH and ENH

$\theta_2 = \tan^{-1} \frac{30}{40}$

M1

$= 36.87^\circ$

A1

(e) angle between lines EH and plane GL

$=$ angle between lines FG and GL

$\theta_3 = \tan^{-1} \frac{30}{9}$

M1

$= 73.30^\circ$

A1

10

21.	<p>(a) (i) $P = k_1 m^2 + k_2 n$</p> $4k_1 + -3k_2 = 3.8$ $9k_1 + 2k_2 = -0.2$ $8k_1 - 6k_2 = 7.6$ $27k_1 + 6k_2 = -0.6$ $35k_1 = 7.0$ $\left. \begin{array}{l} k_1 = 0.2 \\ k_2 = -1 \end{array} \right\}$ <p>$\therefore P = 0.2m^2 - n$</p> <p>(ii) $P = 0.2 \times 10^2 - 4 = 16$</p> <p>(b) $0.2 m^2 = P + n$</p> $m = \sqrt{\frac{P+n}{0.2}}$ <p>(c) New $m = \sqrt{\frac{1.1(P+n)}{0.2}}$</p> $\% \text{ increase in } m = \frac{(\sqrt{1.1} - 1) \sqrt{\frac{P+n}{0.2}}}{\sqrt{\frac{P+n}{0.2}}} \times 100$ $= 4.88\%$	<p>B1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>10</p>	<p>Attempt to solve</p>
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22.	<p>(a) V in terms of t</p> $a = \frac{dV}{dt} = 9 - 3t \Rightarrow V = \int (9 - 3t) dt$ $V = 9t - \frac{3t^2}{2} + C$ <p>when $t = 0, V = 7 \Rightarrow C = 7$</p> $\therefore V = 9t - \frac{3t^2}{2} + 7$ <p>(b) maximum velocity</p> $\Rightarrow a = 9 - 3t = 0 \Rightarrow t = 3$ $\therefore V = 9 \times 3 - \frac{3 \times 9}{2} + 7$ $= 27 - \frac{27}{2} + 7$ $= 34 - 13.5$ $= 20.5 \text{ ms}^{-1}$ <p>(c) $S = \int_0^3 \left(9t - \frac{3}{2}t^2 + 7\right) dt$</p> $\left[\frac{9t^2}{2} - \frac{3t^3}{6} + 7t \right]_0^3$ $\left[\frac{81}{2} - \frac{3 \times 27}{6} + 21 \right] - [0]$ $= 27 + 21$ $= 48 \text{ m}$	<p>B1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>10</p>	
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23. (a) Lower class boundary of modal class
62.5

B1

(b) Mean mark:

$$\begin{aligned} \Sigma fd &= -42 + -36 + -40 + 12 + 48 + 33 \\ &= -25 \end{aligned}$$

M1

$$\therefore \text{mean} = 64 - \frac{25}{40}$$

M1

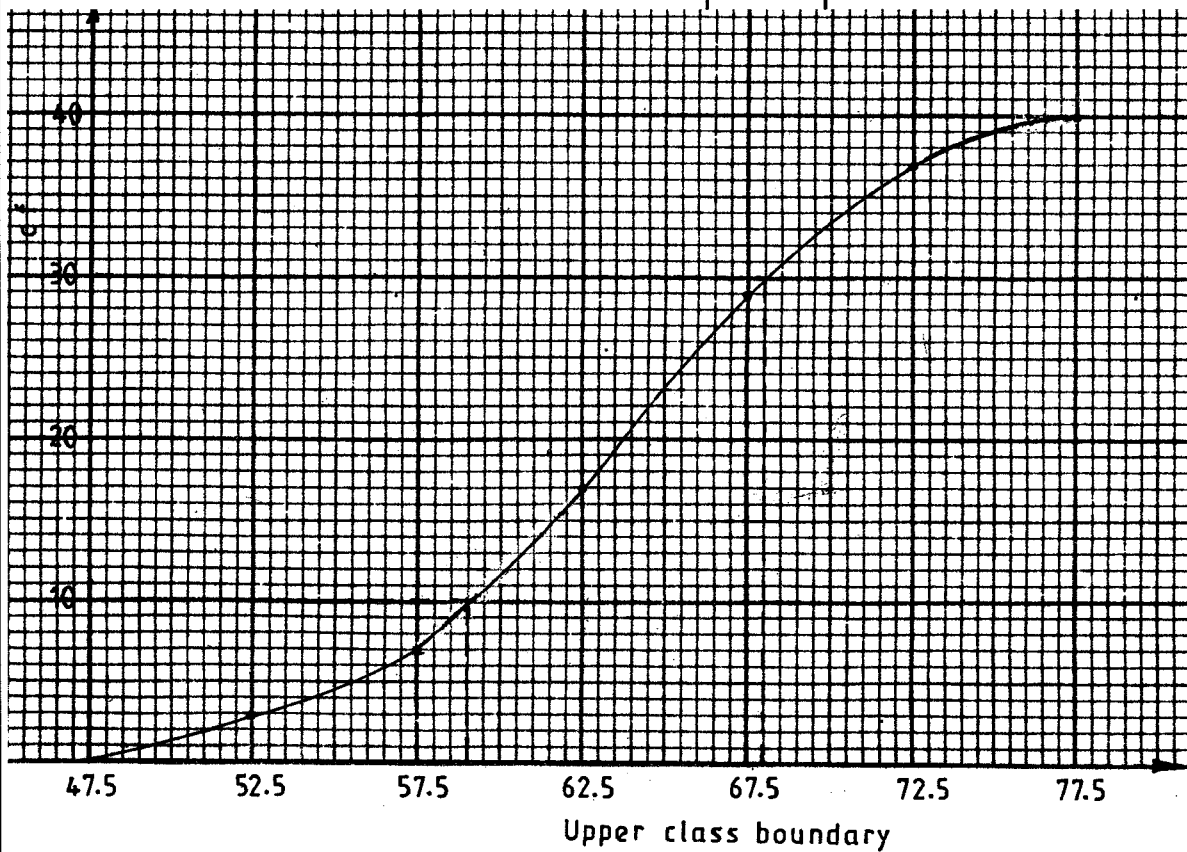
$$= 63.375$$

A1

(c) (i)

Cummulative frequency	3	7	17	29	37	40
Upper class boundary	52.5	57.5	62.5	67.5	72.5	77.5

B1 for c.f



(ii) $Q_3 = 68 \pm 0.5$ $Q_1 = 59 \pm 0.5$

P1

✓ plotting

C1

✓ curve

B1

Semi-interquartile range

$$= \frac{68 - 59}{2}$$

M1

$$= 4.5$$

A1

10

24. (a)

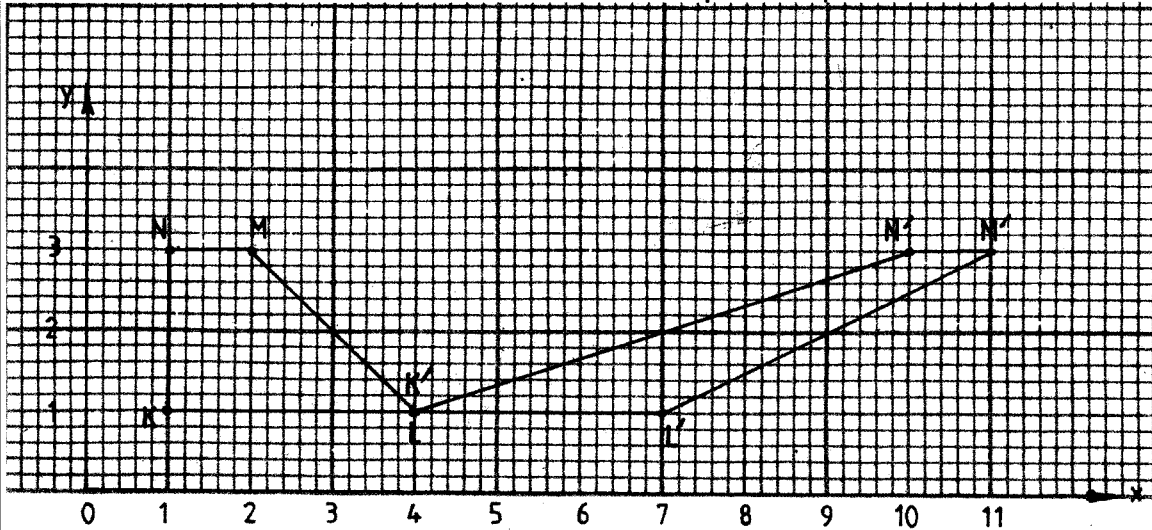
$$\begin{pmatrix} 1 & 3 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 4 & 2 & 1 \\ 1 & 1 & 3 & 3 \end{pmatrix} = \begin{pmatrix} K' & L' & M' & N' \\ 4 & 7 & 11 & 10 \\ 1 & 1 & 3 & 3 \end{pmatrix}$$

M1
A1

coordinates

$$K'(4, 1), L'(7, 1), M'(11, 3), N'(10, 3)$$

B1



(c) (i) shear with x axis ($y = 0$) invariant

and point $N(1,3)$, mapped onto $N'(10,3)$

B1

✓ object KLMN

B1

✓ image K'L'M'N'

B1

B1

any other point and its image may be used

(ii) area of image

$$= \left(\frac{3+1}{2} \right) \times 2 = 4$$

B1

(d) $T^{-1} = \frac{1}{1} \begin{pmatrix} 1 & -3 \\ 0 & 1 \end{pmatrix}$

M1

$$= \begin{pmatrix} 1 & -3 \\ 0 & 1 \end{pmatrix}$$

A1

10