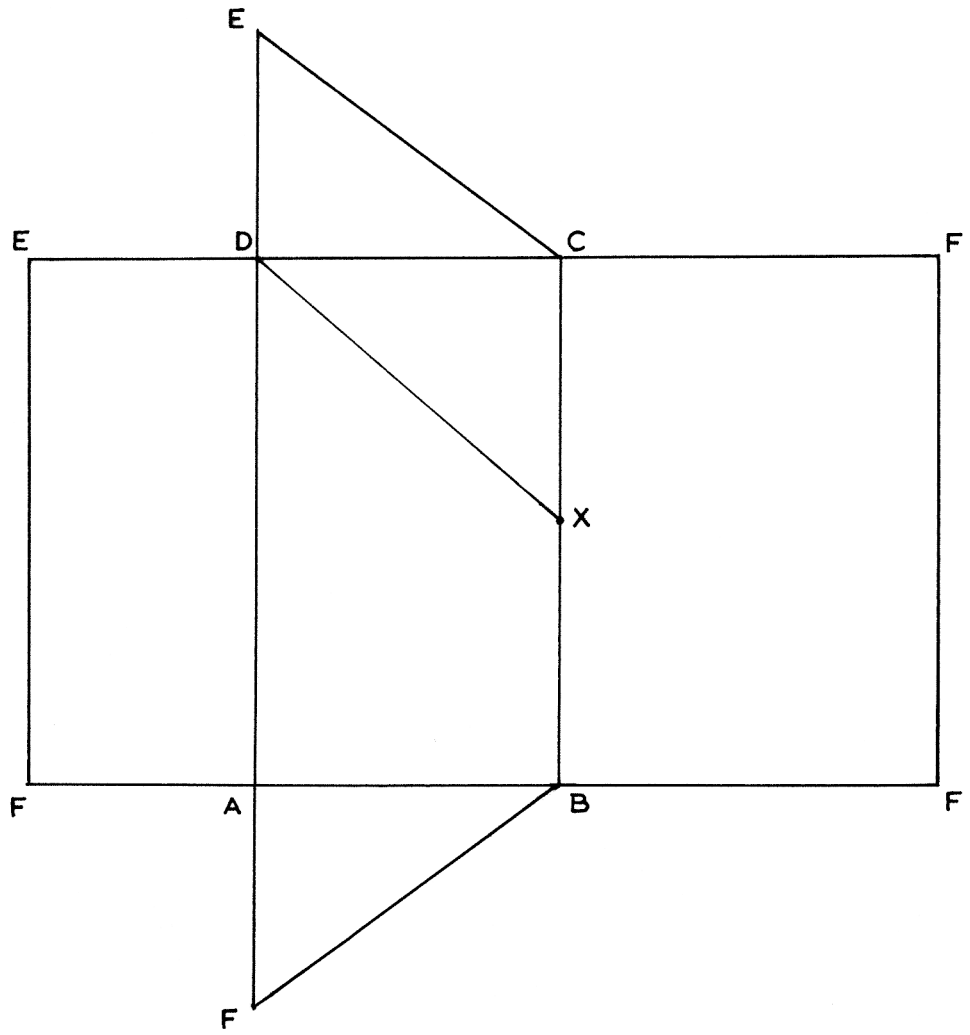
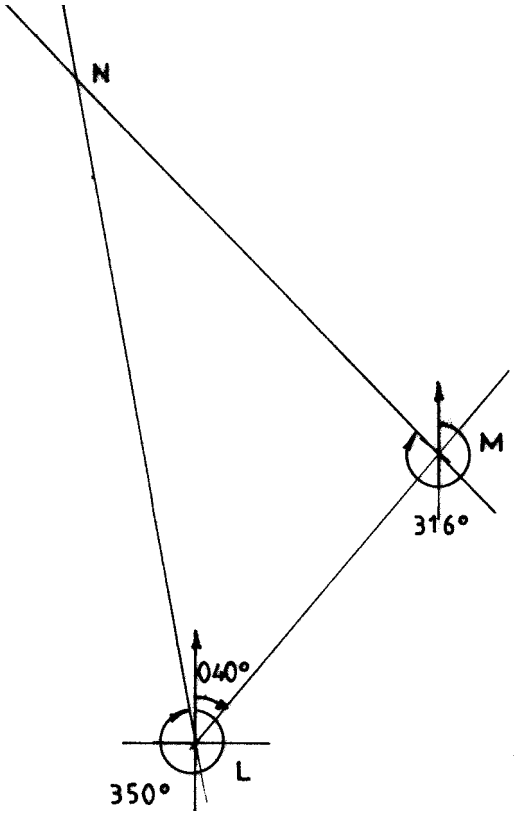
4.3 MATHEMATICS (121 AND 122)

4.3.1 Mathematics Alternative A Paper 1 (121/1

1.	Cows $= 32$ Sheep $= 32 \times 12$ $= 384$ Goats $= 384 + 1344$ $= 1728$ Number of goats that remained $= \frac{1}{4} \times 1728$ $= 432$	 M1 M1 M1 A1 4	
2.	$\frac{\sqrt{1764}}{\sqrt[3]{2744}} = \frac{\sqrt{2^2 \times 3^2 \times 7^2}}{\sqrt[3]{2^3 \times 7^3}}$ $= \frac{2 \times 3 \times 7}{2 \times 7}$ $= 3$	M1 M1 A1 3	For prime factors of both $\sqrt{\ }$ and $\sqrt[3]{\ }$
3.	Volume $= \frac{1}{3} \times \frac{22}{7} \times (14)^2 \times 18$ $= 3696\,\text{cm}^3$ Density $= \frac{4.62 \times 1000}{3696}$ $= 1.25\,\text{g/cm}^3$	M1 M1 A1 3	

4.			
		B1 B1 B1	√ measurements and angles √ complete net (labelled)
	DX = 5.3 ± 0.1		
		3	
5.	C.P. for carpet		
	$= \frac{36000 \times 100}{120}$	M1	
	$= 30000$		
	% profit made during trade fair		
	$= \frac{33600 - 30000}{30000} \times 100$	M1	
	$= 12\%$	A1	
		3	

6.	$= \frac{243^{\frac{-2}{5}} \times 125^{\frac{2}{3}}}{9^{\frac{-3}{2}}}$ $= \frac{27 \times 25}{9}$ $= 75$	M1 M1 A1 3	√ manipulation of all indices or equivalent simplification
7.	$= \frac{\theta}{2\pi} \times \pi \times 2.1 \times 2.1 = 2.31$ $\theta = \frac{2.31 \times 2}{2.1 \times 2.1}$ $= 1.05^{c}$	M1 A1 2	
8.	$(x + 2y)^2 - (2y - 3)^2$ $= (x^2 + 4xy + 4y^2) - (4y^2 - 12y + 9)$ $= x^2 + 4xy + 12y - 9$	M1 A1 2	

9.		B1 B1	√ location of M √ location of N
	Distance MN = 6.8×100 $= 680$ km	M1 A1 4	MN = 6.8 ± 0.1 cm
10.	$(2n-4)\times 90 = 1800$ $180n = 2160$ $n = 12$ size of each exterior angle $= \frac{360}{12} = 30°$	M1 M1 A1 3	
11.	let age of cow be x years $\therefore x\left(x - 4\frac{2}{3}\right) = 8$ $3x^2 - 14x - 24 = 0$ $(3x+4)(x-6) = 0$ $x = 6$ or $-\frac{4}{3}$ Age of cow = 6 years Age of heifer = $1\frac{1}{3}$ years	M1 M1 A1 B1 4	

12.	$4 \le 3x - 2 < 9 + x$ $4 \le 3x - 2 \quad 3x - 2 < 9 + x$ $6 \le 3x \quad 2x < 11$ $x \ge 2 \quad x < 5\frac{1}{2}$ $\therefore 2 \le x < 5\frac{1}{2}$ Integral values 2, 3, 4, 5	M1 A1 B1 3	
13.	Volume of water in container $= \frac{80}{100} \times 90(40 \times 25 - \pi \times 7.5^2)$ $= 59276.54975$ $\frac{59276.54975}{1000}$ $= 59.3$	 M1 M1 M1 A1 3	 for $\frac{80}{100} \times 90$ difference in volumes conversion into litres
14.	Angle for major arc $= 360 - 105$ $= 255°$ Length of arc $= \frac{255}{360} \times 2 \times 8.4 \times \frac{22}{7}$ $= 37.4$ cm	 B1 M1 A1 3	
15.	Amount of work $= 25 \times 16 \times 9$ Machines required $= \frac{25 \times 16 \times 9}{12 \times 10}$ $= 30$	M1 M1 A1 3	 $\div$ by 12×10
16.	$\lvert AB \rvert = \sqrt{(-3+2)^2 + (7-2)^2} = \sqrt{26}$ $\lvert A'B' \rvert = \sqrt{4^2 + (-20)^2} = \sqrt{416}$ Scale factor $= \frac{\lvert A'B' \rvert}{\lvert AB \rvert} = \frac{\sqrt{416}}{\sqrt{26}}$ $= 4$	 M1 M1 A1 3	 for $\lvert AB \rvert$ and $\lvert A'B' \rvert$

17.	(a) Equation of L		
	gradient $= \frac{6-3}{-1--2}$	M1	
	$= 3$		
	equation $= \frac{y-6}{x+1} = 3$		
	$\Rightarrow y - 3x = 9$	A1	
	(b) equation of P		
	$= \frac{y-6}{x+1} = -\frac{1}{3}$	M1	
	$3y + x = 17$	A1	
	(c) equation of Q		
	$= \frac{y-2}{x-1} = 3$		
	$y = 3x - 1$	B1	
	x intercept when $y = 0 \Rightarrow x = \frac{1}{3}$	B1	
	y intercept when $x = 0 \Rightarrow y = -1$	B1	
	(d) Intersection of lines P and Q		
	$3y + x = 17..(i)$ $y - 3x = -1..(ii)$	M1	
	$3y + x = 17$ $3y - 9x = -3$ $10x = 20 \Rightarrow x = 2$	A1	for both $x = 2$ and $y = 5$
	subset $3y + 2 = 17 \Rightarrow y = 5$ $\therefore$ point of intersection $(2, 5)$	B1	
		10	

18. (a)

Class	3-5	6-8	9-11	12-14	15-17	18-20
Frequency	3	8	13	10	4	2

B1
B1

(b) (i) mean length $= \frac{\Sigma fx}{\Sigma f}$

$= \frac{4 \times 3 + 7 \times 8 + 10 \times 13 + 13 \times 10 + 16 \times 4 + 19 \times 2}{40}$ B1 for all √ mid points - i.e 4, 7, 10, 13, 16, and 19

M1

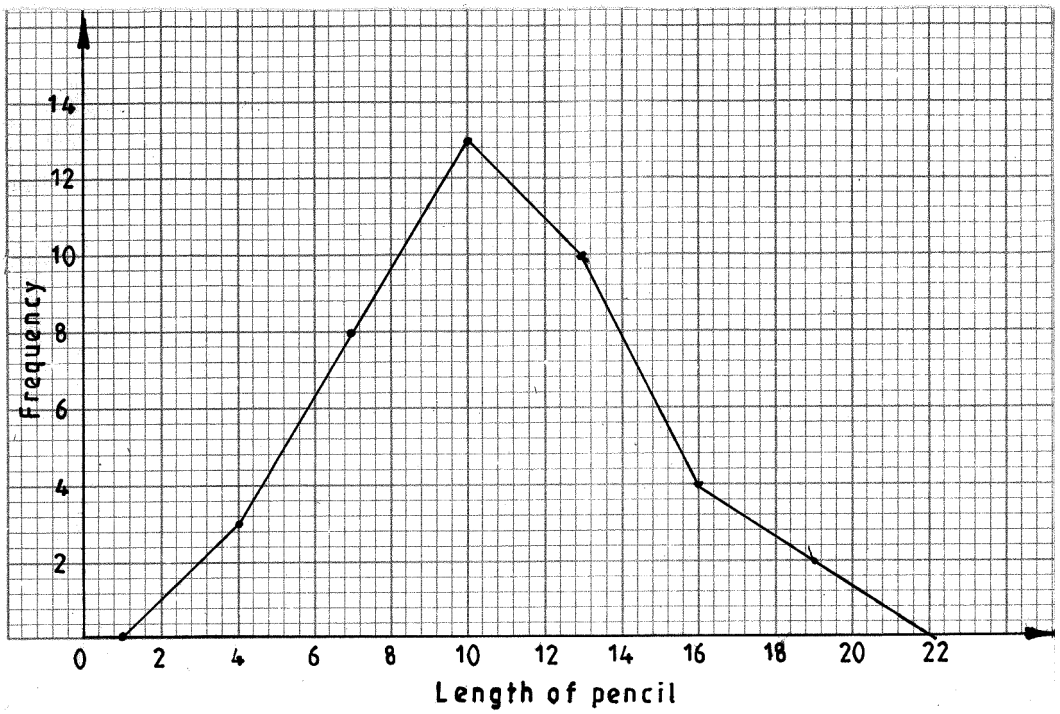
$= 10.75$ A1

(ii)

$= \frac{23}{40} \times 100$ B1 for 23

$= 57.5\%$ B1

(c)



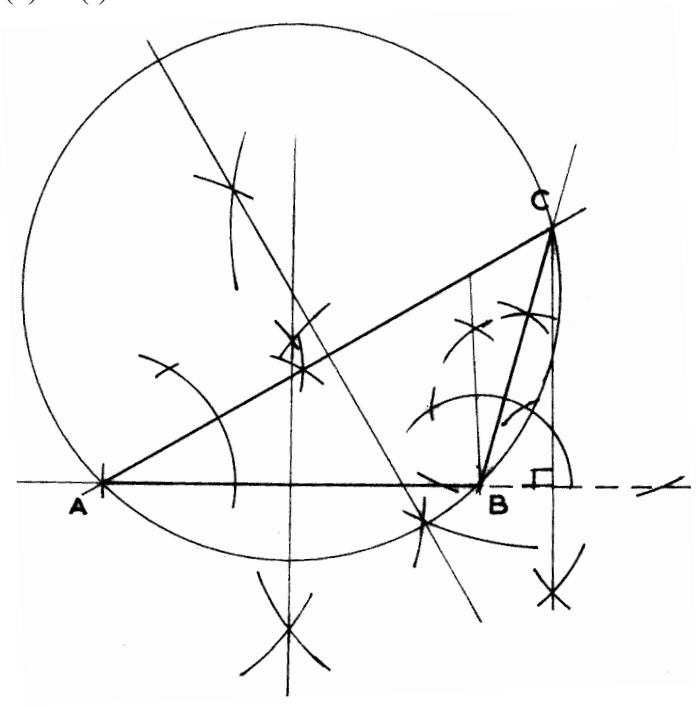
S1
P1
C1

10

19.	(a)	15 m/s	B1	
	(b)	maximum speed		
		$\frac{1}{2}(15+h)\times 10+\frac{1}{2}(10+30)h=825$	M1	
		$75+5h+20h=825$	M1	
		$25h=750$		
		$h=30$ m/s	A1	
	(c)	(i) $=\frac{30-15}{10}$	M1	
		$=1.5$ m/s^2	A1	
		(ii) $=\frac{0-30}{20}=-1.5$ m/s^2	B1	
	(d)	$\left[\frac{1}{2}(15+30)\times 10+10\times 30\right]\div 20$	M1	for distance covered in first 20 seconds
		$=(225+300)\div 20$	M1	
		$=26.25$ m/s	B1	
			10	

20.	(a) base area $= \frac{1}{2} \times 15 \times 15 \sin 72 \times 5$	B1 M1	use of 72^o
	$= 534.97$	A1	
	(b) Length AV $= \sqrt{36^2 + 15^2} = 39$	B1	
	(c) Area of triangular faces: $\frac{AB}{\sin 72} = \frac{15}{\sin 54}$		
	$AB = \frac{15 \sin 72}{\sin 54}$	M1	
	$= 17.63$		
	$\therefore$ area $= \sqrt{\left\{\frac{1}{2}(39 + 39 + 17.63)(30.185)(8.815^2)\right\}}$	M1	$\surd$ application of Herons formula
	$= 334.89$		
		M1 A1	
	Total area $= 334.89 \times 5 + 534.97$ $= 2209.42$		
		M1	
	(d) volume of pyramid $= \frac{1}{3} \times 534.97 \times 36$	A1	
	$= 6419.63 \text{ cm}^2$ $\simeq 6420$ (4 s.f.)	10	

21.	(a) x -2 -1 0 1 2 3 4 5 6 7 8 y 16 10 6 4 4 6 10 16 24 34 46	B2	y values (B1 for at least 6 correct)
	(b) Area using trapezium rule $= \frac{1}{2} \times 1[16 + 46 + 2(10 + 6 + 4 + 4 + 6 + 10 + 16 + 24 + 34)]$	M1	
	$= \frac{1}{2}[62 + 2(114)]$	M1	simplification
	$= 145$	A1	
	(c) Area using mid-ordinate rule		
	$= 2 \times (10 + 4 + 6 + 16 + 34)$	M1	
	$= 140$	A1	
	(d) Area using integration method		
	$\int_{-2}^{8} (x^2 - 3x + 6)\,dx = \frac{x^3}{3} - \frac{3x^2}{2} + 6x \Big|_{-2}^{8}$	M1	√ integration
	$= \left[\frac{512}{3} - \frac{192}{2} + 48\right] - \left[\frac{-8}{3} - \frac{3 \times 4}{2} - 12\right]$	M1	
	$= 122\frac{2}{3} + 20\frac{2}{3}$	A1	
	$= 143\frac{1}{3}$	10	

22.	(a) (i) 	B1 B1 B1	construction of 30° construction of 105° completion of △ABC
	(ii)	B1	⊥ bisectors
		B1	circle
	radius = 3.5 ± 0.1	B1	
	(iii) height construction	B1	height constructed
	height = 3.4 ± 0.1	B1	
	(b) area of circle outside triangle $= \pi \times 3.5^2 - \frac{1}{2} \times 3.4 \times 5$	M1	
	$\simeq 29.98$	A1	
		10	

23.	(a) $\tan\theta = \frac{70}{240}$	M1	
	$= 0.2917$ $\theta = 16.26^\circ$	A1	
	(b) $AC = \sqrt{70^2 + 240^2}$ $= 250 \text{ m}$	B1	
	$\angle ACD = 150^\circ - (90^\circ - 16.26^\circ)$ $= 76.26^\circ$	M1	
	$AD^2 = 200^2 + 250^2 - 2 \times 200 \times 250 \cos 76.26$ $AD = \sqrt{40000 + 62500 - 100000 \cos 76.26^\circ}$ $= 280.6$	M1 A1	
	(c) Area of plot $= \frac{1}{2} \times 240 \times 70 + \frac{1}{2} \times 250 \times 200 \sin 76.26^\circ$	M1	
	$= 8400 + 24284.59$	M1	
	$= 32684.59 \text{ m}^2$		
	$= \frac{32684.59}{10000}$	M1	
	$= 3.27 \text{ ha}$	A1	
		10	

24.	(a) Value of y when $x = -1$ $y = -1 - 4 + 3 = -2$	B1	
	(b) Stationary points $\frac{dy}{dx} = 3x^2 - 8x - 3$	M1	
	for stationary points $3x^2 - 8x - 3 = 0$ $(3x + 1)(x - 3) = 0$	M1	
	$x = -\frac{1}{3}$ or $x = 3$	A1	
	when $x = -\frac{1}{3}$, $y = \frac{14}{27}$ when $x = 3$, $y = -18$ $\therefore$ stationary points $\left(-\frac{1}{3}, \frac{14}{27}\right)$	B1	
	and (3, -18)	B1	
	(c) Equation of normal to curve: gradient of tangent at $x = 1$		
	$\frac{dy}{dx} = 3 - 8 - 3 = -8$	B1	
	gradient of normal $= \frac{1}{8}$	B1	
	$\therefore$ equation of normal at $x = 1$ $\frac{y+6}{x-1} = \frac{1}{8}$	M1	
	$y + 6 = \frac{1}{8}x - \frac{1}{8}$		
	$y = \frac{1}{8}x - 6\frac{1}{8}$	A1	
		10	

4.3.2 Mathematics Alternative A Paper 2 (121/2)

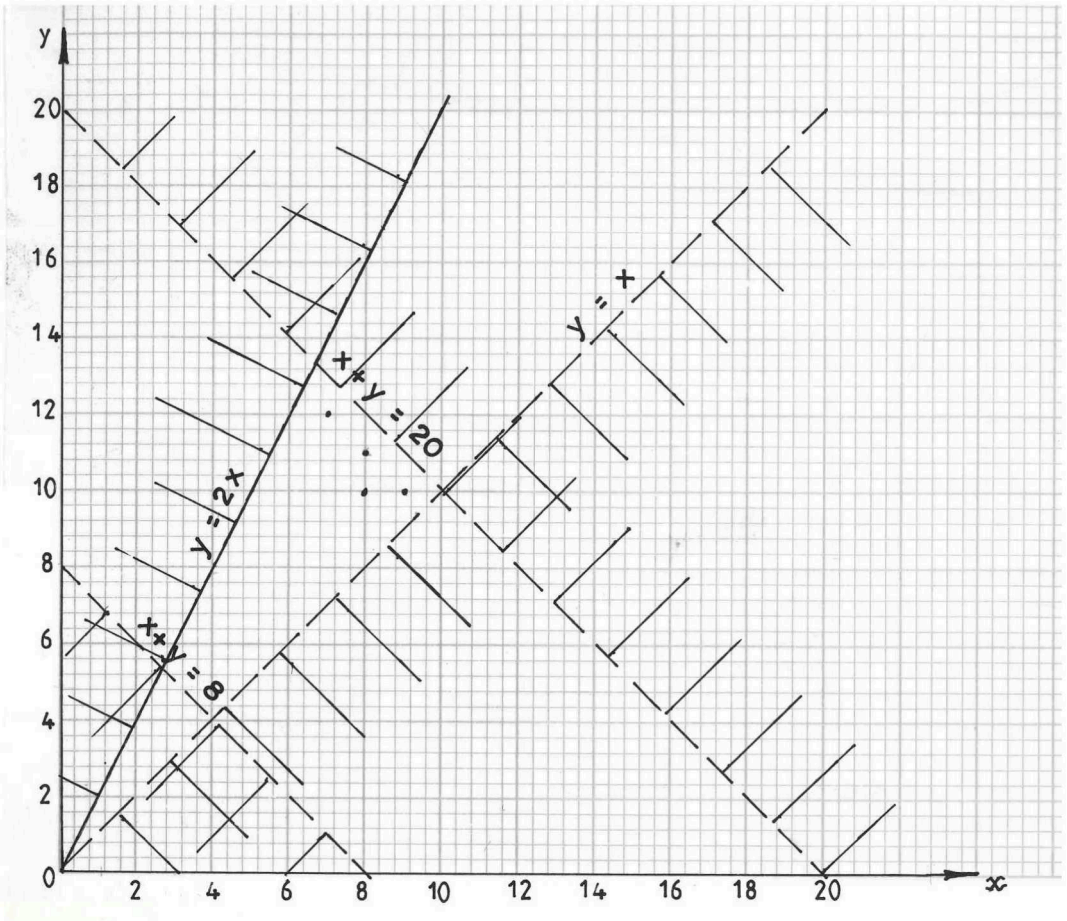
1.	Limits: 12.5 ± 0.05 m and 9.23 ± 0.005 m Maximum difference $= 12.55 - 9.225$ $= 3.325$ m	B1 M1 A1 3	
2.	a) First 6 terms $-7, -4, -1, 2, 5, 8$ b) Sum of 1st 50 terms $S_{50} = \frac{50}{2}\{2 \times -7 + 49 \times 3\}$ $= 3325$	 B1 M1 A1 3	
3.	a) $\angle BAC = 70^\circ - 30^\circ = 40^\circ$ Reflex $\angle BOC = 360^\circ - 80^\circ$ $= 280^o$ b) $\angle ACO = 40^\circ - 30^\circ = 10^\circ$	B1 B1 B1 3	
4.	$L = \frac{kM}{N^2}$ $2 = \frac{k \times 12}{36}$ $k = 6$ $\therefore$ equation $L = \frac{6M}{N^2}$	B1 M1 A1 3	
5.	<table><tr><th>Marks</th><th>Frequency</th><th>c.f</th></tr><tr><td>1 - 10</td><td>2</td><td>2</td></tr><tr><td>11 - 20</td><td>4</td><td>6</td></tr><tr><td>21 - 30</td><td>11</td><td>17</td></tr><tr><td>31 - 40</td><td>5</td><td>22</td></tr><tr><td>41 - 50</td><td>3</td><td>25</td></tr></table> Median $= 20.5 + \frac{12.5 - 6}{11} \times 10$ $= 20.5 + 5.91$ $= 26.41$ $\simeq 26$	 B1 M1 M1 A1 4	for c.f

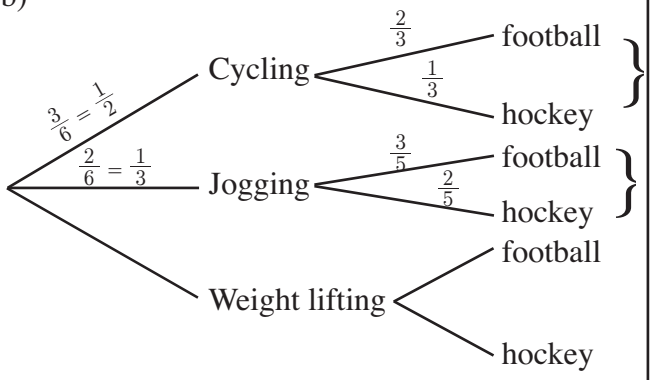
6.	Amplitude = 2 Period $= \frac{360}{3} = 120°$	B1 B1 2	
7.	Area scale factor $= \frac{30}{5} = 6$ $4x - 2x + 2 = 6$ $2x = 4$ $x = 2$	B1 M1 A1 3	
8.	$(3-x)^7 = 3^7 - 7(3)^6x + 21(3)^5x^2 - 35(3)^4x^3$ $+35(3)^3x^4 + ...$ $= 2187 - 5103x + 5103x^2 - 2835x^3 + 945x^4$ $(2.8)^7 = (3 - 0.2)^7$ $= 2187 - 5103(0.2) + 5103(0.2)^2$ $- 2835(0.2)^3 + 945(0.2)^4$ $= 1349.352$	 B1 M1 A1 3	
9.	$\text{Log}\frac{15^2}{x} = \log 5(x-4)$ $\frac{15^2}{x} = 5(x-4)$ $x^2 - 4x - 45 = 0$ $(x - 9)(x + 5) = 0$ $x = 9$ or -5 $x = 9$	M1 M1 M1 A1 4	
10.	$PR = \sqrt{60^2 + 11^2} = 61$ $\text{Tan}\,\theta = \frac{10}{61}$ $\theta = 9.31°$	B1 M1 A1 3	

11.	$3x - y = 9$ ..... $\times x$ $x^2 - xy = 4$ $3x^2 - xy = 9x$ $x^2 - xy = 4$ $2x^2 = 9x - 4$ $2x^2 - 9x + 4 = 0$ $(2x - 1)(x - 4) = 0$ $x = \frac{1}{2}$ or $x = 4$ $y = 3\left(\frac{1}{2}\right) - 9$ or $3(4) - 9$ $= -7\frac{1}{2}$ or 3	M1 M1 A1 B1 4	Attempt to solve Factors
12.	$\left(1 + \frac{r}{100}\right)^4 = \frac{495000}{280000}$ $1 + \frac{r}{100} = 1.153$ $r = 15.3$	M1 M1 A1 3	
13.	$8008 = \frac{40 + \theta}{360} \times 2 \times \frac{22}{7} \times 6370$ $40 + \theta = \frac{8008 \times 360 \times 7}{2 \times 22 \times 6370} = 72$ $\theta = 72^\circ - 40^\circ$ $= 32^\circ$ Position of B(32^o S, 20^oW)	M1 M1 A1 3	or 32^o seen
14.	$\underset{\sim}{r} + \underset{\sim}{s} = (7\underset{\sim}{i} + 2\underset{\sim}{j} - \underset{\sim}{k}) + (-\underset{\sim}{i} + \underset{\sim}{j} - \underset{\sim}{k})$ $= 6\underset{\sim}{i} + 3\underset{\sim}{j} - 2\underset{\sim}{k}$ $\lvert \underset{\sim}{r} + \underset{\sim}{s} \rvert = \sqrt{6^2 + 3^2 + (-2)^2}$ $= 7$	B1 M1 A1 3	

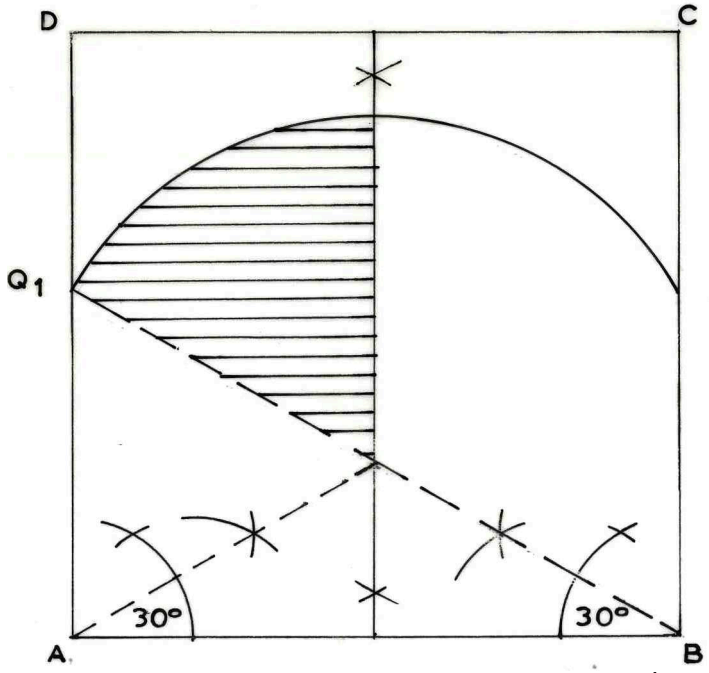
15.	$y = \int (x^2 - 4x + 3)\, dx$ $= \frac{1}{3}x^3 - 2x^2 + 3x + c$ $0 = \frac{1}{3} - 2 + 3 + c$ $\therefore c = -\frac{4}{3}$ $\therefore y = \frac{1}{3}x^3 - 2x^2 + 3x - \frac{4}{3}$	M1 M1 A1 3	
16.	Temperature at the 2nd minute = 60^o Temperature at the 11th minute = 18^o Average rate of cooling $= \frac{60 - 18}{2 - 11}$ $= \frac{42}{\lvert 9 \rvert}$ $= 4\frac{2}{3}$ C/ min	B1 M1 A1 3	for both √
17.	a) $A = \frac{3}{4}B, C = 2B$ $\Rightarrow A:B:C = \frac{3}{4}B:B:2B$ $= 3:4:8$ b) $\left(\frac{168}{8} \times 4\right)$litres $= 84\ l$ c) (i) $\frac{3 \times 160 + 4 \times 205 + 8 \times 100}{3 + 4 + 8}$ $=$ Ksh 140 (ii) $\frac{182 - 140}{140} \times 100\%$ $= 30\%$ (iii) Ksh $140 \times \frac{125}{100}$ $=$ Ksh 175	M1 A1 M1 A1 M1 A1 M1 A1 M1 A1 10	

18.	a) (i) $(50 + 40)(50) = 30(30 + x)$ $4500 = 900 + 30x$ $30x = 3600$ $QS = x = 120$ cm	M1 A1	
	(ii) $RS = \frac{1}{2}QS$ $= \frac{1}{2}(120) = 60$ cm $OR = \sqrt{61^2 - 60^2}$ $= 11$ cm	B1 M1 A1	
	b) (i) $\text{Sin}\,\theta = \frac{60}{61}$ $\theta = 79.6°$	M1 A1	or equivalent
	(ii) Angle at the centre $= 2 \times 79.6$ $= 159.2^o$	M1	
	Length of minor arc QS $= \frac{159.2}{360} \times 2\pi \times 61$ $= 169.5$ cm	M1 A1	
		10	
19.	a) (i) $38392 + 2108$ $=$ Ksh 41000	M1 A1	
	(ii) $10164 \times 0.1 + 9576 \times 0.15 + 9576 \times 0.2$ $+ 9576 \times 0.25 + 2108 \times 0.3$ $= 1016.4 + 1436.4 + 1915.2 + 2394 + 632.4$ $=$ Ksh 7394.4	M1 M1 M1 A1	$\surd$ 1st band $\surd$ 3 middle bands $\surd$ last (5th) band
	monthly income tax $= 7394.4 - 1162$ $=$ Ksh 6232.4	B1	
	b) Amount saved in coop society $= \frac{5}{100} \times (41000 - 15000)$ $=$ Ksh1300	M1	
	Nett pay 41000 - (6232.4 + 1300) $=$ Ksh 33467.6	M1 A1	
		10	

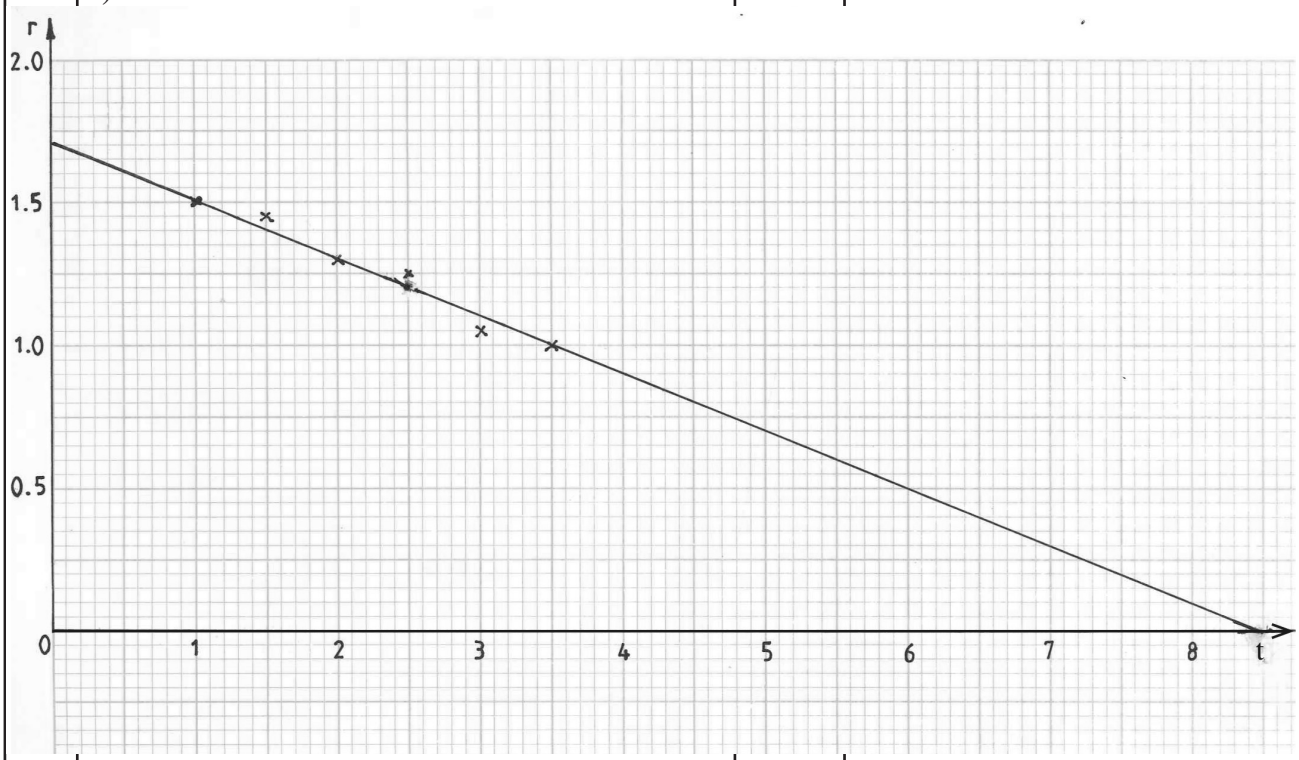
20.	a) $y > x$ $y \leq 2x$ $x + y < 20$ $x + y > 8$	B1 B1 B1 B1	
	b) (i)		
			
		B1 B1 B1 B1	line y = 2x and √ shading broken line x + y = 20 and √ shading broken line x + y = 8 and √ shading broken line y = x and √ shading
	(ii) Maximum area: 9×10 $= 90\ m^2$	 M1 A1	
		10	

21.	a) (i) $\frac{3}{6}+\frac{1}{6}$	M1	
	$=\frac{2}{3}$	A1	
	(ii) $\frac{2}{6}\times\frac{2}{6}$	M1	
	$=\frac{1}{9}$	A1	
	b) 	B1 B1	
	c) (i) P(Gataro plays football)		
	$=\frac{1}{2}\times\frac{2}{3}+\frac{1}{3}\times\frac{3}{5}+\frac{1}{6}\times\frac{1}{2}$	M1	
	$=\frac{37}{60}$	A1	
	(ii) P(neither jogs nor plays football)		
	$=\frac{1}{2}\times\frac{1}{3}+\frac{1}{6}\times\frac{1}{2}$	M1	
	$=\frac{1}{4}$	A1	
		10	

22.	a) (i) $\underset{\sim}{BA} = \underset{\sim}{a} - \underset{\sim}{b}$	B1	
	(ii) $\underset{\sim}{BN} = \frac{1}{3}\underset{\sim}{BA} = \frac{1}{3}(\underset{\sim}{a} - \underset{\sim}{b})$	B1	
	(iii) $\underset{\sim}{ON} = \underset{\sim}{b} + \frac{1}{3}(\underset{\sim}{a} - \underset{\sim}{b})$	M1	
	$= \frac{1}{3}\underset{\sim}{a} + \frac{2}{3}\underset{\sim}{b}$	A1	
	b) $\underset{\sim}{BX} = h\underset{\sim}{BM} = h\left(\frac{1}{2}\underset{\sim}{a} - \underset{\sim}{b}\right)$		
	$\underset{\sim}{OX} = k\underset{\sim}{ON} = k\left(\frac{1}{3}\underset{\sim}{a} + \frac{2}{3}\underset{\sim}{b}\right)$	B1	
	also		
	$\underset{\sim}{OX} = \underset{\sim}{OB} + \underset{\sim}{BX}$		
	$= \underset{\sim}{b} + h\left(\frac{1}{2}\underset{\sim}{a} - \underset{\sim}{b}\right)$	B1	
	$k\left(\frac{1}{3}\underset{\sim}{a} + \frac{2}{3}\underset{\sim}{b}\right) = \underset{\sim}{b} + h\left(\frac{1}{2}\underset{\sim}{a} - \underset{\sim}{b}\right)$	M1	
	$\frac{1}{3}k\underset{\sim}{a} = \frac{1}{2}h\underset{\sim}{a}$		
	$\frac{1}{3}k = \frac{1}{2}h \Longrightarrow k = \frac{3}{2}h$.....(i)		
	$\frac{2}{3}k\underset{\sim}{b} = \underset{\sim}{b} - h\underset{\sim}{b}$	M1	
	$\frac{2}{3}k = 1 - h$.....(ii)		
	Substituting $k = \frac{3}{2}h$ in (ii)		
	$\frac{2}{3}\left(\frac{3}{2}h\right) = 1 - h \Longrightarrow h = \frac{1}{2}$	M1	
	Substituting $h = \frac{1}{2}$ in (i)		
	$k = \frac{3}{2}\left(\frac{1}{2}\right) = \frac{3}{4}$	A1	for $h = \frac{1}{2}$ and $k = \frac{3}{4}$
		10	

23.			
	(i)	B2	locus of P
	(ii)	B1	construction of 30°
		B1	identification of centre
		B1	drawing of arc
	b) (i) $9.2 \times 10 = 92$ m	B1	
	(ii) area of region bounded by locus of P, locus of Q and line BQ_1	B1	Identifying region
	angle = 60° radius = 46 m	B1	for radius and angle of sector
	$= \pi \times 46^2 \times \frac{60}{360}$	M1	
	$= 1107.94$		
	$\simeq 1108\ m^2$	A1	
		10	

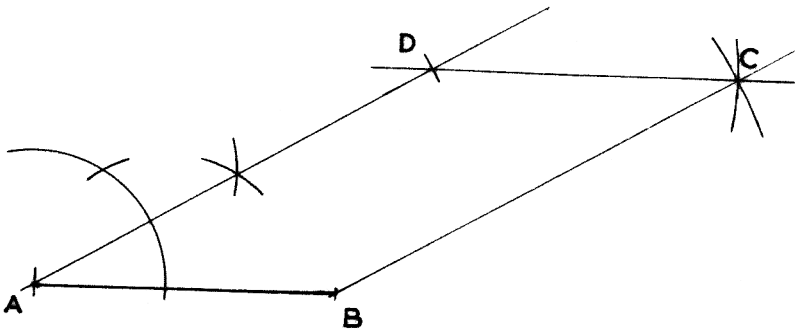
24. a)

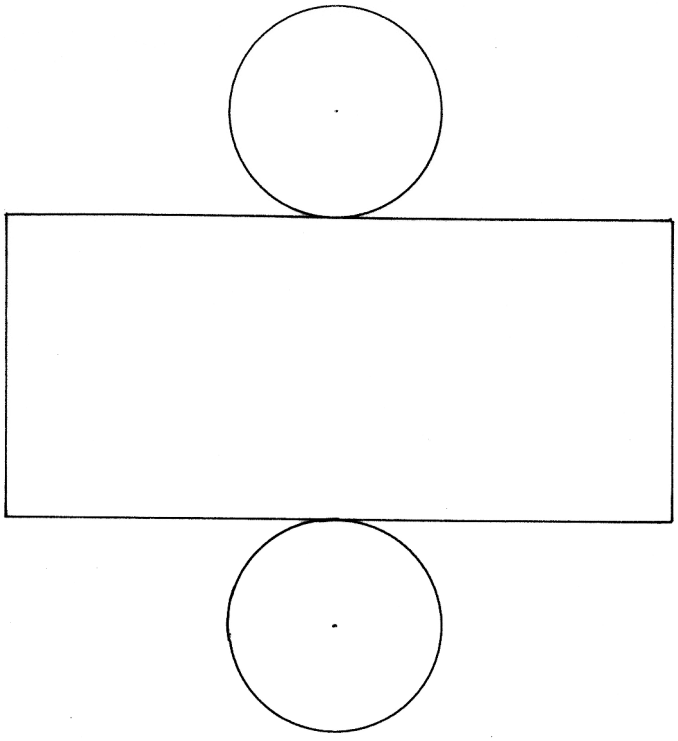


	S1	√ scale
	P2	(P1 for 4 points √ plotted)
	L1	√ line
b) (i) value of a $= \frac{-0.7}{3.5}$	M1	
$= -0.2$	A1	
value of k = 1.7	B1	
(ii) equation: $r = -0.2t + 1.7$	B1	
(iii) value of t when r = 0 $\therefore 0 = -0.2t + 1.7$ $0.2\,t = 1.7$	M1	
$t = \frac{1.7}{0.2} = 8.5$	A1	
	10	

4.3.3 Mathematics Alternative B (122/1)

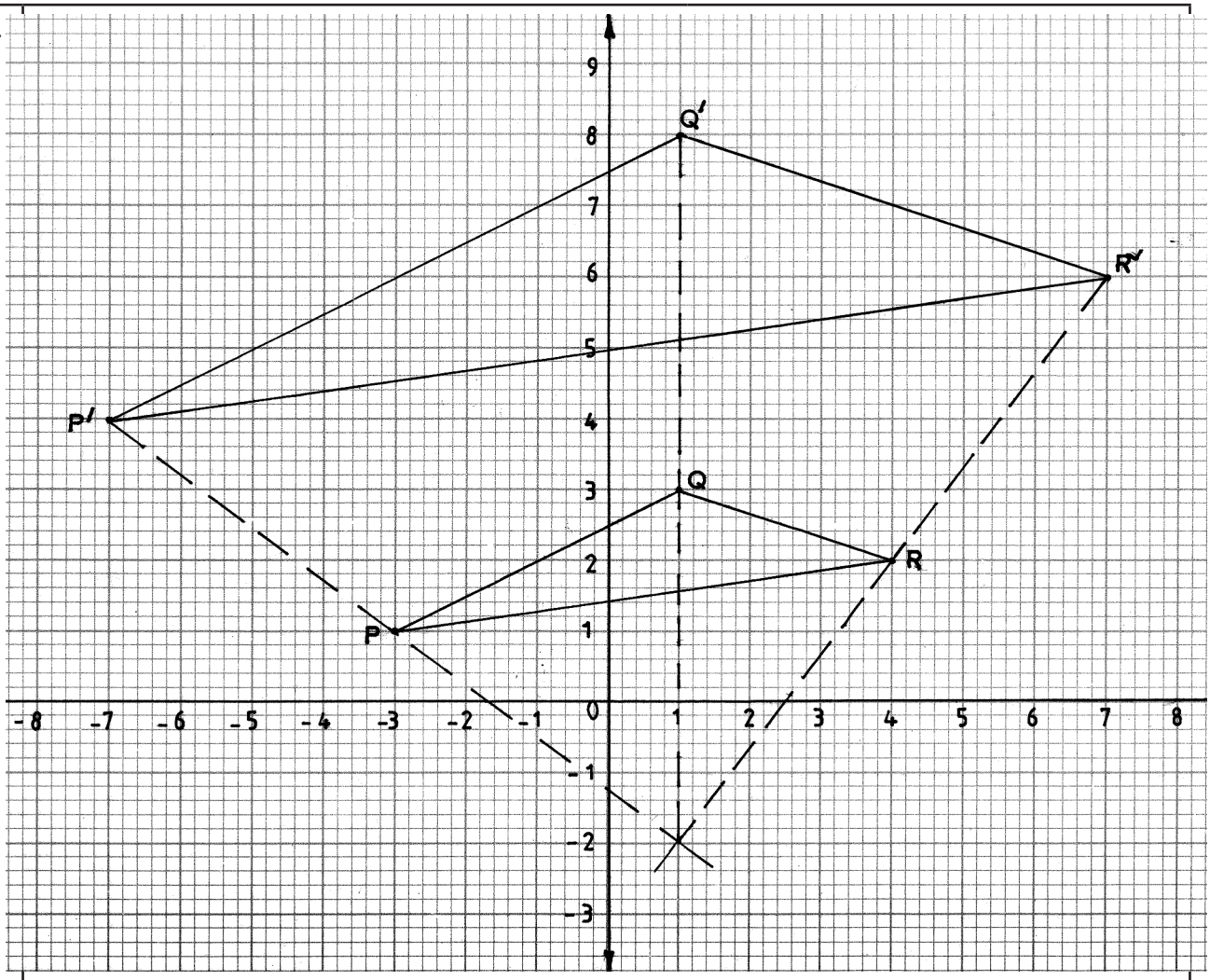
1.	$\frac{^{-}8 \times {}^{+}2 + {}^{-}11}{{}^{+}18 \div {}^{-}2 \times {}^{+}3} = \frac{-27}{-27}$ $= 1$	M1 A1 2	
2.	Number of boys $= 630 - 84$ $= 546$ Number of students $= 630 + 546$ $= 1176$ Number of parents $= 1176 \div 4$ $= 294$	M1 M1 A1 3	
3.	$3(78 - y) + 5y = 300$ $2y = 66$ $y = 33$ $\therefore x = 78 - 48 = 45$ $10x + 15y = 450 + 495 = 945$	M1 A1 B1 3	
4.	(a) $96 = 2^5 \times 3$ $84 = 2^2 \times 3 \times 7$ $36 = 2^2 \times 3^2$ GCD of 96, 84 and 36 $= 2^2 \times 3 = 12$ (b) Number of packets of foodstuffs $= \frac{96}{12} + \frac{84}{12} + \frac{36}{12}$ $= 8 + 7 + 3 = 18$	M1 A1 M1 A1 4	or equivalent
5.	$\frac{128}{2^5 \div 2^8} = \frac{2^7}{2^{-3}}$ $= 2^{10}$	B1 B1 B1 3	√ numerator √ denominator

6.		B1 B1 B1 3	√ construction of 30° √ construction of AD = 6 cm identifying C and completing parallelogram
7.	$4\alpha + \alpha + 10 = 90^\circ$ $5\alpha = 80^\circ$ $\alpha = 16^\circ$ $\sin\alpha = 0.276$	M1 A1 B1 3	
8.	$\frac{0.375 \div 0.06 - 4.2}{3.96 + 2.8 \times 0.05} = \frac{6.25 - 4.2}{3.96 + 0.14}$ $= \frac{2.05}{4.1}$ $= 0.5$	M1 M1 A1 3	Evidence of division and multiplication should be seen.
9.	Mangoes: $2x + x + \frac{1}{3}x$ $= 3\frac{1}{3}x$ Oranges: $\frac{1}{3}y + y + \frac{2}{3}y = 2y$ Total Fruits $= 3\frac{1}{3}x + 2y$	M1 M1 A1 3	

10.	(a) Cylinder (b)  Two circles of radius 1.4 touching the longer sides of a rectangle 4 cm by 8.8 cm.	B1 B1 B1 3	 for correct circles for correct rectangle
11.	Fraction of circumference made $= \frac{12}{60}$ $\frac{22}{7} \times 2r \times \frac{12}{60} = 17.6$ $r = \frac{7}{22} \times \frac{60}{12} \times \frac{17.6}{2}$ $= 14$	B1 M1 M1 A1 4	 or equivalent
12.	$\angle RQP = 147^\circ$ $\angle SRP = 90^\circ$ $\angle SRQ = 90 + 12 = 102^\circ$	B1 B1 B1 3	or $\angle RPS = 57^\circ$ or $180 - (57 + 21) = 102^\circ$

13.	$2x^2 + 6y - 3x - 4xy$ $= 2x^2 - 4xy - 3x + 6y$ $= 2x(x - 2y) - 3(x - 2y)$ $= (2x - 3)(x - 2y)$	M1 A1 2	or equivalent
14.	$x^2 \sin 30^0 = 34$ $x = \sqrt{\frac{34}{\sin 30}}$ $\simeq 8$ cm	M1 M1 A1 3	

15.



	(a) $\triangle PQR$ $\triangle P'Q'R'$ (b) Centre of enlargement $(1, -2)$ Scale factor of enlargement $= \frac{10}{5} = 2$	B1 B1 B1 B1 4	
16.	$\frac{L}{2.1} = \frac{L+5}{3.5}$ $3.5L - 2.1L = 10.5$ $L = 7.5$ $L = 5 + 7.5 = 12.5$ Curved area $= \frac{22}{7} \times (3.5 \times 12.5 - 2.1 \times 7.5)$ $= 88 \text{ cm}^2$	M1 M1 M1 A1 4	 for area for difference

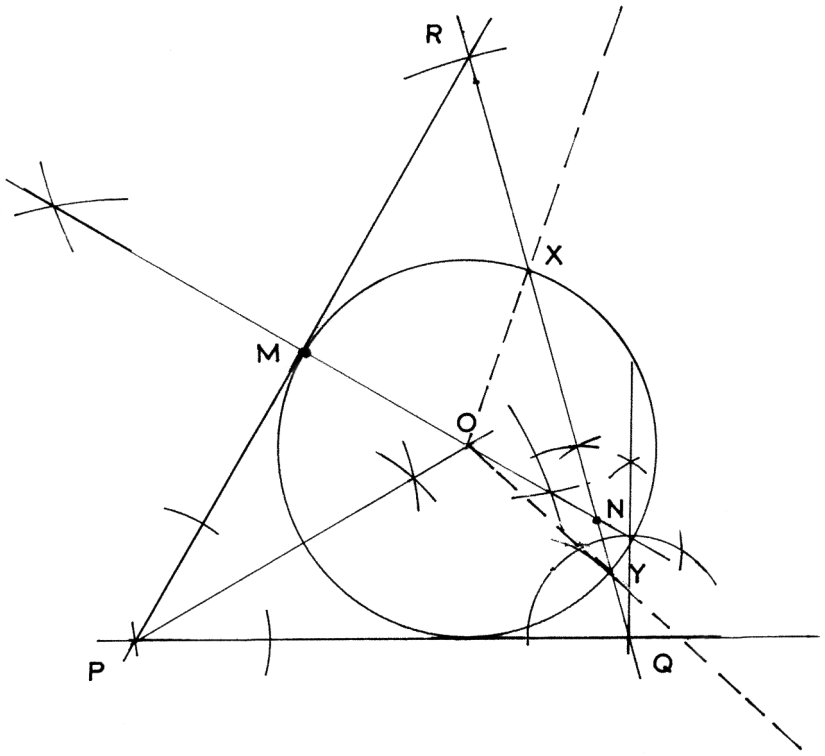
17.	(a) (i) Mumo's contribution:		
	$= \frac{25}{100} \times (30000 + 50000)$	M1	
	$= 20000$	A1	
	(ii) Ratio - Keya : Limo : Mumo		
	$= 30000 : 50000 : 20000$	M1	
	$= 3 : 5 : 2$	A1	
	(b) Mumo's share of profit		
	$= \frac{2}{10} \times 25000$	M1	
	$= 5000$	A1	
	(c) (i) $20000 + x = 80000 \times \frac{7}{8}$	M1	
	$x = 50000$	A1	
	(ii) Mumo's % contribution in business during 2nd year		
	$= \frac{70000}{150000} \times 100$	M1	or $\frac{7}{15} \times 100\%$ M1
	$= 46\frac{2}{3}\%$	A1	$= 46\frac{2}{3}\%$ A1
		10	

18.	(a) $1.54l = 1540\ \text{cm}^3$	B1	
	Volume $= \frac{22}{7} \times r^2 \times 10 = 1540$	M1	
	$r = \sqrt{\frac{1540 \times 7}{22 \times 10}}$		
	$= 7$		
	$\therefore$ Diameter $= 2 \times 7 = 14\ \text{cm}$	A1	
	(b) (i) Length of ribbon		
		M1	
	$= 2 \times \frac{22}{7} \times 14 + 2 \times 2$	M1	addition of the overlap
	$= 88 + 4 = 92$	A1	
	(ii) Surface area covered by ribbon		
	$= 88 \times 1.5 = 132\ \text{cm}^2$	B1	
	(c) Surface area		
	$= \frac{22}{7} \times 49 + \frac{22}{7} \times 14 \times 10$	M1	
		M1	
	$= 154 + 440$		
	$= 594\ \text{cm}^2$	A1	
		10	

19.	(a) Scale used:		
	9 cm represent 90 m	B1	
	$\therefore$ scale 1:1000	B1	
	(b) (i) perimeter of homestead		
	$(2 \times 10) \times 4$	M1	
	$= 80$ m	A1	
	(ii) Area of piece of land in ha.		
	$AB = 13.8 \times 10 = 138;$ $BC = 6 \times 10 = 60$		
	$\frac{\frac{1}{2}(60+90) \times 138}{10000}$	M1 M1	conversion to Hectares
	$= 1.035$ ha	A1	
	(c) $\perp$ distance from centre of homestead to side CD shown	B1	
	Distance, 3.6 cm, on map	B1	
	Actual distance $3.6 \times 10 = 36$ m	B1	
		10	

20.	(a) Gradient of L_1		
	$= \frac{1 - {}^{-}2}{6 - {}^{-}3}$	M1	
	$= \frac{1}{3}$		
	equation of L_1		
	$= \frac{y-1}{x-6} = \frac{1}{3}$	M1	
	$3y - 3 = x - 6$ $3y = x - 3$ $y = \frac{1}{3}x - 1$	A1	
	(b) Gradient of L_2		
	$= \frac{-1}{\frac{1}{3}}$	M1	
	$= -3$		
	$\therefore$ equation $\frac{y-2}{x-{}^{-}1} = -3$	M1	
	$y = -3x - 1$ $\Rightarrow 3x + y + 1 = 0$	A1	
	(c) equation of L_3		
	$\frac{y-1}{x-1} = -3$	M1	
	$y - 1 = -3(x - 1)$	A1	
	$y = -3x + 4$		
	x intercept: when $y = 0$, $x = \frac{4}{3}$ $\therefore$ coordinates of x intercepts $\left(\frac{4}{3}, 0\right)$	B1	
	y intercept: when $x = 0$, $y = 4$ $\therefore$ coordinates of y intercept $(0, 4)$	B1	
		10	

21.

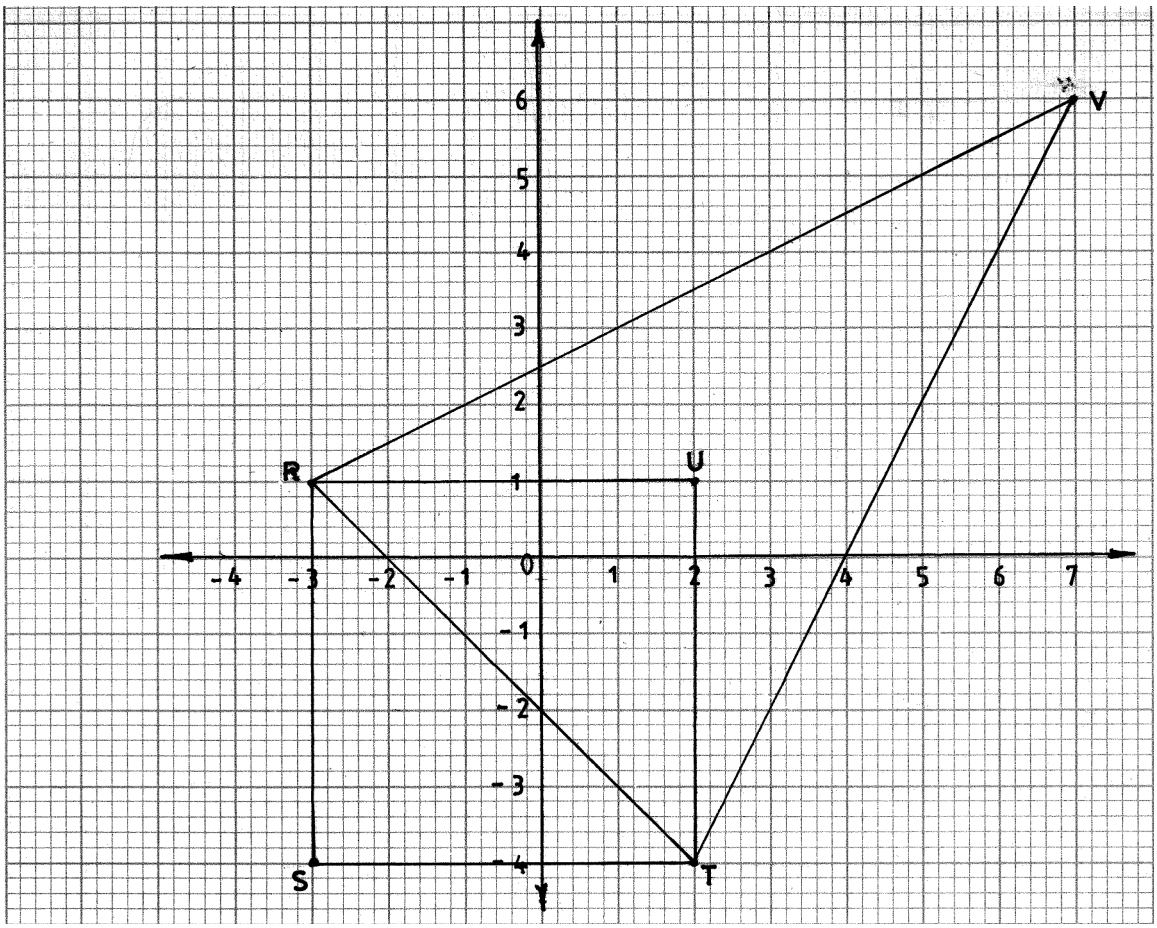


(a)	Lines PQ and PR	B1
	angle 75° constructed	B1
	completion of △ PQR.	B1
		B1
(b)	(i) ⊥ bisector of PR	B1
	(ii) angle bisector ∠ QPR	B1
	∠ POM 60° ± 1°	B1
	(iii) circle with radius OM	B1
	XY = 4.3 ± 0.1	B1
	∠ XOY 114° ± 1°	B1
		10

22.	(a) (i) $\frac{400\text{m}}{64\text{s}}$	M1	
	$= 6.25$ m/s	A1	
	(ii) speed during second lap		
	6.25×1.06	M1	
	6.625 m/s	A1	
	(b) (i) total time for two laps		
	time for 2nd lap $= \frac{400}{6.625}$	M1	
	$\simeq 60.38$ s		
	total time		
	$= 64 + 60.38$	M1	
	$= 124.38$ s	A1	
	(ii) average speed in km/h		
	$\frac{800}{124.38}$ m/s	M1	
	$= \frac{800}{124.38} \times \frac{3600}{1000}$	M1	√ conversion
	$= 23.15$ km/h	A1	
		10	

23.	(a) (i) amount of money spent		
	$= \frac{420}{8} \times 20 + 50$	M1	
	$= 1100$	A1	
	(ii) number of bananas sold		
	$= 420 + \frac{420}{70} - 14$		
	$= 412$	B1	
	(b) (i) s.p. of bananas		
	$= 1100 \times 1.6$ $= 1760$	M1	
	let x be number of bananas sold at sh 30		
	$\therefore \frac{x}{5} \times 30 + \frac{412 - x}{3} \times 10 = 1760$	M1	
	$18x + 412 - 10x = 1760$	M1	
	$x = 145$	A1	
	(ii) No of bananas sold at sh 10		
	$= 412 - 145 = 267$	B1	
	Amount of money obtained		
	$= \frac{267}{3} \times 10$	M1	
	$= 890$	A1	
		10	

24.

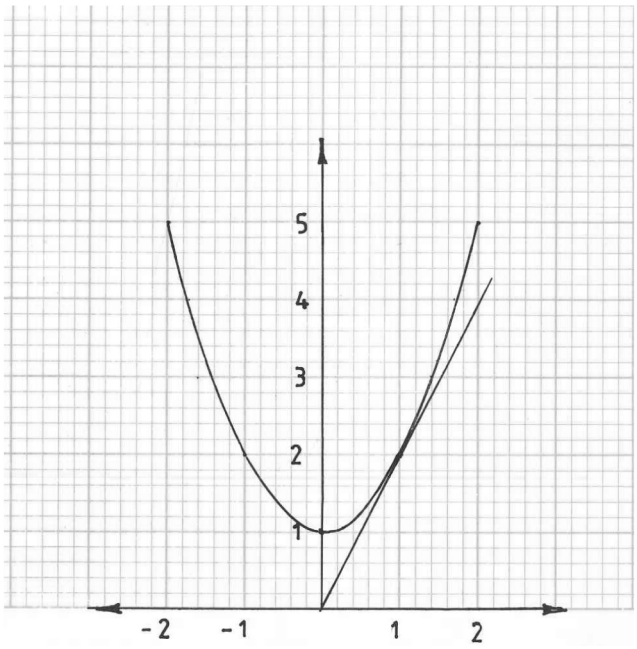


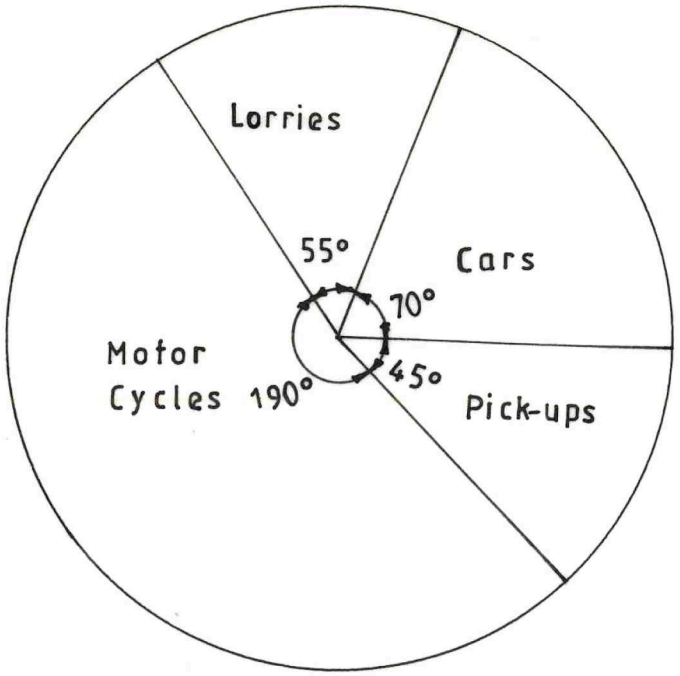
(a) (i)	$\triangle$ RST $\surd$ drawn	B1	
(ii)	Area of $\triangle$ RST: $\frac{1}{2} \times 5^2$ $= 12.5$	M1 A1	
(b) (i)	Plotting point U coordinates of point U $(2, 1)$	B1 B1	
(ii)	Plotting of point V coordinates of point V $(7, 6)$	B1 B1	
(c)	Area of quadrilateral RSTV diagonals RT $= \sqrt{50}$ and SV $= \sqrt{200}$	B1	for RT and SV
	$\therefore$ Area $= \frac{1}{2} \times \sqrt{50} \times \sqrt{200}$	M1	
	$= \frac{1}{2} \times 5\sqrt{2} \times 10\sqrt{2}$		
	$= 50$	A1	
		10	

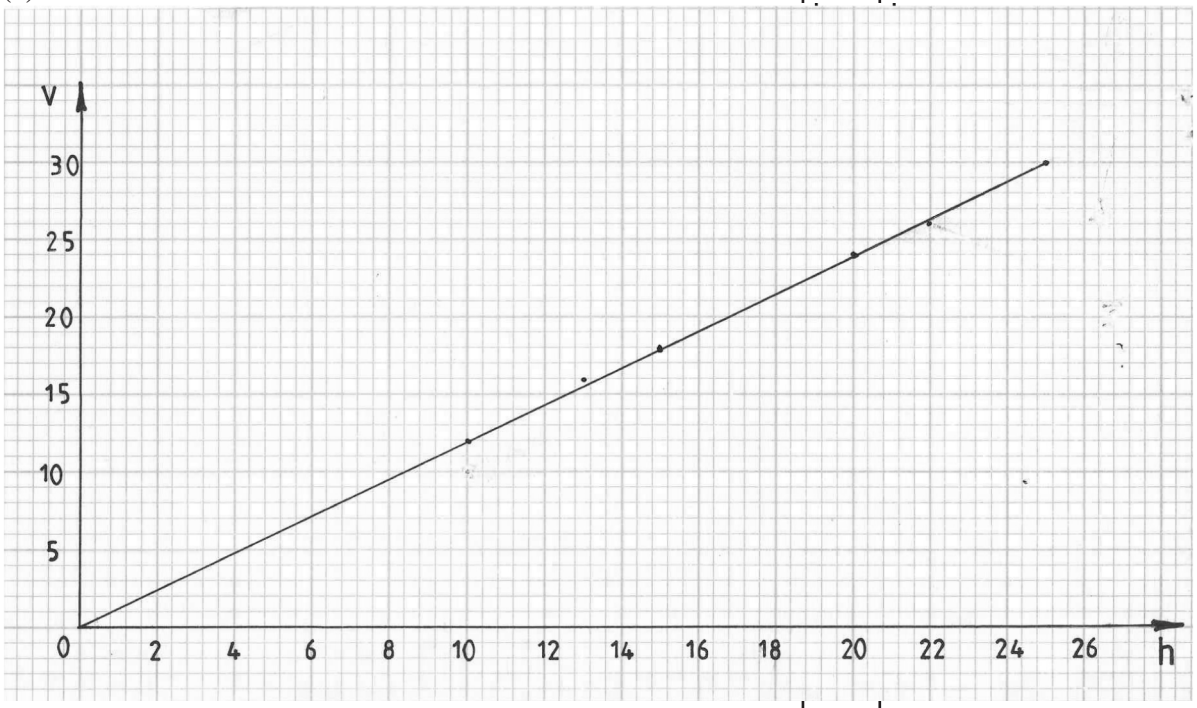
4.3.4 Mathematics Alternative B Paper 2 (122/2)

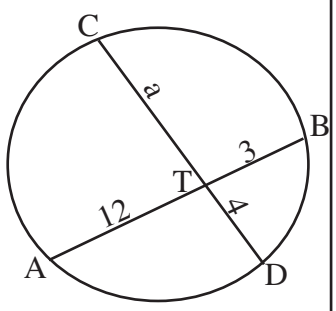
1.	$\frac{(0.214)^{1/2}-(0.38)^3}{(0.817)^{1/4}}=\frac{0.40772934}{0.950726313}$ $=0.4289$	B1 B1 2	
2.	(a) $\frac{ar^5}{ar^2}=\frac{5}{32}\times\frac{4}{5}$ $r^3=\frac{1}{8}\Rightarrow r=\frac{1}{2}$ (b) $ar^2=\frac{5}{4}$ $a\times\left(\frac{1}{2}\right)^2=\frac{5}{4}\Rightarrow a=\frac{5}{4}\times\frac{4}{1}$ $a=5$	M1 A1 M1 A1 4	
3.	$\frac{1}{2}\times 4a\{3a+(3a+3)\}=60$ $2a(6a+3)=60$ $12a^2+6a-60=0$ $2a^2+a-10=0$ $(2a+5)(a-2)=0$ $a=2$ or $a=-\frac{5}{2}$ $a=2$	M1 M1 A1 3	
4.	Complete squares = 12 Part squares = 20 Approx. area $=12+\frac{20}{2}$ $=22$	B1 M1 A1 3	for 12 and 20

5.	$A = 48000\ (1.05)^3$ $= 55\ 566$ Interest = 55 566 - 48 000 $= 7\ 566$	M1 A1 B1 3	
6.	$3(4\underset{\sim}{i} + 5\underset{\sim}{j}) - 2(8\underset{\sim}{i} - 3\underset{\sim}{j}) = p\underset{\sim}{i} + 3q\underset{\sim}{j}$ $12\underset{\sim}{i} + 15\underset{\sim}{j} - 16\underset{\sim}{i} + 6\underset{\sim}{j} = p\underset{\sim}{i} + 3q\underset{\sim}{j}$ $-4\underset{\sim}{i} + 21\underset{\sim}{j} = p\underset{\sim}{i} + 3q\underset{\sim}{j}$ $\therefore p = -4$ $3q = 21 \Rightarrow q = 7$	 M1 M1 A1 3	 for -4i + 21 j for both p = -4 and q = 7
7.	ln 1h A does $\frac{1}{8}$ of work B does $\frac{1}{10}$ of work ln 3h both A and B do $3\left(\frac{1}{8}+\frac{1}{10}\right)$ $= \frac{27}{40}$ of work Remaining piece of work $= 1 - \frac{27}{40}$ $= \frac{13}{40}$ Time for A to complete the remaining work $= \frac{13}{40} \div \frac{1}{8}$ $= 2\frac{3}{5}$ h	 M1 M1 M1 A1 4	

8.	 tangent at A gradient = $\frac{4-0}{2-0}$ = 2	B1 M1 A1 3	
9.	$\tan^{-1}\sqrt{3} = 60$ $2\theta - 30 = 60°, 240°, 420°, 600°$ $2\theta = 90°, 270°, 450°, 630°$ $\theta = 45°, 135°, 225°, 315°$	B1 B1 B1 3	
10.	Longitude difference = 50° + 22° = 72° Distance = $\frac{72}{360} \times \frac{22}{7} \times 2 \times 6370$ = 8008 km	M1 M1 A1 3	

11.	$\det \begin{pmatrix} 8 & 3 \\ 4 & 2 \end{pmatrix} = 16 - 12 = 4$ Matrix N = $\frac{1}{4}\begin{pmatrix} 2 & -3 \\ -4 & 8 \end{pmatrix}$ $= \begin{pmatrix} \frac{1}{2} & -\frac{3}{4} \\ -1 & 2 \end{pmatrix}$	B1 M1 A1 3	
12.	5x + 6y =50 7x + 5y = 53 42x + 30y = 318 25x + 30y = 250 17x = 68 x = 4 20 + 6y = 50 $\Rightarrow$ y = 5	M1 M1 A1 B1 4	for both equations set
13.	Angle for: Cars = $\frac{14}{72} \times 360^\circ = 70^\circ$ Lorries = $\frac{11}{72} \times 360^\circ = 55^\circ$ Motor cycle = $\frac{38}{72} \times 360^\circ = 190^\circ$ Pick ups = $\frac{9}{72} \times 360^\circ = 45^\circ$  	B2 B1 3	All angles correct (allow B1 for 3 correct)

14.	Area scale factor = Det of matrix $= \frac{4}{9} - 0$ $= \frac{4}{9}$ Area of A'B'C'D' = $\frac{4}{9} \times 27$ $= 12 \text{ cm}^2$	M1 M1 A1 3	
15.	(a)  (b) Constant of proportionality = Gradient = $\frac{24-12}{20-10} = 1.2$	P1 L1 B1 3	√ plotting √ line drawn or equivalent

16.	Let CT = a AT.TB = CT.TD $12 \times 3 = a \times 4$ $a = \frac{12 \times 3}{4}$ $= 9$ CT : TD = 9:4	 M1 A1 B1 3	
17.	(a) (i) $40000 \times \frac{20.5}{100}$ $= 8200$ (ii) total hire purchase price $= 8200 + 12 \times 4800$ $= 65800$ (iii) deposit as percentage of hire purchase price $= \frac{8200}{65800} \times 100\%$ $= 12.46200608 = 12.5\%$ (iv) h.p. price more than cash price $= 65800 - 40000 = 25800$ (b) Bidii's deposit as percentage of cash price $= 65800 - (12 \times 4000)$ $= 17800$ %age $= \frac{17800}{40000} \times 100\%$ $= 44.5\%$	M1 A1 M1 A1 M1 A1 B1 M1 A1 B1 10	

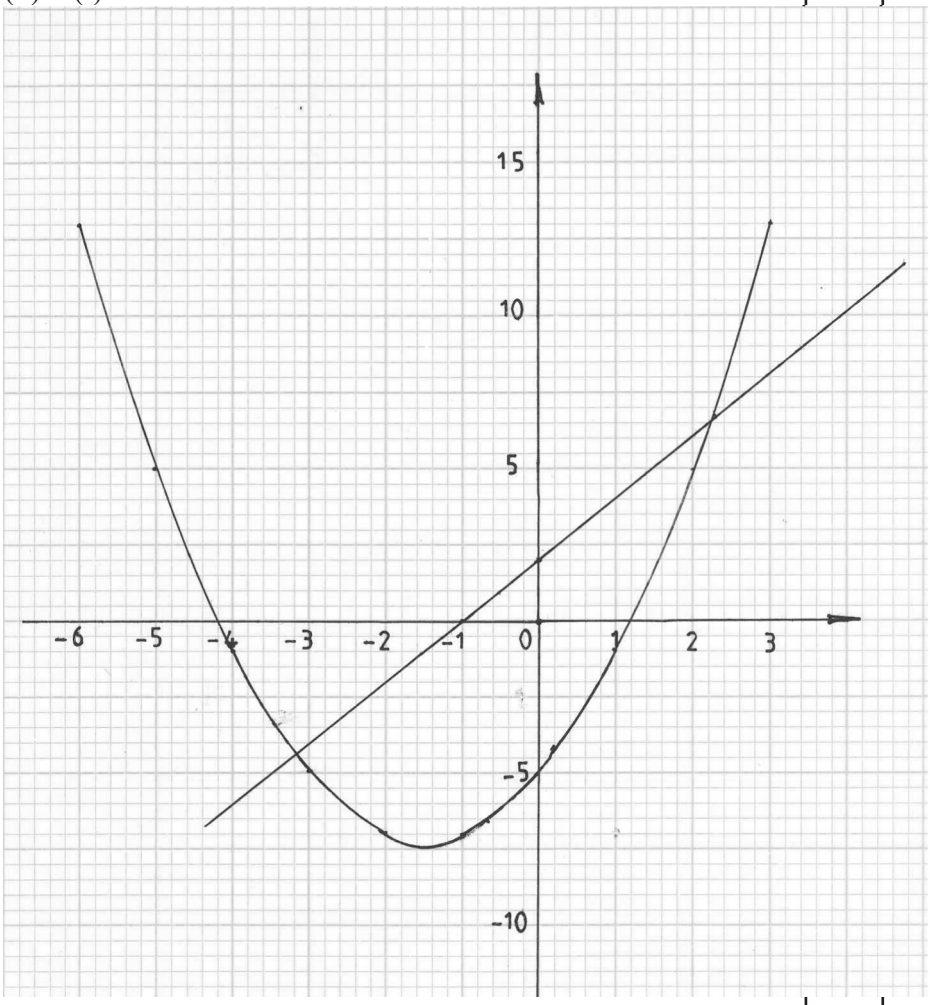
18.	(a) (i) let number of pieces be n		
	$15 = 0.5 + (n - 1) \times 0.25$	M1	
	$0.25n = 14.75$		
	$n = 59$	A1	
	(ii) length of 10th piece		
	$= 0.5 + (10 - 1)0.25$	M1	
	$= 0.5 + 9 \times 0.25 = 2.75$ m	A1	
	(iii) $S_{59} = \frac{59}{2}\{2 \times 0.5 + 58 \times 0.25\}$	M1	
	$= 457.25$ m	A1	
	(b) $63 = \frac{n}{2}\{2 \times 0.5 + (n-1)0.25\}$	M1	
	$126 = n\{1 + 0.25n - 0.25\}$		
	$0.75n + 0.25n^2 = 126$		
	$n^2 + 3n - 504 = 0$		
	$(n + 24)(n - 21) = 0$	M1	or equivalent
	$n = -24$ or 21	A1	
	$n = 21$	B1	
		10	

19. (a)

x	-6	-5	-4	-3	-2	-1	0	1	2	3
y	13	5	(-1)	-5	-7	-7	(-5)	-1	5	13

B2 (allow B1 for 5 values √)

(b) (i)



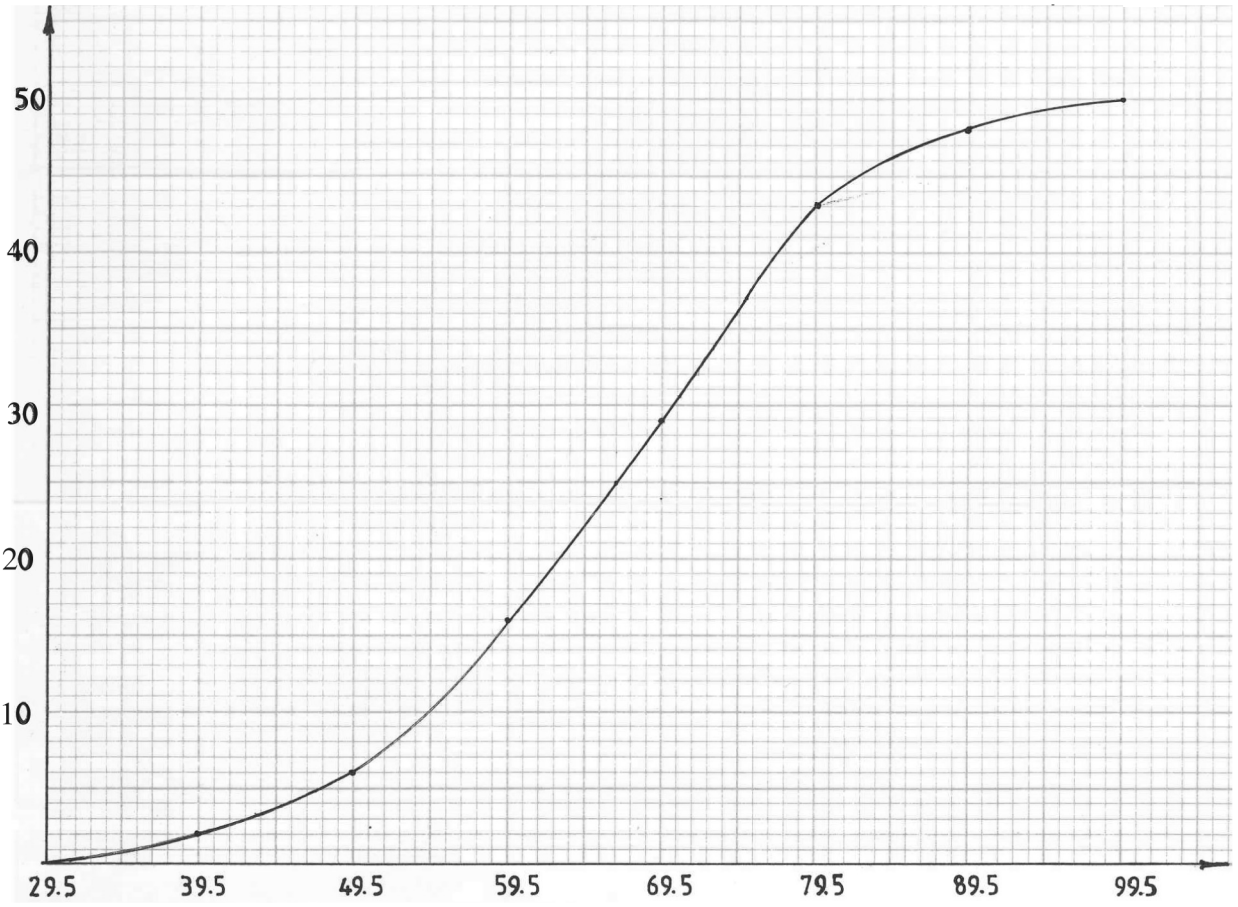
S1
P1
C1
B1
B1
L1
B1
B1

√ coordinates

(ii) -4.2, 1.2

c(i)
(-3.2, -4.5)
(2.2, 6.5)

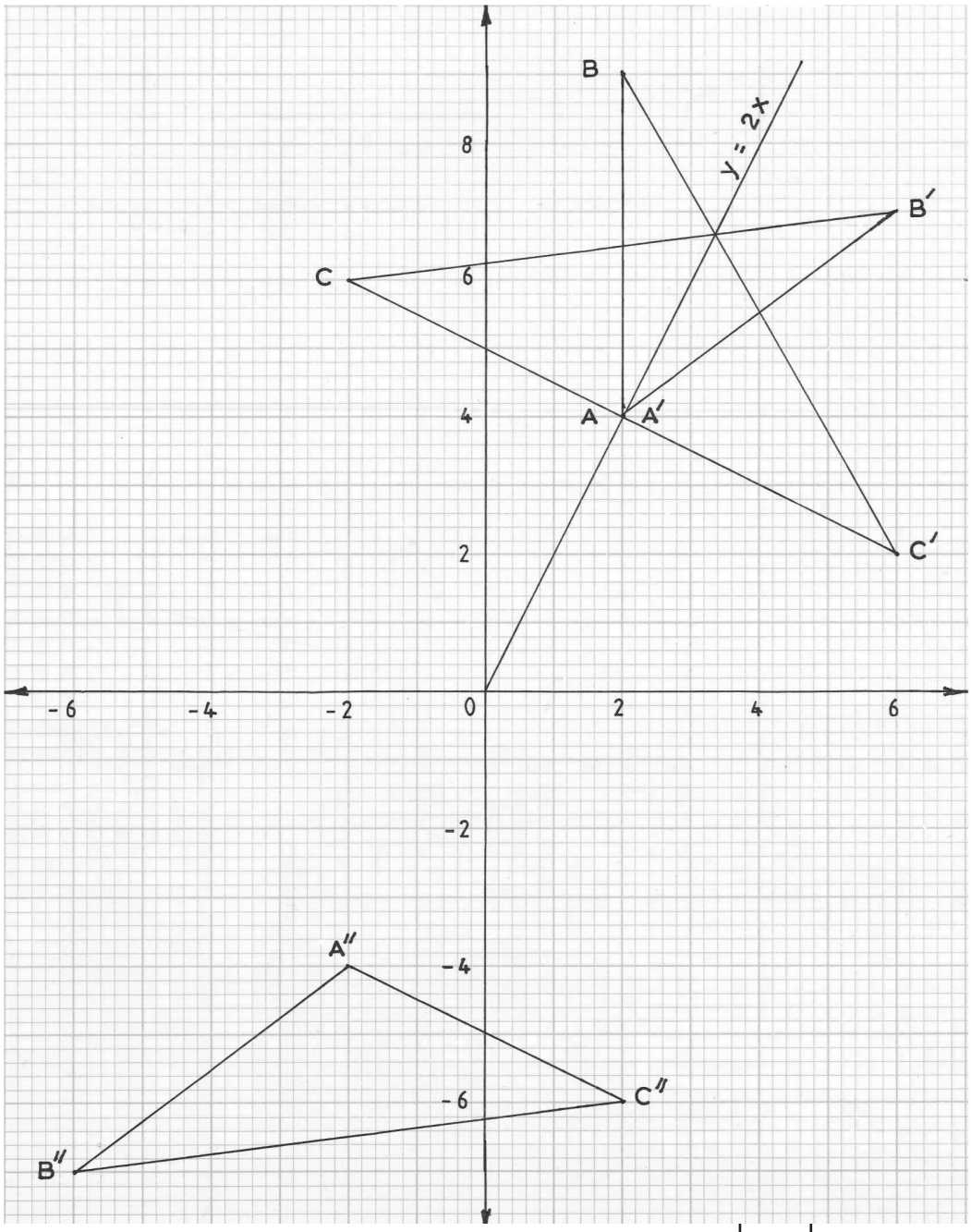
10

20.	(a) The mean: $= \frac{2\times 34.5 + 4\times 44.5 + 10\times 54.5 + 13\times 64.5 + 14\times 74.5 + 5\times 84.5 + 2\times 94.5}{50}$ $= \frac{3285}{50}$ $= 65.7$	B1 M1 A1	mid points for $\sum fx$
	(b) **Marks** | 30-39 | 40-49 | 50-59 | 60-69 | 70-79 | 80-89 | 90-99 **frequency** | 2 | 4 | 10 | 13 | 14 | 5 | 2 **cf** | 2 | 6 | 16 | 29 | 43 | 48 | 50	B1	√ cfs
		S1 P1 C1	
	(c) (i) median : 66.5 (ii) position of student who scores 75 = 37th	B1 B1 B1	25th pos for 66.5
		10	

21.	(a) AD $= \sqrt{9.2^2 - 6^2}$	M1	
	$= 7.0$	A1	
	(b) Angle ABD $= \cos^{-1} \frac{6}{9.2}$	M1	
	$= 49.3°$	A1	
	(c) $\frac{BC}{9.2} = \tan 40°$	M1	
	BC $= 9.2 \tan 40$		
	$= 7.7$	A1	
	(d) Area of ΔACD:		
	$\angle ADB = 90° - 49.3° = 40.7$	B1	
	Side DC: $\frac{9.2}{DC} = \cos 40°$		
	DC $= \frac{9.2}{\cos 40°} = 12\ cm$	B1	
	$\therefore$ Area ΔACD		
	$= \frac{1}{2}$ AD $\times$ DC sin (40 + 40.7)		
	$= \frac{1}{2} \times 7 \times 12 \times \sin 80.7$	M1	
	$= 41.4$ cm^2	A1	
		10	

22.	(a) P(Daudi uses a train and is punctual)		
	$= 0.3 \times 0.8$	M1	
	$= 0.24$	A1	
	(b) P(Daudi uses bus and is late for work)		
	$= 0.5 \times 0.3$	M1	
	$= 0.15$	A1	
	(c) P(Daudi punctual)		
	$= 0.3 \times 0.8 + 0.5 \times 0.7 + 0.2 \times 0.9$	M1	
	$= 0.24 + 0.35 + 0.18$		
	$= 0.77$	A1	
	(d) P(Daudi late)		
	$= 1 - 0.77$	M1	
	$= 0.23$	A1	
	(e) P(Daudi uses train or bus and is punctual)		
	$= 0.3 \times 0.8 + 0.5 \times 0.7$	M1	
	$= 0.59$	A1	
		10	

23.



(a) (i)

(ii) $\begin{pmatrix} -\frac{3}{5} & \frac{4}{5} \\ \frac{4}{5} & \frac{3}{5} \end{pmatrix}\begin{pmatrix} 2 & 2 & 6 \\ 4 & 9 & 2 \end{pmatrix} = \begin{pmatrix} 2 & 6 & -2 \\ 4 & 7 & 6 \end{pmatrix}$

(b) Reflection in line y = 2x

(c) (i)

(ii) matrix of H = $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

(d) $HT = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} -\frac{3}{5} & \frac{4}{5} \\ \frac{4}{5} & \frac{3}{5} \end{pmatrix} = \begin{pmatrix} \frac{3}{5} & -\frac{4}{5} \\ -\frac{4}{5} & -\frac{3}{5} \end{pmatrix}$

B1	ΔABC drawn
M1	
A1	
B1	ΔA'B'C' √ drawn
B1	reflection
B1	equation y = 2x
B1	ΔA"B"C" √ drawn
B1	
M1	or equivalent
A1	
10	

24.

Dr			Cr		
Date 2014	Particulars	Sh Cts	Date 2014	Particulars	Sh Cts
January			January		
1	Balance	3250.00	3	Oranges	9000.00
5	Orange	11750.00	4	Pawpaw	1650.00
6	Pawpaw	1812.50	4	Vegetables	700.00
6	Vegetable	1140.00	4	Transport	200.00
			8	Market fees	150.00
			10	Wages	400.00
			11	Balance	5852.50
		17952.50			**17952.50**

Oranges sales = 11750.00	B1
Pawpaw sales = 1812.50	B1
Oranges purchase = 9000.00	B1
Pawpaw purchase = 1650.00	B1
all other entries correct	B2
Totals	M1
Dr/Cr columns = 17952.50	A1
Balance on 11/01/2011	
= Sh 17952.50 - (900 + 1650 + 700 + 200 + 150 + 400)	M1
= 5852.50	A1
	10