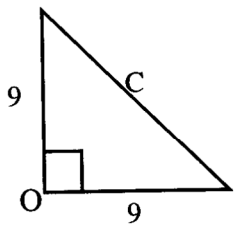
4.3.2 Mathematics Alternative A Paper 2 (121/2)

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

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

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7.	$\text{Log}(x - 1) + \log 100 = \log(3x + 2) + \log 25$ $\text{Log } 100(x - 1) = \text{Log } 25(3x + 2)$ $(x - 1)100 = (3x + 2)\,25$ $100x - 100 = 75x + 50$ $25x = 150$ $x = 6$	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	

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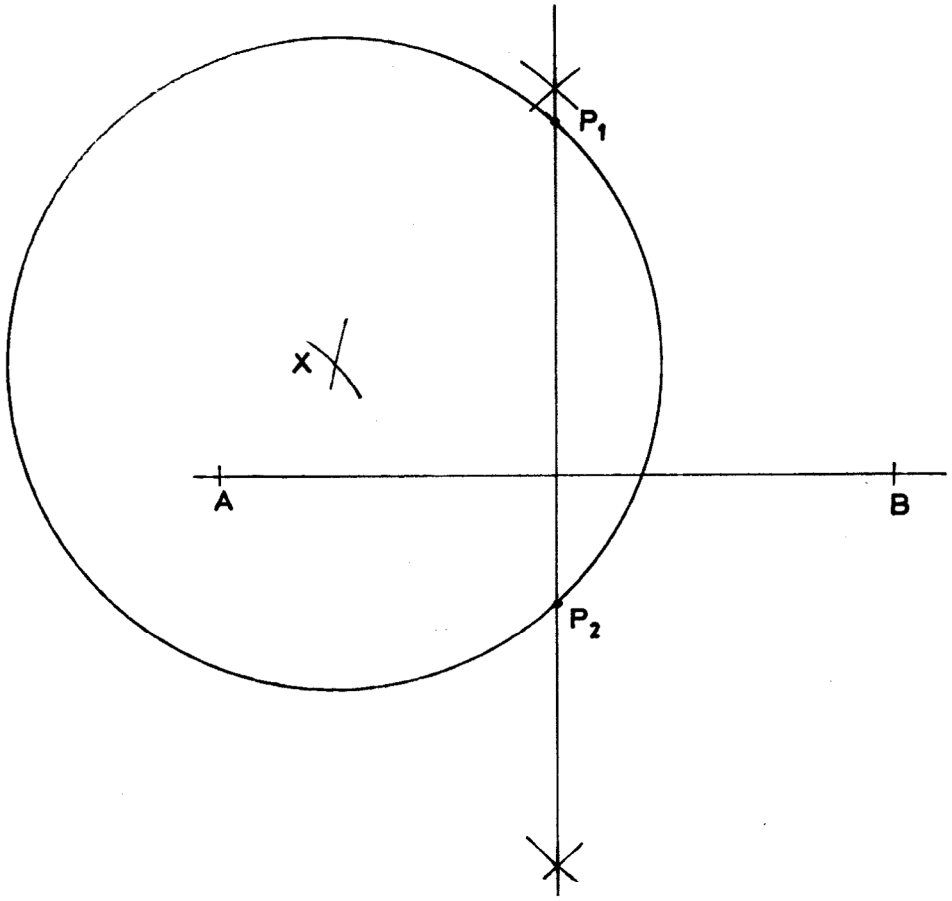
9.	Centre of circle $= \left(\frac{-1+5}{2}, \frac{6+-2}{2}\right)$ $= (2,2)$ Radius $= \frac{\sqrt{(-1-5)^2+(6+2)^2}}{2}$ $= \frac{\sqrt{36+64}}{2} = 5$ Equation of circle = $(x - 2)^2 + (y - 2)^2 = 5^2$ $x^2 - 4x + 4 + y^2 - 4y + 4 = 25$ $x^2 + y^2 - 4x - 4y = 17$	M1 M1 M1 A1 4	
10.			
	⊥ar bisector of AB Drawing circle centre x, radius 4 cm Locating P_1 and P_2 ($P_1P_2 = 6 \pm 0.1$ cm)	B1 B1 B1 3	

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11.	$\frac{3}{8}\times\frac{5}{7}+\frac{5}{7}\times\frac{3}{7}$ $=\frac{15}{28}$	M1 A1 2	
12.	$m+b\geq 32$ $m>20$ $b\geq 6$ $2500\,m+3500\,b\leq 100000$ $5m+7b\leq 200$	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	

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

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18.	(a) (i) $40 + (10 - 1)(-3)$	M1	
	$= 40 - 27 = 13$ km	A1	
	(ii) First term after 10 days		
	$= 13 - 2 = 11$	B1	
	16th day: $11 + 5 \times -2$	M1	
	$= 1$ 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		
	$=$ Ksh 301×200	M1	
	$=$ Ksh 60 200	A1	
		10	

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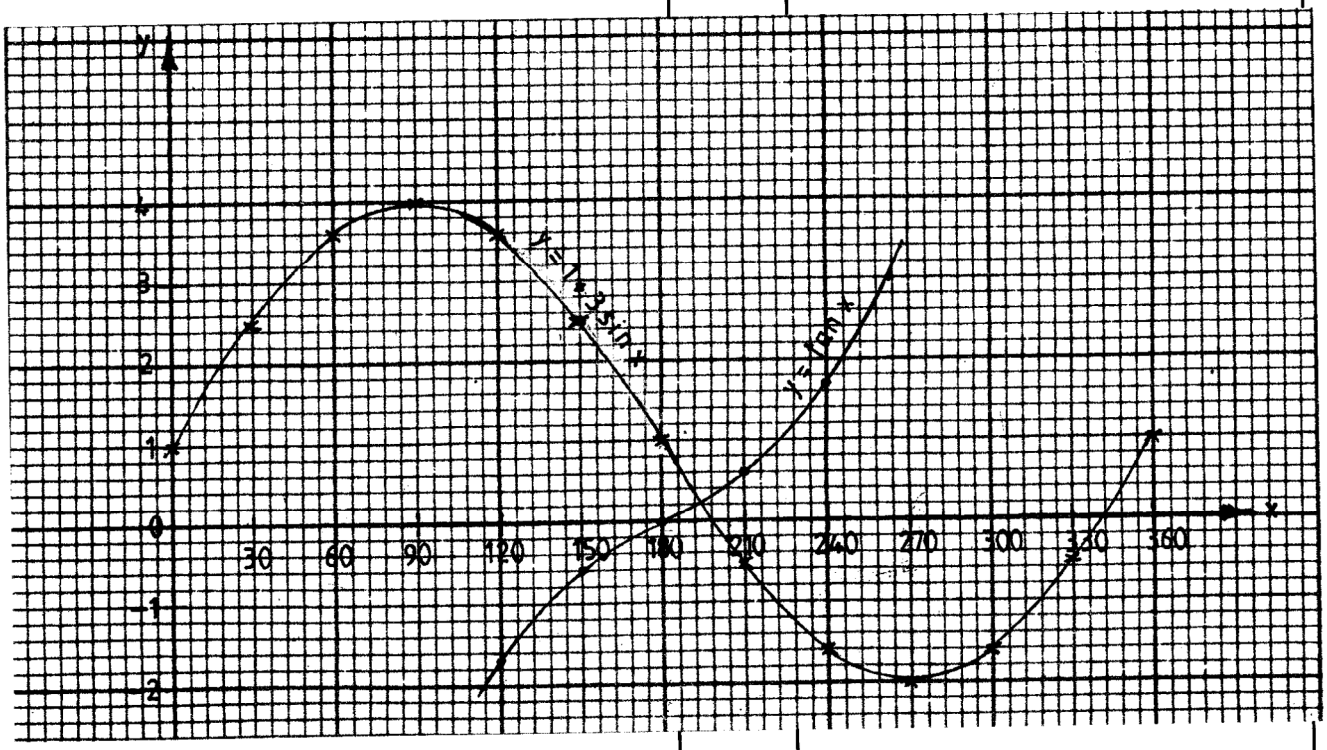
19. (a)

$x°$	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 √

(b) (i)



S1
P1
C1

(ii) Amplitude of curve = 3 B1

(c) tan x values

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

B1

Plotting y = tan x P1

tan x curve C1

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

$x = 195°$ B1

10

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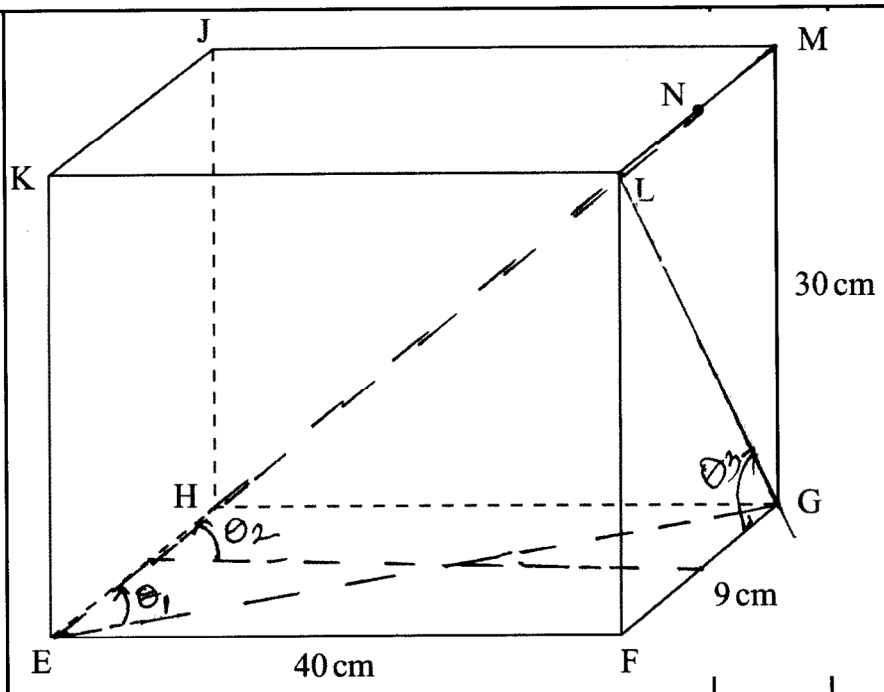
20.



(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
$= 36.19°$	A1
(d) angle between the plane EFGH and ENH	
$\theta_2 = \tan^{-1}\frac{30}{40}$	M1
$= 36.87°$	A1
(e) angle between lines EH and plane GL	
= angle between lines FG and GL	
$\theta_3 = \tan^{-1}\frac{30}{9}$	M1
$= 73.30°$	A1
	10

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21.	(a) (i) $P = k_1m^2 + k_2n$	B1	
	$4k_1 + -3k_2 = 3.8$		
	$9k_1 + 2k_2 = -0.2$		
	$8k_1 - 6k_2 = 7.6$		
	$27k_1 + 6k_2 = -0.6$	M1	Attempt to solve
	$35k_1 = 7.0$		
	$\left.\begin{array}{l} k_1 = 0.2 \\ k_2 = -1 \end{array}\right\}$	A1	
	$\therefore P = 0.2m^2 - n$	B1	
	(ii) $P = 0.2 \times 10^2 - 4 = 16$	B1	
	(b) $0.2\,m^2 = P + n$	M1	
	$m = \sqrt{\frac{P+n}{0.2}}$	A1	
	(c) New $m = \sqrt{\frac{1.1(P+n)}{0.2}}$	M1	
	% increase in $m = \frac{(\sqrt{1.1}-1)\sqrt{\frac{P+n}{0.2}}}{\sqrt{\frac{P+n}{0.2}}} \times 100$	M1	
	$= 4.88\%$	A1	
		10	

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22.	(a) V in terms of t		
	$a = \frac{dV}{dt} = 9 - 3t \Rightarrow V = \int (9 - 3t)\, dt$	B1	
	$V = 9t - \frac{3t^2}{2} + C$	M1	
	when $t = 0, V = 7 \Rightarrow C = 7$	M1	
	$\therefore \quad V = 9t - \frac{3t^2}{2} + 7$	A1	
	(b) maximum velocity		
	$\Rightarrow a = 9 - 3t = 0 \Rightarrow t = 3$	B1	
	$\therefore V = 9 \times 3 - \frac{3 \times 9}{2} + 7$	M1	
	$= 27 - \frac{27}{2} + 7$		
	$= 34 - 13.5$		
	$= 20.5\ ms^{-1}$	A1	
	(c) $S = \int_0^3 \left(9t - \frac{3}{2}t^2 + 7\right) dt$		
	$\left[\frac{9t^2}{2} - \frac{3t^3}{6} + 7t\right]_0^3$	M1	
	$\left[\frac{81}{2} - \frac{3 \times 27}{6} + 21\right] - [0]$	M1	
	$= 27 + 21$		
	$= 48$ m	A1	
		10	

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23. (a) Lower class boundary of modal class

62.5 — B1

(b) Mean mark:

$\Sigma fd = -42 + -36 + -40 + 12 + 48 + 33$ — M1

$= -25$

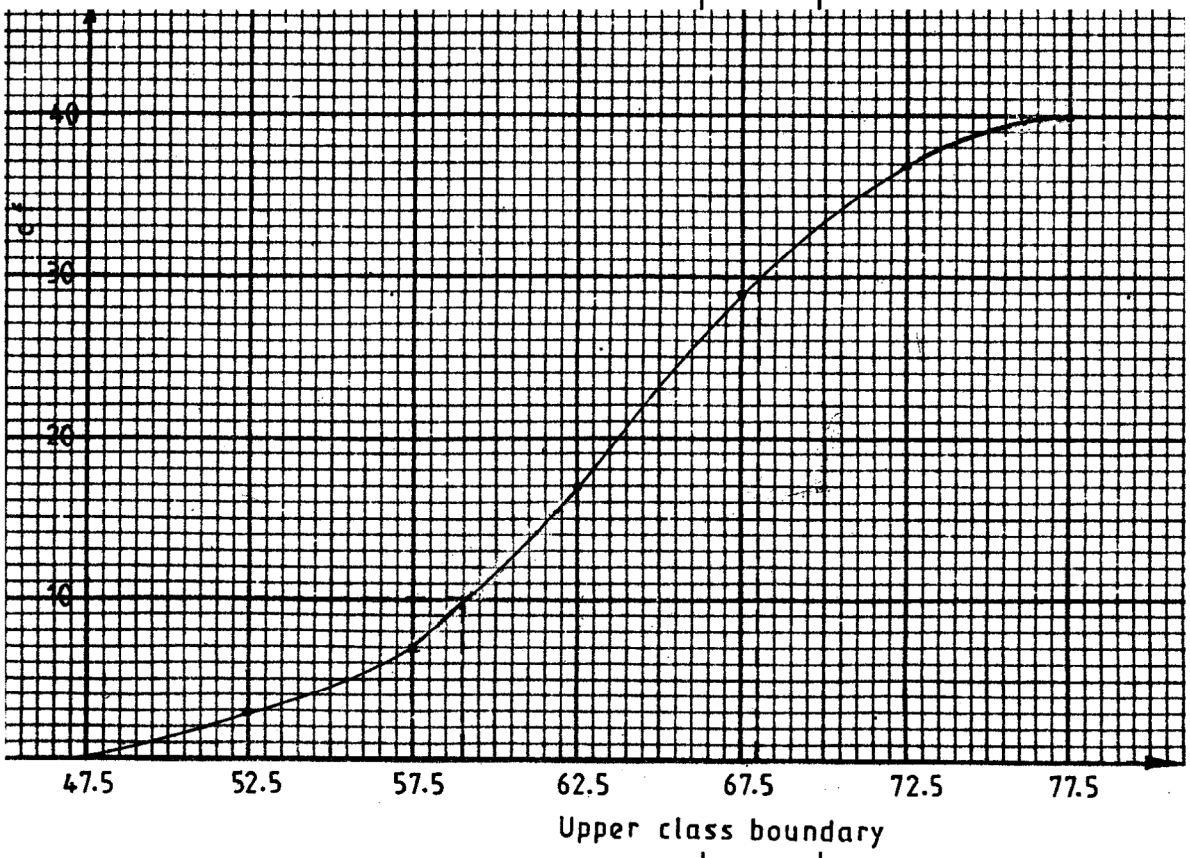
$\therefore$ mean $= 64 - \frac{25}{40}$ — M1

$= 63.375$ — 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



P1 √ plotting

C1 √ curve

(ii) $Q_3 = 68 \pm 0.5$ $Q_1 = 59 \pm 0.5$ — B1

Semi-interquartile range

$= \frac{68 - 59}{2}$ — M1

$= 4.5$ — A1

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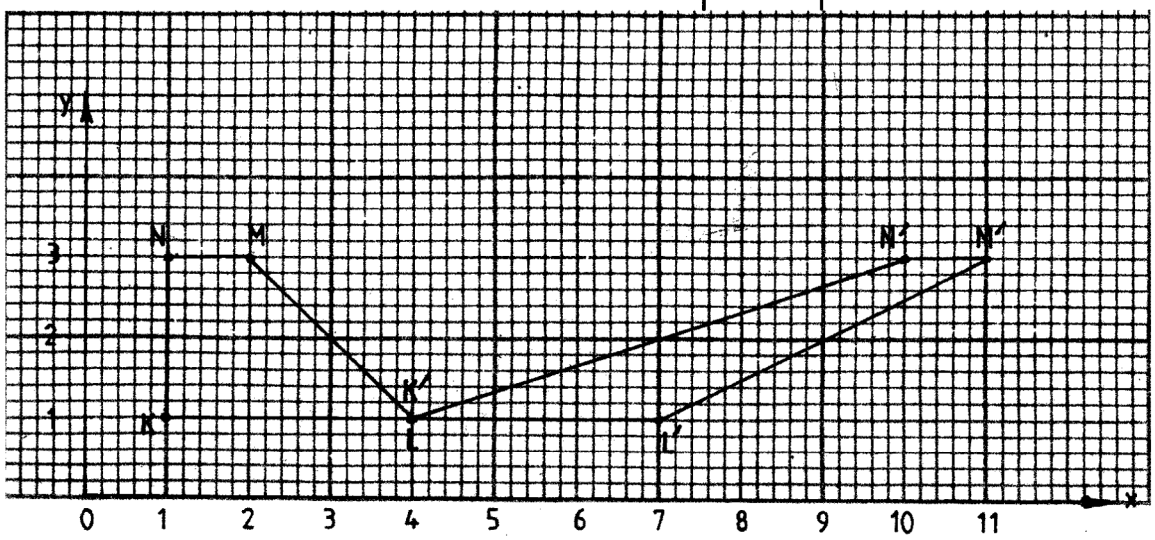
24.	(a) $\begin{pmatrix}1 & 3\\0 & 1\end{pmatrix}\begin{array}{c}\begin{array}{cccc}K & L & M & N\end{array}\\\begin{pmatrix}1 & 4 & 2 & 1\\1 & 1 & 3 & 3\end{pmatrix}\end{array} = \begin{array}{c}\begin{array}{cccc}K' & L' & M' & N'\end{array}\\\begin{pmatrix}4 & 7 & 11 & 10\\1 & 1 & 3 & 3\end{pmatrix}\end{array}$	M1 A1	
	coordinates $K'(4,1), L'(7,1), M'(11,3), N'(10,3)$	B1	
			
		B1 B1	√ object KLMN √ image K'L'M'N'
	(c) (i) shear with x axis (y = 0) invariant	B1	
	and point N(1,3), mapped onto N'(10,3)	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	

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