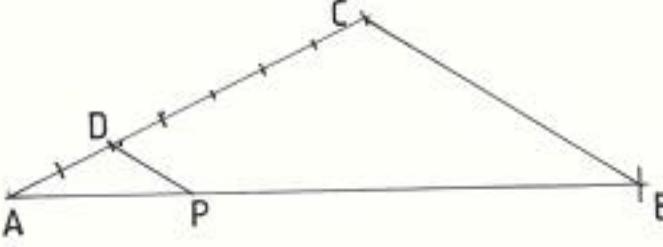
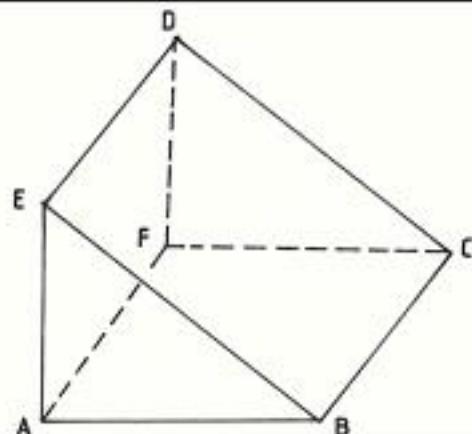


4.3.1 Mathematics Alternative A Paper 1 (121/1)

1.	$\begin{array}{r} 36 \\ -12 \\ \hline 4 \end{array}$ $\begin{array}{r} -108 \\ -27 \\ \hline -3 \end{array}$ $= -3 - 4$ $= -7$	M1															
		A1															
		2															
2.	(a) Mode = 22	B1															
	(b) Median 15, 15, 16, 19, 19, 20, 20, 21, 22, 22, 22, 26, 27, 28 $\text{median} = \frac{20 + 21}{2}$ $= 20.5$	M1															
		A1															
		3															
	<table border="1"> <thead> <tr> <th>No.</th> <th>Log</th> </tr> </thead> <tbody> <tr> <td>1.794</td> <td>0.2538</td> </tr> <tr> <td>0.038</td> <td><u>2.5798</u></td> </tr> <tr> <td>1.243</td> <td>2.8336</td> </tr> <tr> <td></td> <td>0.0945</td> </tr> <tr> <td>0.3799</td> <td><u>2.7391 ÷ 3</u></td> </tr> <tr> <td></td> <td>1.5797</td> </tr> </tbody> </table>	No.	Log	1.794	0.2538	0.038	<u>2.5798</u>	1.243	2.8336		0.0945	0.3799	<u>2.7391 ÷ 3</u>		1.5797		
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No.	Log																
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0.3799	<u>2.7391 ÷ 3</u>																
	1.5797																
M1	+ and - operations ✓																
M1	÷ 3 ✓																
A1																	
4																	
4.	$\begin{aligned} & \frac{(4m+3n)(4m-3n)}{(4m+3n)(m-n)} \\ &= \frac{4m-3n}{m-n} \end{aligned}$	M1	factorizing numerator ✓														
		M1	factorizing denominator ✓														
		A1															
		3															
5.	Retailer 130% → 1560 100% → $\frac{1560 \times 100}{130}$ $= 1200$	M1															
	Wholesaler 120% → 1200 100% → $\frac{1200 \times 100}{120}$ $= 1000$	M1															
		A1															
		3															

6.		B1 B1 B1 3	construction of equal parts on AC draw $DP \parallel CB$ such that $AP = \frac{2}{7} AB$ locating point P
7.	From 0700 h Monday to 1900 h Wednesday $= 24 \times 2 + 12$ h $= 60$ h Time lost $= 60 \times 15 = 900$ sec $= 15$ min Time shown on clock: $1900 \text{ h} - 15 \text{ min} = 1845 \text{ h}$	M1 M1 A1 3	
8.	$x + 20 = 230^\circ$ or $x + 20 = 310^\circ$ $x = 210^\circ$ or $x = 290^\circ$	B1 B1 B1 3	for 230° or 310°
9.	(a) $\begin{array}{r} 2357 \\ - 941 \\ \hline 1416 \end{array}$ (b) $1416 = 2^3 \times 3 \times 59$	B1 B1 B1 3	for 2357 and 941 ✓ for 1416
10.		B1 B1 B1 3	lines AF, ED equal and parallel to BC lines AB, FC equal and parallel or lines AE and FD equal and parallel or lines CD, EB equal and parallel. completing the solid showing dotted lines.

11.	$2x + \frac{1}{2}x + x + 40 + 110 + 135 + 160 + 2x + 10 + 185 = 1080$	M1	
	$\frac{11}{2}x = 440 \Rightarrow x = 440 \times \frac{2}{11} = 80^\circ$	A1 2	
12.	(a) Gradient of line: $\frac{3 - 1}{6 - 2} = \frac{1}{4}$ \therefore line equation: $\frac{y - 3}{x - 6} = \frac{1}{4}$ $y - 3 = \frac{1}{4}(x - 6)$ $y = \frac{1}{4}x + 1\frac{1}{2}$	M1 A1	
	(b) Gradient of perpendicular line $\frac{1}{4}m' = -1$ $m' = -4$	B1 3	
13.	(a) $5^2 = 7^2 + 6^2 - 2 \times 6 \times 7 \cos C$ $\cos C = \frac{49 + 36 - 25}{84}$ $C = 44.42^\circ$	M1 A1	
	(b) $h = 7 \sin 44.42^\circ$ $= 4.9 \text{ cm}$	M1 A1 4	
14.	Volume of pipe material $\frac{22}{7}(1.75^2 - 1.05^2) \times 250 \text{ cm}^3$ $= 1540 \text{ cm}^3$ \therefore mass of pipe $= \frac{1540 \times 1.25}{1000}$ $= 1.925 \text{ kg}$	M1 M1 MI A1 4	

15.	$h = 2.5 \tan 54^\circ = 3.441 \text{ cm}$ <p>Area of pentagonal faces</p> $= 2\left(\frac{1}{2} \times 5 \times 3.441 \times 5\right)$ $= 86.025$ <p>Total area</p> $= 86.025 + 5(12 \times 5)$ $= 386.0$	B1 M1 M1 A1 4	
16.	(a) $x - 5 \leq 3x - 8$ $-2x \leq -3$ $x \geq 1.5$ <p>$3x - 8 < 2x - 3$ $x < 5$</p> <p>$\therefore 1.5 \leq x < 5$</p> (b)	B1 B1 B1 B1 3	

17.	(a) Mass after decrease		
	$112 \times \frac{15}{16}$	M1	or equivalent
	= 105 kg		
	Total decrease		
	$(112 - 105) \times 540$	M1	
	= 3780 kg	A1	
	(b) (i) No. of 90 kg bags		
	$\frac{105 \times 540}{90}$	M1	
	= 630		
	Least number of trips		
	$\frac{630}{120}$	M1	
	= 5.25	A1	
	$\Rightarrow 6$ trips		
	(ii) Expenses		
	buying price = 1500×630 = 945000	M1	
	transport = 2500×6 = 15000		
	Total $945000 + 15000$	M1	
	Selling price per bag:		
	$= \frac{960000 \times 1.26}{630}$	M1	
	= 1920	A1	
		10	

18.	(a)	$(x + 3)(x - 2) = 24$	M1	
		$x^2 + x - 30 = 0$	M1	
		$(x + 6)(x - 5) = 0$	M1	
		$x = -6 \text{ or } x = 5$	A1	
	(b) (i)	$(x + 9)x = 136$	M1	
		$x^2 + 9x - 136 = 0$		
		$(x + 17)(x - 8) = 0$	M1	
		$x = -17 \text{ or } x = 8$		
		$\therefore x = 8$	A1	
		perimeter $= 2(8 + 17) = 50 \text{ m}$	B1	
	(ii)	$2x \times x = 136 - 64$	M1	
		$2x^2 = 72$		
		$x^2 = 36$		
		$x = 6 \text{ m}$	A1	
				10

19.	(a) $2c + 9g = 98200$ $3c + 4g = 96000$	B1 B1	
	(b) Det. of $\begin{pmatrix} 2 & 9 \\ 3 & 4 \end{pmatrix} = -19$ $M' = -\frac{1}{19} \begin{pmatrix} 4 & -9 \\ -3 & 2 \end{pmatrix}$	B1	
	$-\frac{1}{19} \begin{pmatrix} 4 & -9 \\ -3 & 2 \end{pmatrix} \begin{pmatrix} 2 & 9 \\ 3 & 4 \end{pmatrix} \begin{pmatrix} c \\ g \end{pmatrix} = -\frac{1}{19} \begin{pmatrix} 4 & -9 \\ -3 & 2 \end{pmatrix} \begin{pmatrix} 98200 \\ 96000 \end{pmatrix}$ $-\frac{1}{19} \begin{pmatrix} -19 & 0 \\ 0 & -19 \end{pmatrix} \begin{pmatrix} c \\ g \end{pmatrix} = -\frac{1}{19} \begin{pmatrix} -471200 \\ -102600 \end{pmatrix}$	M1 M1	
	$\begin{pmatrix} c \\ g \end{pmatrix} = \begin{pmatrix} 24800 \\ 5400 \end{pmatrix}$ cost of cow = sh 24800 cost of goat = sh 5400	A1	
	(c) (i) selling price of cows = $2 \times 24800 \times 1.3$ selling price of goats = $9 \times 5400 \times 1.4$		
	Total selling price $= 2 \times 24800 \times 1.3 + 9 \times 5400 \times 1.4$ $= 132520$	M1 A1	
	(ii) % profit $= \frac{132520 - 98200}{98200} \times 100\%$ $= 34.95\%$	M1 A1	10

20.	(a) (i) Time taken by Juma = $\frac{x}{40}$ h Time taken by Mutuku = $\frac{80-x}{60}$ Let x km be distance from A $\therefore \frac{x}{40} - \frac{80-x}{60} = \frac{1}{2}$ $\frac{3x - 2(80-x)}{120} = \frac{1}{2}$ $2(5x - 160) = 120$ $10x = 440$ $x = 44$ km	B1 B1 M1 M1 A1
	(ii) Time they met $10.00 \text{ am} + \frac{44}{40} \text{ h}$ $= 10.00 + 1 \text{ h } 6 \text{ min}$ $= 11.06 \text{ am}$	M1 A1

(b) Speed if Kamau delayed by 21 minutes

$$\text{Kamau's time} = \left(\frac{44}{40} - \frac{21}{60}\right) \text{h}$$

$$= \frac{3}{4} \text{h}$$

\therefore speed needed: $\frac{44}{\frac{3}{4}}$

$$= 58 \frac{2}{3} \text{ km/h}$$

M1

M1

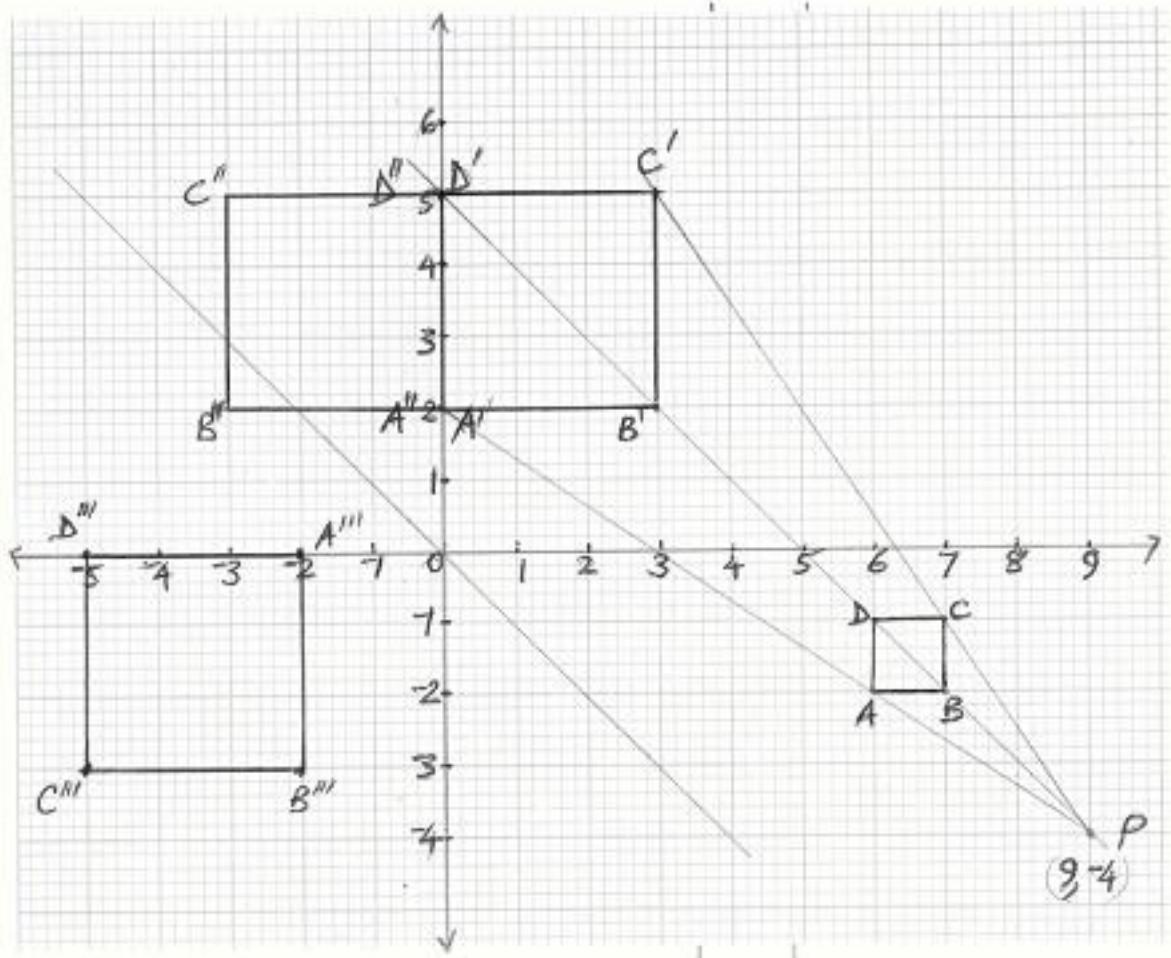
A1

10

21.	(a) Displacement, s, when $t = 2$ $2^3 - 5 \times 2^2 + 3 \times 2 + 10$ $= 4$	M1 A1	
	(b) (i) velocity when $t = 5$ seconds $V = \frac{ds}{dt} = 3t^2 - 10t + 3$	B1	
	when $t = 5$, $V = 3 \times 5^2 - 10 \times 5 + 3$ $= 28$	M1 A1	
	(ii) $3t^2 - 10t + 3 = 0$ $(3t - 1)(t - 3) = 0$ $t = \frac{1}{3}, \quad t = 3$	M1 M1 A1	
	(c) time when velocity of particle is at its maximum acceleration $= \frac{dv}{dt} = 6t - 10 = 0$	M1	
	$t = \frac{10}{6} = 1\frac{2}{3}$ s	A1 10	

22.	(a) (i) $\underline{OB} = \underline{p} + \underline{q}$	B1	
	(ii) $\underline{AD} = -\underline{p} + \frac{3}{5} \times 5\underline{q}$	M1	
	$= -\underline{p} + 3\underline{q}$	A1	
	(iii) $\underline{CB} = -5\underline{q} + \underline{p} + \underline{q}$	M1	or equivalent
	$= -4\underline{q} + \underline{p}$	A1	
	(b) $\underline{AX} = k(\underline{AD})$		
	$= k(-\underline{p} + 3\underline{q})$	B1	
	$= -k\underline{p} + 3k\underline{q}$		
	also $\underline{AX} = -\underline{p} + r(\underline{OB})$		
	$= -\underline{p} + r(\underline{p} + \underline{q})$	B1	
	$= \underline{p}(r-1) + r\underline{q}$		
	$\underline{p}(r-1) + r\underline{q} = -k\underline{p} + 3k\underline{q}$	M1	
	$-k = r-1 \text{ and } r = 3k$		
	$-k = 3k-1$	M1	
	$-4k = -1 \Rightarrow k = \frac{1}{4}$		
	substitute $r = 3 \times \frac{1}{4} = \frac{3}{4}$	A1	
		10	

23.



(a) ABCD ✓ drawn

B1

(b) (i) Centre identified and used ✓

B1

B1 AA', BB', CC' and DD' drawn ✓
B1 completion of square A'B'C'D'
and labelled

(ii) A"B"C"D"

B2 A"B"C"D" drawn ✓

(iii) A"B"C"D"

B2 A"B"C"D" drawn

(c) Reflection on line $y = -x$ B1 reflection
B1 line $y = -x$

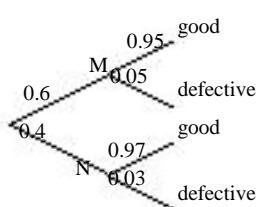
10

24.	(a) (i)		M1	
	$\frac{r}{9} = \frac{4}{12}$			
	$r = \frac{9 \times 4}{12} = 3 \text{ cm}$		A1	
	(ii) volume of material drilled out			
	$= \frac{1}{3} \pi \times 3^2 \times 4$		M1	
	$= 12 \pi$		A1	
	(b) Slant height of cone			
	$= \sqrt{9^2 + 12^2} = 15 \text{ cm}$		B1	
	(c) Surface area of solid after conical has been drilled			
	$\pi \times 9 \times 15 + \pi \times (9^2 - 3^2) + \pi \times 3 \times 5$		M1	for $\pi \times 9 \times 15$
	$= \pi(135 + 72 + 15)$		M1	for $\pi(9^2 - 3^2)$
			M1	$\pi \times 3 \times 5$
			M1	summing up
	$= 222\pi$		A1	
				10

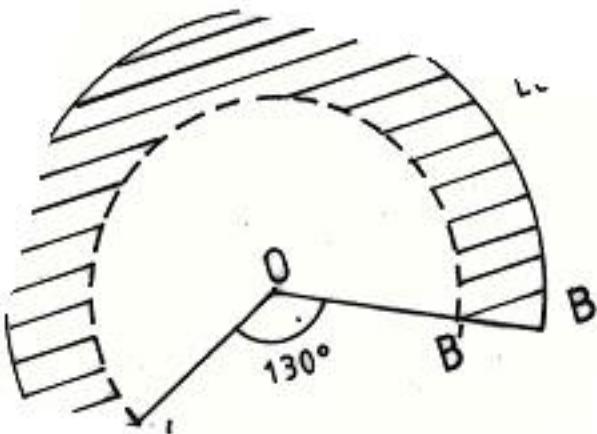
4.3.2 Mathematics Alternative A Paper 2 (121/2)

1.	1 st term, $a = 3$; common difference, $d = 6$ $7500 = \frac{n}{2} "2 \# 3 + (n - 1) \# 6,$ $3n^2 = 7500$ $n = \sqrt{2500} = 50$	B1 M1 A1 3
2.	$y = (x + 2)(x - 1)$ $y = x^2 + x - 2$	M1 A1 2
3.	$P = \frac{1}{2} mn^2 - \frac{qd^2}{n}$ $\frac{qd^2}{n} = \frac{1}{2} mn^2 - P$ $d^2 = \frac{\frac{1}{2} mn^3 - nP}{q}$ $d = \sqrt{\frac{\frac{1}{2} mn^3 - nP}{q}}$	M1 M1 A1 3
4.	$\log c \frac{x^2}{(x - 2)} m = \log 3^2$ $\frac{x^2}{x - 2} = 9$ $x^2 - 9x + 18 = 0$ $(x - 6)(x - 3) = 0$ $x = 6 \text{ or } x = 3$	M1 M1 A1 3

5.	<p>(a)</p> <p>(b) radius = 3.1</p>	<p>B1 extending YX and YZ B1 bisecting +s VXZ and XZW B1 escribed circle drawn B1 allow ± 0.1</p>
6.	<p>Completing square on L.H.S.</p> $x^2 + 4x + 4 + y^2 - 2y + 1 = 4 + 4 + 1$ $(x + 2)^2 + (y - 1)^2 = 9$ <p>centre of circle : (-2, 1) 4</p> <p>radius of circle: 3 units</p>	<p>B1</p> <p>B1</p> <p>B1</p>
7.	<p>(a) $(1 - x)^5 = 1 + 5(-x) + 10(-x)^2 + 10(-x)^3 + 5(-x)^4 + (-x)^5$</p> $= 1 - 5x + 10x^2 - 10x^3 + 5x^4 - x^5$ <p>(b) $(0.98)^5 = (1 - 0.02)^5 \quad \& \quad x = 0.02$</p> $\begin{aligned} & (0.98)^5 = 1 - 5(0.02) + 10(0.02)^2 - 10(0.02)^3 \\ & = 1 - 0.1 + 0.004 - 0.00008 \\ & = 0.90392 \end{aligned}$	<p>B1</p> <p>M1</p> <p>A1</p>

8.	$h = \frac{-1}{4 + (-1)} f + \frac{4}{4 + (-1)} g$ $= -\frac{1}{3} f + \frac{4}{3} g$	M1 A1 2	
9.	$P(\text{defective}) : M \# 0.6 \# 0.05 = 0.03$ $N \# 0.4 \# 0.03 = 0.012$ $P(\text{defective}) 0.03 + 0.02 = 0.042$	M1 M1 A1 3	For 0.6 # 0.05 or 0.4 # 0.03  <pre> graph LR Root(()) --> M1[M] Root --> N1[N] M1 --> M05[M 0.05] M1 --> M95[M 0.95] N1 --> N03[N 0.03] N1 --> N97[N 0.97] M05 --> G1[good] M05 --> D1[defective] M95 --> G2[good] M95 --> D2[defective] N03 --> G3[good] N03 --> D3[defective] N97 --> G4[good] N97 --> D4[defective] </pre>
10.	(a) Fraction filled if A and R are open for 5h $5 \# c \frac{1}{3} - \frac{1}{6} m = \frac{5}{6}$ Fraction of tank still empty = $1 - \frac{5}{6} = \frac{1}{6}$ (b) Fraction filled if A, B and R are open for 1h $\frac{1}{3} + \frac{1}{2} - \frac{1}{6} = \frac{2}{3}$ Time taken to fill the tank = $' \frac{1}{6} = \frac{2}{3} \quad \frac{1}{6} \# \frac{3}{2}$ $= \frac{1}{4} \text{ h or } 15 \text{ min}$	B1 B1 M1 A1 4	
11.	$\frac{\sqrt{48}}{\sqrt{5} + \sqrt{3}} = \frac{4 \sqrt{3} \wedge \sqrt{5} - 3 \sqrt{h}}{\sqrt{5} + \sqrt{3} h \sqrt{5} - 3 \sqrt{h}}$ $= 4 \sqrt{3} \wedge \sqrt{5} - 3 \sqrt{h}$ $5 - 3$ $= 2 \sqrt{3} \wedge \sqrt{5} - 3 \sqrt{h}$ $= 2 \sqrt{15} - 6$	M1 M1 A1 3	

12.



$$\angle AOB = 130^\circ$$

arc AB - solid curve

arc A'B' - broken curve

region shown

B1

B1

B1

B1

4

13. $9680 \# 0.1 = 968$

M1

$$9120 \# 0.15; 9120 \# 0.2; 4580 \# 0.25 \\ = 1368 \quad = 1824 \quad = 1145$$

M1

Net tax

M1

$$= (968 + 1368 + 1824 + 1145) - 1056$$

A1

$$= 4249$$

4

14. $6(1 - \sin^2 x) + 7 \sin x - 8 = 0$

M1

$$6 - 6 \sin^2 x + 7 \sin x - 8 = 0$$

$$6 \sin^2 x - 7 \sin x + 2 = 0$$

M1

$$(3 \sin x - 2)(2 \sin x - 1) = 0$$

M1

$$\sin x = \frac{2}{3} \text{ or } \sin x = \frac{1}{2}$$

A1

$$x = 41.81^\circ \text{ or } x = 30^\circ$$

4

18.	(a) $\angle QPR = 90^\circ - 72^\circ = 18^\circ$ $\angle PQR = 90^\circ$ - angle subtended by diameter	B1																											
	(b) $\angle PQS = 180^\circ - 2(72) = 36^\circ$ $\angle PSQ = 72^\circ$ - angle subtended at the circumference by chord PQ equal and base angles of isosceles $\triangle QPS = 72^\circ$	B1																											
	(c) $\angle OQS = 36^\circ - 18^\circ = 18^\circ$ base angles of isosceles $\triangle OPQ = 18^\circ$	B1																											
	(d) $\angle RTS = 180^\circ - (36^\circ + 18^\circ) = 126^\circ$ extension angle RTS equal to sum of opposite interior angles TSP and TPS	B1	or equivalent																										
	(e) $\angle RSV = 90^\circ - 36^\circ = 54^\circ$ $\angle RSV = \angle RPS$ - angle in alternate segment.	B1 B1																											
10																													
19.	(a)																												
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>x</th><th>-5</th><th>-4</th><th>-3</th><th>-2</th><th>-1</th><th>0</th><th>1</th><th>2</th> </tr> </thead> <tbody> <tr> <td>y</td><td>-5</td><td>15</td><td></td><td>13</td><td>3</td><td></td><td>-5</td><td>9</td> </tr> <tr> <td>$=x^3 + 4x^2 - 5x - 5$</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table>	x	-5	-4	-3	-2	-1	0	1	2	y	-5	15		13	3		-5	9	$=x^3 + 4x^2 - 5x - 5$									B2
x	-5	-4	-3	-2	-1	0	1	2																					
y	-5	15		13	3		-5	9																					
$=x^3 + 4x^2 - 5x - 5$																													
(b)																													
	S1 P1 C1	Suitable scale All correctly plotted 																											
(c)	(i) $x = -4.8, -0.7, 1.5$	B2	± 0.1 allow B1 for 2 values : plotting for line																										
	(ii) $y = -4x - 1$ Solutions $x = -4, -1, 1.$	P1 L1 B1																											
		10																											

20. (a) = distance of EF from plane ABCD

slant height from F to BC

$$= \sqrt{5^2 - 3^2}$$

$$= 4$$

= distance of EF from plane ABCD

$$= \sqrt{4^2 - 2^2}$$

$$= \sqrt{12} = 3.46 \text{ m}$$

(b) (i) angle between planes

ADE and ABCD

$$= \tan^{-1} \frac{\sqrt{12}}{2}$$

$$= 60^\circ$$

(ii) angle between line AE
and plane ABCD

$$= \sin^{-1} \frac{\sqrt{12}}{5}$$

$$= 43.9^\circ$$

(iii) angle between planes

ABFE and DCFE

$$= 2 \cot^{-1} \frac{3}{\sqrt{12}} \text{ m}$$

$$= 81.8^\circ$$

M1

M1

A1

M1 or equivalent

A1

M1 or equivalent

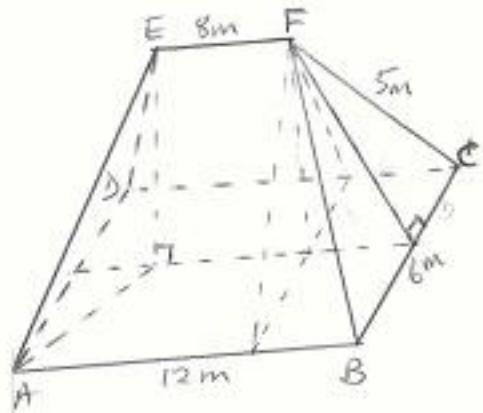
A1

M1 $\tan^{-1} \frac{3}{\sqrt{12}}$ or equivalent

M1 doubling

A1

10

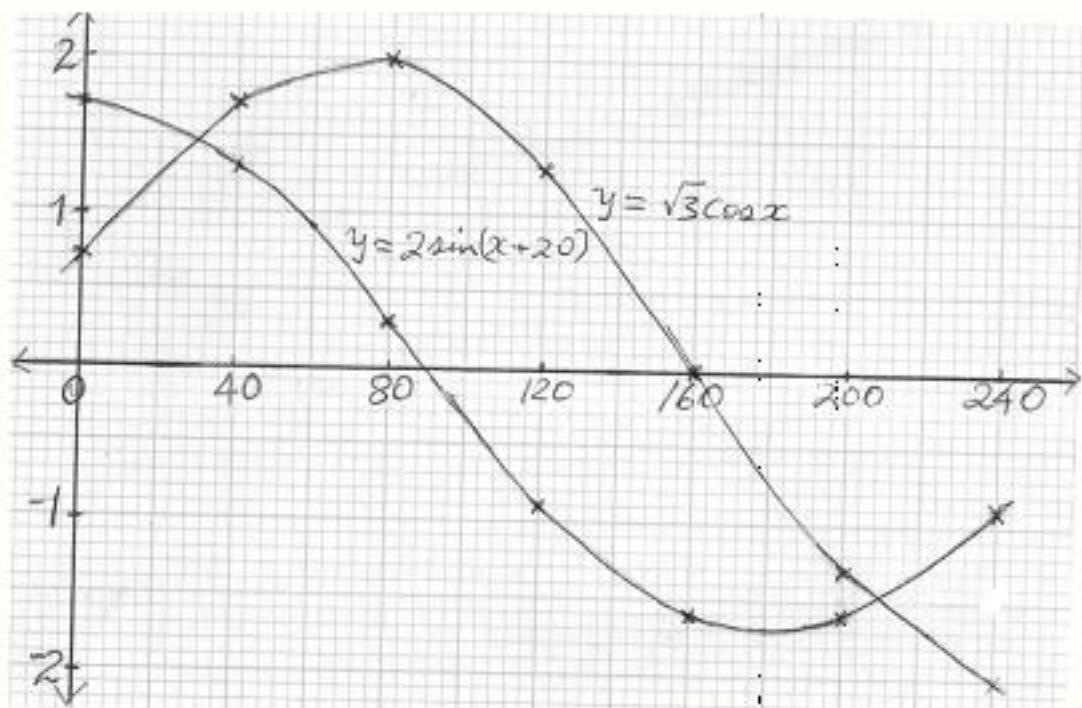


21. (a)

x	0	40	80	120	160	200	240
y = $2 \sin x + 20$		1.7		1.3		-1.3	
y = $\sqrt{3} \cos x$			0.3		-1.6		-0.9

B1
B1

(b)



(c) (i) $2 \sin(x + 20) = \sqrt{3} \cos x$
 $x = 30^\circ$
and $x = 210^\circ$

S1	suitable scale used
P1	plotting $2 \sin(x + 20)$
P1	plotting $\sqrt{3} \cos x$
C1	curve for $2 \sin x + 20$
C1	curve for $\sqrt{3} \cos x$
B1	
B1	

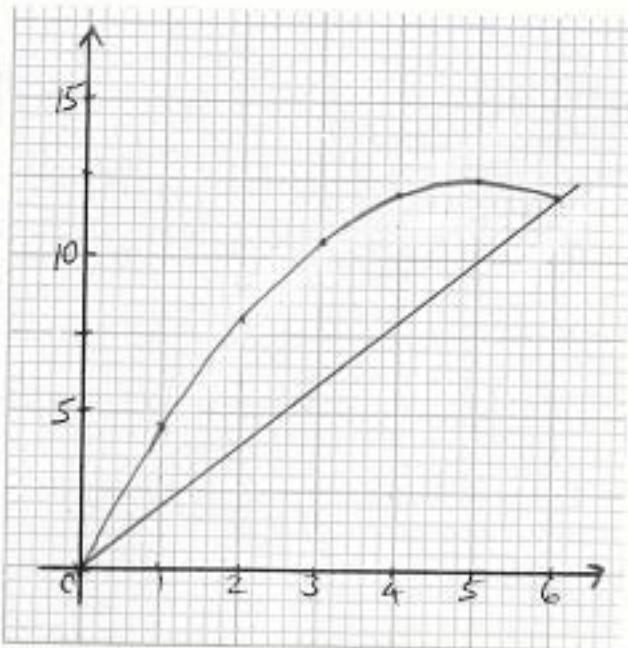
(ii) amplitude difference
 $2 - 1.7 = 0.3$

B1

10

22.	<p>(a) $R \setminus \frac{S}{T^2}$ & $R = \frac{kS}{T^2}$</p> <p>$R = 480$ whe n $S = 150$ and $T = 5$</p> $\Rightarrow 480 = \frac{k \times 150}{5^2}$ $= \frac{150k}{25}$ $\Rightarrow k = \frac{480 \times 25}{150} = 80$ $\therefore R = \frac{80S}{T^2}$ <p>(b) (i)</p> $R = \frac{80 \# 360}{(15)^2}$ $= \frac{80 \# 360}{2.25}$ $= 12800$ <p>(ii) $S_2 = 1.05S$, $T_2 = 0.8T$</p> $R_2 = \frac{80 \# 1.05S}{(0.8T)^2}$ $= \frac{80 \# 1.05}{(0.8)^2} \# \frac{S}{T^2}$ $R_2 = 131.25 \frac{S}{T^2}$ $\frac{cR_2 - R}{R} m \# 100\% = \frac{131.25 \frac{S}{T^2} - \frac{80S}{T^2}}{\frac{80}{T^2}} \# 100\%$ $= \frac{\cancel{\frac{S}{T^2}}}{\cancel{\frac{S}{T^2}}} c 131.25 - 80 m \# 100$ $= 64.0625$ $= 64.06 \%$	B1 M1 A1 B1 M1 A1 B1 M1 A1 B1 M1 A1 B1 M1 A1 B1 M1 A1 B1 M1 A1 B1 M1 A1 B1 M1 A1
		10

23.	(a)																									
	<table border="1"> <thead> <tr> <th>x</th> <th>0</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> </tr> </thead> <tbody> <tr> <td>y</td> <td>0</td> <td>4.5</td> <td>8</td> <td>10.5</td> <td>12</td> <td>12.5</td> <td>12</td> </tr> <tr> <td>= $5x - \frac{1}{2}x^2$</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	x	0	1	2	3	4	5	6	y	0	4.5	8	10.5	12	12.5	12	= $5x - \frac{1}{2}x^2$								B1 : table may be implied
x	0	1	2	3	4	5	6																			
y	0	4.5	8	10.5	12	12.5	12																			
= $5x - \frac{1}{2}x^2$																										



(b)

$$\begin{aligned}
 & \int_0^6 (5x - \frac{1}{2}x^2) dx \\
 &= [\frac{5}{2}x^2 - \frac{1}{2}x^3]_0^6 \\
 &= [\frac{5}{2}(6)^2 - \frac{1}{2}(6)^3] - [0] \\
 &= 690 - 36 = 544
 \end{aligned}$$

M1 : integral

M1 : substitution

A1

(c) (i) Drawing line $y = 2x$

L1

$$\text{(ii) Area of } \Delta : \frac{1}{2} \# 6 \# 12 = 36$$

M1

A1

$$\therefore \text{Bounded area} = 54 - 36 = 18$$

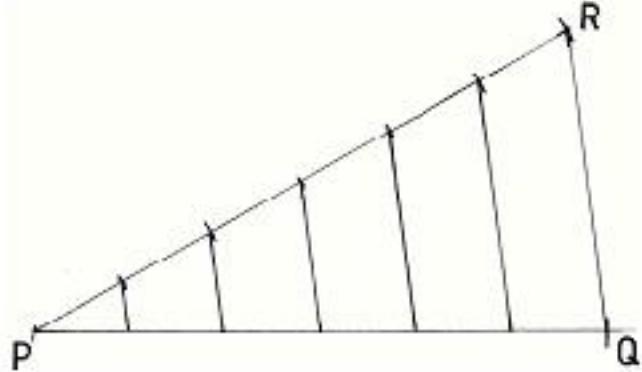
B1

10

24.	(a)	<table border="1"> <thead> <tr> <th>Marks</th><th>Frequency</th><th>cf</th><th></th></tr> </thead> <tbody> <tr><td>25-34</td><td>4</td><td>4</td><td></td></tr> <tr><td>35-44</td><td>5</td><td>9</td><td></td></tr> <tr><td>45-54</td><td>8</td><td>17</td><td></td></tr> <tr><td>55-64</td><td>12</td><td>29</td><td></td></tr> <tr><td>65-74</td><td>9</td><td>38</td><td></td></tr> <tr><td>75-84</td><td>3</td><td>41</td><td></td></tr> <tr><td>85-94</td><td>1</td><td>42</td><td></td></tr> </tbody> </table>	Marks	Frequency	cf		25-34	4	4		35-44	5	9		45-54	8	17		55-64	12	29		65-74	9	38		75-84	3	41		85-94	1	42			B1 : marks class column
Marks	Frequency	cf																																		
25-34	4	4																																		
35-44	5	9																																		
45-54	8	17																																		
55-64	12	29																																		
65-74	9	38																																		
75-84	3	41																																		
85-94	1	42																																		
(b) (i) cfs																																				
			B1 : frequency column	B1																																
	(c) (i) Identification of median $= 57.5 \pm 0.5$ (ii) Identification of upper quartile mark $= 66.5 \pm 0.5$		B1	S1 : scale P1 : plotting C1 : curve																																
10																																				

4.3.3 Mathematics Alternative B (122/1)

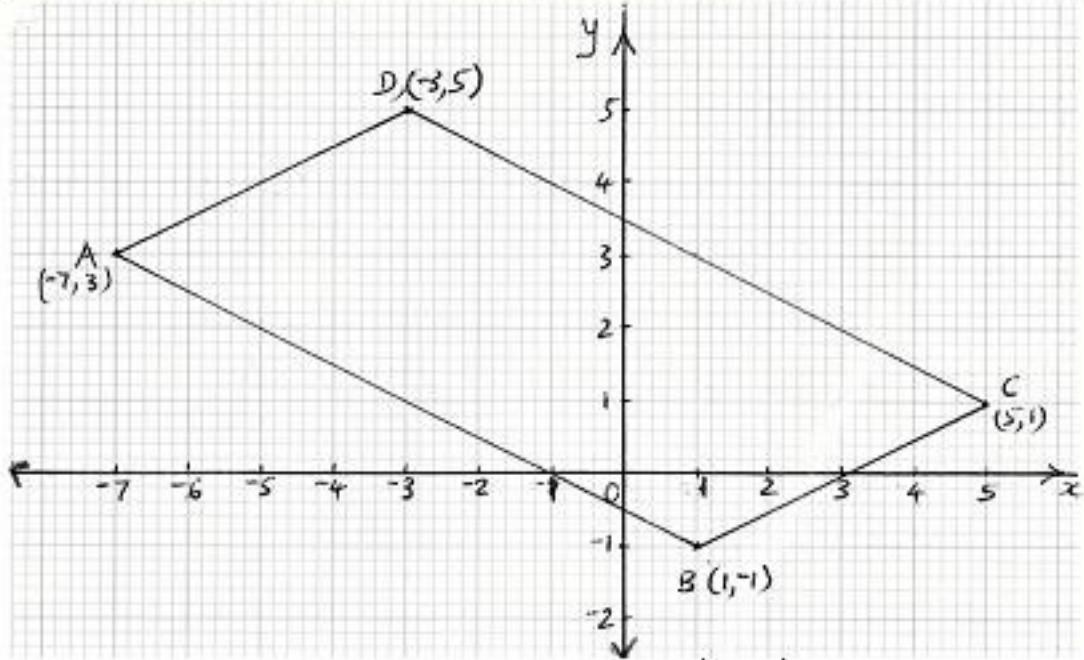
1.	$\begin{aligned} & -3^2 - 5 - + 7h + 2^2 - 3 + - 6h \\ & = -3^2 - 12h + 2^2 - 9h \\ & = 36 - 18 \\ & = -2 \end{aligned}$	M1 M1 A1 3
2.	<p>(a) Number is 7532</p> <p>(b) Total value of hundreds digit = 500</p>	B1 B1 2
3.	$\begin{aligned} & \frac{2}{3} \# \frac{27}{5} - 2 \cdot \frac{3}{10} = \frac{18}{5} - \frac{23}{10} = \frac{13}{10} \\ & \frac{3}{5} \cdot 4 \cdot \frac{1}{2} + 1 \cdot \frac{3}{5} = \frac{3}{5} \# \frac{2}{9} + \frac{8}{5} = \frac{26}{15} \\ & \therefore \frac{13}{10} \cdot \frac{26}{15} = \frac{13}{10} \# \frac{15}{26} = \frac{3}{4} \end{aligned}$	M1 M1 A1 3
4.	<p>Nekesa: Mwita: Auma = 600 : 750 : 650</p> $= 12 : 15 : 13$ <p>Amount Mwita got more than Nekesa</p> $\begin{aligned} & = \frac{15}{40} \# 1200 - \frac{12}{40} \# 1200 \\ & = 450 - 360 = 90 \end{aligned}$	B1 3
5.	$\begin{aligned} h &= 3r - 1 \quad (h = 3 \# 2 - 1 = 5) \\ \therefore \frac{7r^2 + 2rh}{4h - 2r} &= \frac{7 \# 2^2 + 2 \# 2 \# 5}{4 \# 5 - 2 \# 2} \\ &= \frac{28 + 20}{16} \\ &= \frac{48}{4} \\ &= 12 \end{aligned}$	M1 3

6.	<p>Area of each face = $\frac{1176}{6} = 196$</p> <p>Length of side $\sqrt{196} = 14$</p>	M1 M1 A1 3	
7.		B1 Line, PR, drawn and divided into six (6) equal parts. B2 Joining QR and drawing five lines parallel to QR intersecting with PQ.	
8.	$\sin x = \frac{3}{5}$ and $\cos = \frac{4}{5}$ $2 \sin x - \cos x = 2 \# -\frac{3}{5} - \frac{4}{5}$ $= \frac{6}{5} - \frac{4}{5} = \frac{2}{5}$	B1 M1 A1 3	
9.	$5x + 6x^{10h} = 2600$ $5x + 60x = 2600$ $x = \frac{2600}{65}$ $= 40$ Total number of coins: $= 40 + 6 \# 40 = 280$	M1 M1 A1 B1 4	
10.	$\frac{3^{-2} \# 81^{\frac{3}{2}}}{4^{-3} \cdot 8^{-\frac{1}{3}}} = \frac{3^{-2} \# 3^{2 \cdot 3}}{\frac{1}{2_6} \cdot 2}$ $= 3^4 \# 2^7$ $= 10368$	M1 M1 A1 B1 4	powers of 3 powers of 2

11.	<p>Marked price = $5750 \# 1.12 = 6440$</p> <p>% discount = $\frac{6440 - 6118}{6440} \# 100$ $= 5\%$</p>	M1 M1 A1 3																													
12.	$9a^2 - \frac{16}{b^2 c^2} = ^3ah^2 - \frac{4^2}{^3bch^2}$ $= c3a + \frac{4}{bc} m c3a - \frac{4}{bc} m$	M1 A1 2																													
13.	<p>(a)</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td></td><td style="text-align: center;">12</td><td style="text-align: center;">28</td><td style="text-align: center;">54</td></tr> <tr> <td style="text-align: right;">2</td><td style="text-align: center;">6</td><td style="text-align: center;">14</td><td style="text-align: center;">27</td></tr> <tr> <td style="text-align: right;">2</td><td style="text-align: center;">3</td><td style="text-align: center;">7</td><td style="text-align: center;">27</td></tr> <tr> <td style="text-align: right;">3</td><td style="text-align: center;">1</td><td style="text-align: center;">7</td><td style="text-align: center;">9</td></tr> <tr> <td style="text-align: right;">3</td><td style="text-align: center;">1</td><td style="text-align: center;">7</td><td style="text-align: center;">3</td></tr> <tr> <td style="text-align: right;">3</td><td style="text-align: center;">1</td><td style="text-align: center;">7</td><td style="text-align: center;">1</td></tr> <tr> <td style="text-align: right;">7</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td><td style="text-align: center;">1</td></tr> </table>		12	28	54	2	6	14	27	2	3	7	27	3	1	7	9	3	1	7	3	3	1	7	1	7	1	1	1	M1 factorization	
	12	28	54																												
2	6	14	27																												
2	3	7	27																												
3	1	7	9																												
3	1	7	3																												
3	1	7	1																												
7	1	1	1																												
	<p>The height (LCM) = $2 \# 3 \# 7_3$ $= 756$</p>	M1 A1																													
14.	<p>(b) Number of books = $\frac{756}{12} = 63$</p> <p>Let number of sides be n</p> $^2n - 4h \# 90 = 1260$ $2n \# 90 = 1260 + 360$ $n = \frac{1620}{180} = 9$ <p>Size of each angle = $\frac{1260}{9} = 140^\circ$</p>	B1 4	M1 A1 B1 3																												

15	$L.S.F = \frac{7}{5} = 1.5.$ $\therefore A.S.F = 1.5 = 2.25$ Area of smaller triangle = $\frac{22.5}{2.25} = 10 \text{ cm}^2$	B1 M1 A1 3	
16.	$r^2 = \frac{22}{7} \# \frac{45}{360} = 77$ $r = \sqrt{\frac{77 \# 360 \# 7}{45 \# 22}} = 14$ Circumference = $2 \# 14 \# \frac{22}{7} = 88 \text{ cm}$	M1 A1 M1 A1 4	
17.	<p>(a) (i) Volume of prism = Area of crosssection $\# L$</p> $= 1.4 \# 0.8 \dots \quad \frac{1}{2} \# \frac{22}{7} \# 0.7h \# 2$ $= 0.35 \# 2$ $= 0.7 \text{ m}^3$ <p>(ii) Total S.A</p> $= 0.8 \# 2 \# 2 + 2 \# 1.4 + \text{rectangularh} \quad = 0.7 \# \frac{22}{7} \# 2 \quad \text{M1 rectangular}$ $+ 0.35 \# 22 - \text{semicircularh} \quad \text{M1 triangular}$ sectionh $= 6 + 4.4 + 0.7..$ $= 11.1 \text{ m}^2$ <p>(b)</p> $= 6 \# 100$ $6 + 4.4. + 2 \# 0.35h$ $= 54.05405405\%$ $= 54.1\%$	M1 M1 M1 Multiplication by length A1 M1 rectangular M1 triangular M1 cross section A1 M1 A1	10

18.



(a)

B1 plotting vertices A, B and C.
 B1 identifying vertex D (-3, 5) and
 completing parallelogram.

(b) (i) grad AB = $\frac{3 - 1}{-7 - 1}$

$$= -\frac{1}{2}$$

(ii) $\frac{y - 3}{x - -7} = -\frac{1}{2}$ or $\frac{y - 1}{x - 1} = -\frac{1}{2}$

$$y = -\frac{1}{2}x - \frac{7}{2} + 3 \text{ or } y = -\frac{x}{2} - \frac{1}{2} + 1$$

$$y = -\frac{1}{2}x - \frac{1}{2}$$

(c) (i) Let grad L be m

M1

A1

M1

A1

B1

M1

A1

$$\therefore \underline{\underline{m}} = -1 \quad (m = 2)$$

$$\text{equation of line } \frac{y - 3}{x - 1} = 2$$

$$y - 2x = 1$$

(ii) y - intercept: when $x = 0$

$$y = 2 \# 0 + 1 = 1$$

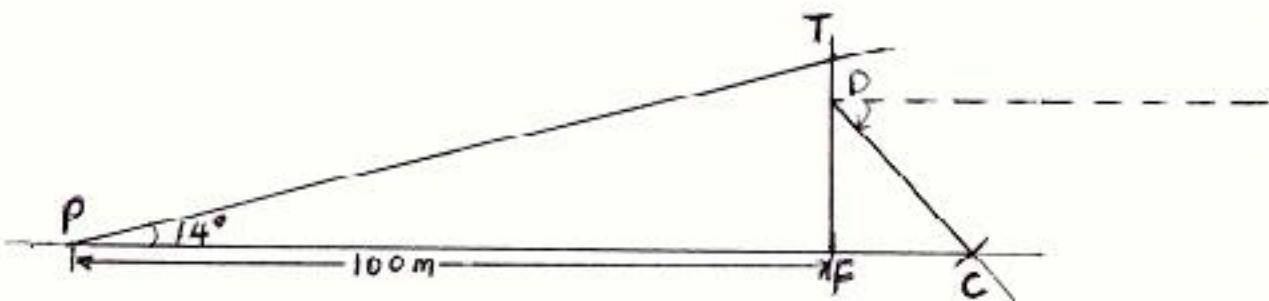
co-ordinates $\approx 0, 1$

B1

10

19.	<p>(a) $cx - \frac{1}{2}m^2x + 1h = 0$</p> $x^2 + x - \frac{1}{2}x - \frac{1}{2} = 0$ $x^2 + \frac{1}{2}x - \frac{1}{2} = 0$ $2x^2 + x - 1 = 0$	B1 M1 A1 B1	or equivalent
	(b) (i) $2y + 1h^2y = 55$	M1	
	$2y + 11h^2y - 5h = 0$	A1	
	$y = -5 \quad \frac{1}{2} \text{ or } y = 5$	B1	
	price of one mango Sh 5		
	(ii) no. of mangoes Karau got		
	mangoes bought = $\frac{95 + 55}{5} = 30$	M1	
	extra mangoes = $\frac{30}{6} = 5$	A1	
	Total mangoes = $30 + 5 = 35$	B1	
		10	

20.



(a) : use of scale

angle of elevation 14° : drawn

completion of scale drawing

(b) height of mast " $2.5 ! 0.1$

$$= 25. \# 10$$

$$= 25 \text{ m}$$

(c) position of cable drawn

B1

B1

B1

B1

B1

B1 : positions of C and D
B1 cable CD shown

(d) (i) + of depression of C from D

$$48c ! 1c$$

B1

(ii) Distance from P to C

$$\sqrt{10^2 + 1.8^2} ! 0.1h \# 10$$

M1

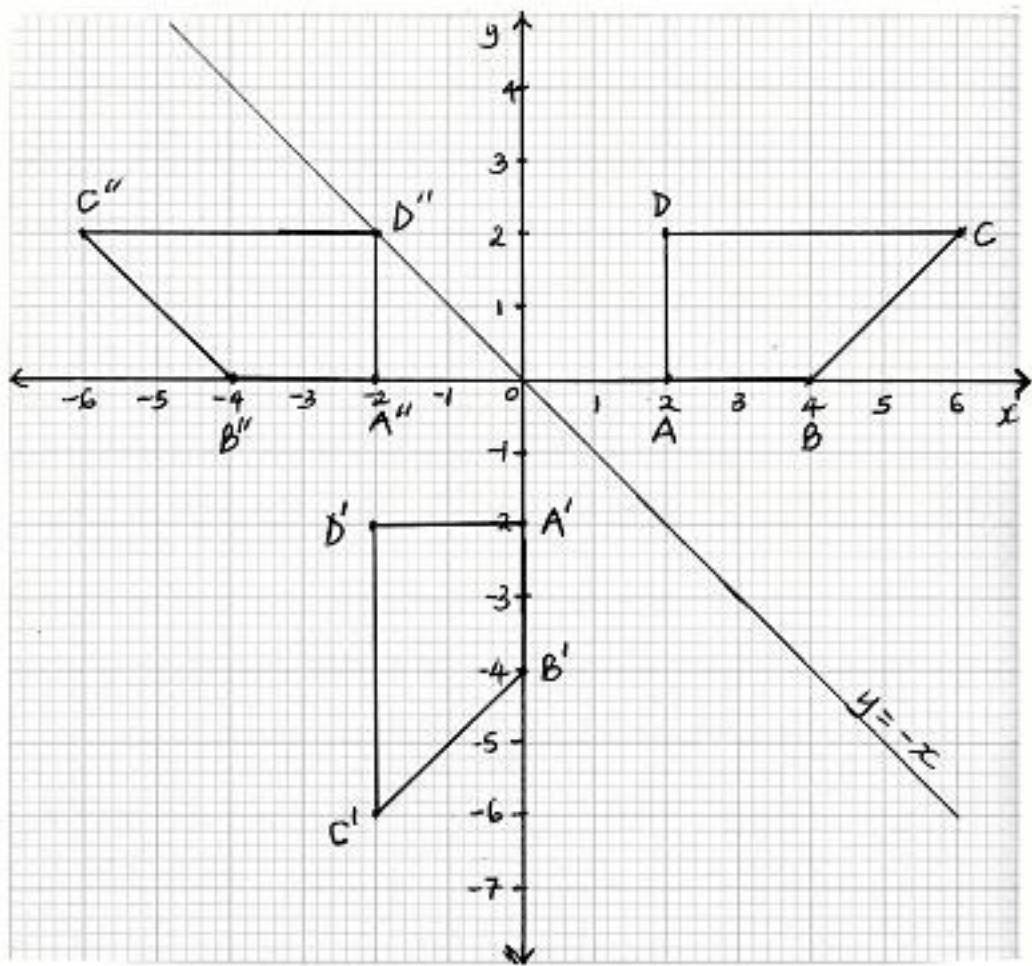
$$= 118 ! 1 m$$

A1

10

21.	(a) $\angle ROP = 2 \times 64^\circ = 128^\circ$ angle subtended at centre is twice angle subtended at O circumference.	B1	allow other valid reasons
	(b) $\angle PSR = 180^\circ - 64^\circ = 116^\circ$ opposite angles of cyclic quadrilateral add up to 180° .	B1	
	(c) $\angle ORP = 90^\circ - 64^\circ = 26^\circ$ angle in semicircle ($\angle QRP = 90^\circ$) and base angles of isosceles triangle equal.	B1	
	(d) $\angle TRP = 64^\circ$ angle in alternate segment.	B1	
	(e) $\angle RTP = 180^\circ - 2 \times 64^\circ = 52^\circ$ $\angle TRP = 64^\circ$ angle in alternate segment and sum of angles in triangle PRT = 180° .	B1	
			10

22.	(a) (i) $r = \sqrt{15^2 - 12^2}$ $= 9$ (ii) Volume of cone: $= \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \times 9^2 \times 12$ $= 1017.87602$ $- 1017.88$ (b) (i) $\frac{h}{12} = \frac{6}{9}$ $h = \frac{12 \times 6}{9} = 8$ (ii) volume of smaller cone $= \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \times 6^2 \times 8$ $= 301.5928947$ $- 301.59$ (iii) Volume of frustum $1017.88 - 301.59$ $= 716.29$	M1 A1 M1 A1 M1 A1 M1 A1 M1 A1 M1 A1 10
-----	---	--



(a) (i) trapezium ABCD : drawn

B1

(ii) line of reflection $y = -x$ drawn

B1 may be implied by : image

trapezium A'B'C'D' : drawn

B1

(iii) points A''B''C''D'' plotted

B1

trapezium A''B''C''D'' drawn

B1

(b) transformation which maps

B1

A''B''C''D'' onto ABCD

B1

reflection

B1 or y - axis

on line $x = 0$

(c) directly congruent pair

B1

A'B'C'D' and A''B''C''D''

B1

oppositely congruent pairs

B1

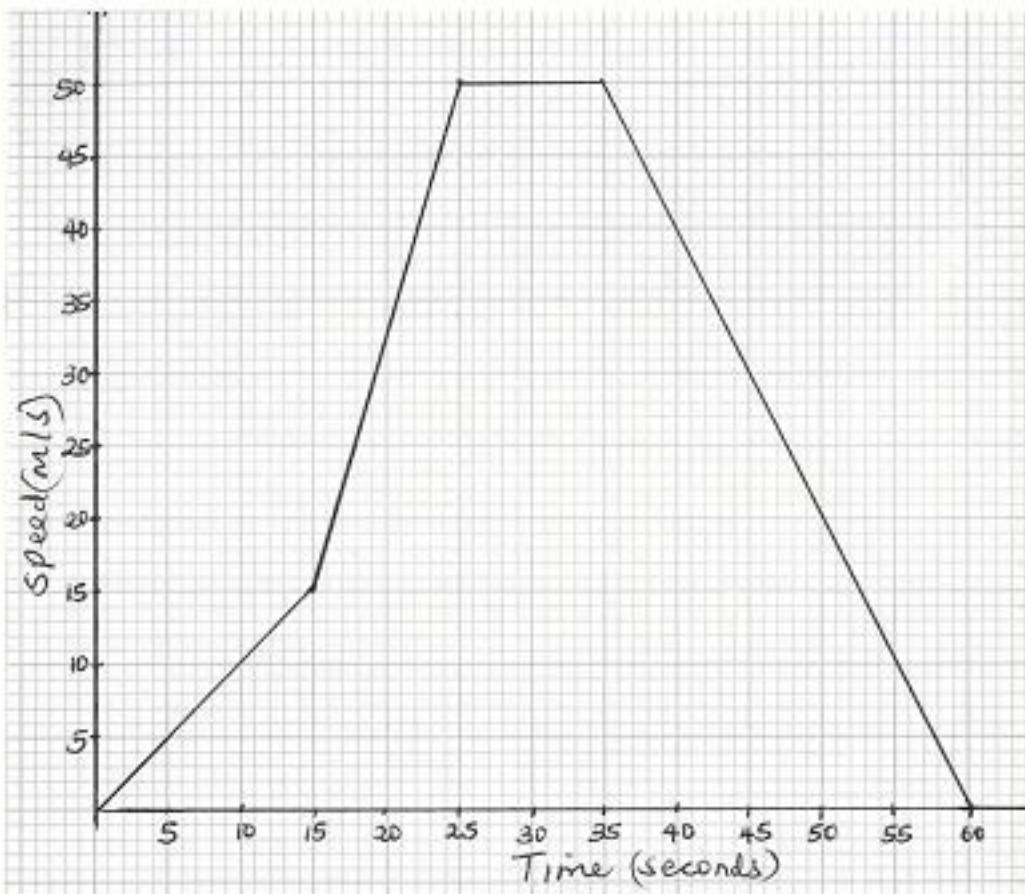
ABCD and A'B'C'D'

B1

ABCD and A''B''C''D''

B1

10



- (a) : scale
 acceleration parts
 constant speed
 deceleration

S1
 B1
 B1
 B1

(b) (i) deceleration = $\frac{50}{25}$
 $= 2 \text{ m/s}^2$

M1
 A1

(ii) Total distance

$$= \frac{1}{2} \times 15 \times 15 + \frac{1}{2} \times 15 + 50 \times 10 + 10 \times 50 + \frac{1}{2} \times 50 \times 25$$

$$= 112.5 + 325 + 500 + 625 = 1562.5$$

M1 or equivalent
 A1

(iii) Average speed

$$= \frac{1562.5}{60}$$

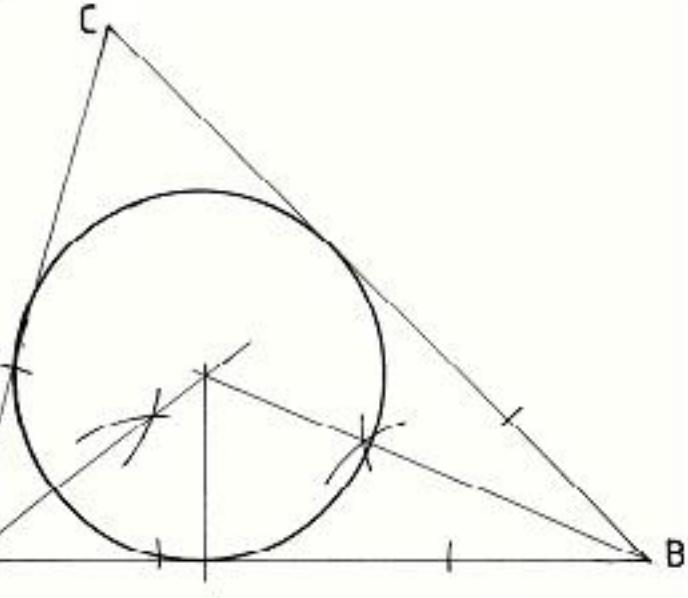
$$= 26.0416 = 26.0 \text{ m/s}$$

M1
 A1
 10

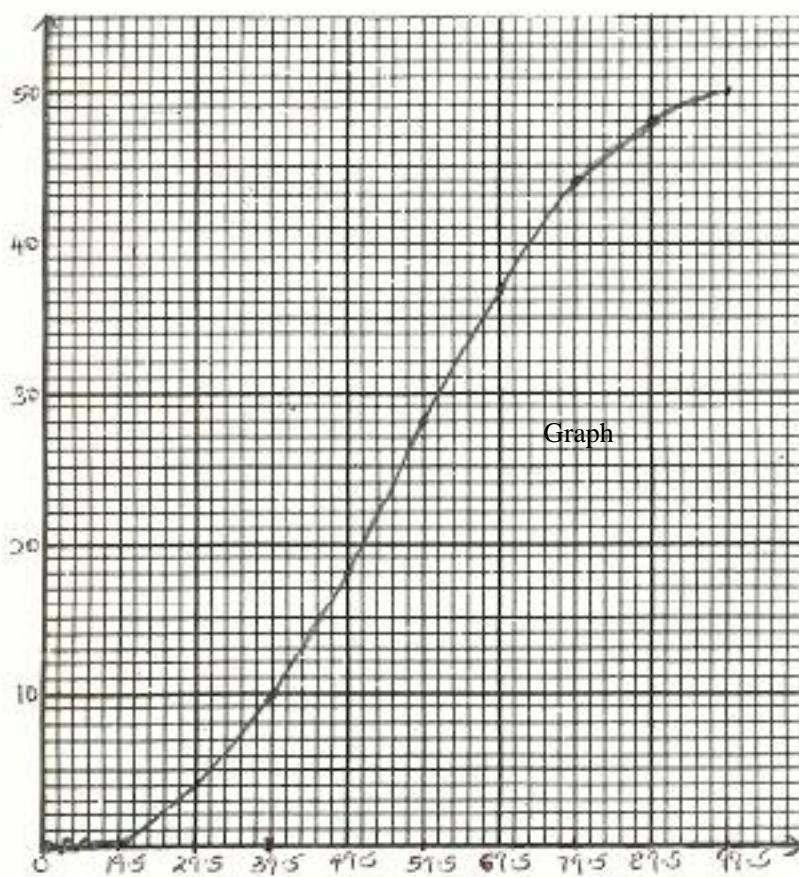
4.3.4 Mathematics Alternative B Paper 2 (122/2)

1.	$\frac{4.957}{0.2638 - 0.0149} = \frac{4.96}{0.263 - 0.015}$ $= 20$	B1 B1 2	
2.	$AB = c \begin{array}{r} 2 \\ 3 \end{array} \begin{array}{r} 4 \\ 0 \end{array} \begin{array}{r} m \\ 1 \end{array} \begin{array}{r} 3 \\ 1 \end{array} m$ $= c \begin{array}{r} 8 \\ 6 \end{array} \begin{array}{r} 10 \\ 9 \end{array} m$ $AB - 5B = c \begin{array}{r} 8 \\ 6 \end{array} \begin{array}{r} 10 \\ 9 \end{array} m - c \begin{array}{r} 10 \\ 5 \end{array} \begin{array}{r} 15 \\ 5 \end{array} m$ $= c \begin{array}{r} -2 \\ 1 \end{array} \begin{array}{r} -5 \\ 4 \end{array} m$	B1 M1 : Subtraction and multiplication by 5 A1 3	
3.	$A : B : C \quad A : B : C$ $4 : 3 \quad (4 : 3)$ $1 : 2 \quad 3 : 6$ <p>combined ratio A:B:C = 4:3:6</p> <p>mass of type C = $\frac{6}{13} \# 52$</p> $= 24$	B1 M1 A1 3	
4.	(a) $\frac{ar^5}{ar_3} = \frac{96}{24}$ $r_2 = 4 \quad \$ r = 12$ (b) when $r = 2$ $(a \# 2 = 24 \quad a = \frac{24}{8} = 3)$ when $r = -2 \quad (a \# -2 = 24 \quad a = \frac{24}{-8} = -3)$	M1 A1 B1 B1 B1 4	

5.	<p>(a)</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>+</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr> <tr><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr> <tr><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr> <tr><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr> <tr><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td></tr> </table> <p>(b) $P^{\wedge} 6 \ 1 \times 1 \ 10h$</p> $= \frac{15}{36} = \frac{5}{12}$	+	1	2	3	4	5	6	1	2	3	4	5	6	7	2	3	4	5	6	7	8	3	4	5	6	7	8	9	4	5	6	7	8	9	10	5	6	7	8	9	10	11	6	7	8	9	10	11	12		<p>B2 : probability space</p> <p>B1</p> <p>3</p>
+	1	2	3	4	5	6																																														
1	2	3	4	5	6	7																																														
2	3	4	5	6	7	8																																														
3	4	5	6	7	8	9																																														
4	5	6	7	8	9	10																																														
5	6	7	8	9	10	11																																														
6	7	8	9	10	11	12																																														
6.	<p>(a)</p> $OB = c \frac{2}{5}m + c \frac{4}{4}m$ $= c \frac{6}{9}m$ <p>(b) co-ordinates of M</p> $OM = OA + \frac{3}{4}AB$ $= c \frac{2}{5}m + \frac{3}{4}c^4m$ $= c \frac{2}{5}m + c \frac{3}{3}m = c \frac{5}{8}m$ <p>coordinates of M are (5, 8)</p>		<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>4</p>																																																	
7.	<p>Let angle APT = x°</p> $3x + 75 = 180^\circ$ $x = 35^\circ$ <p>angle BAP = angle BPR = $2 \# 35^\circ$</p> $= 70^\circ$		<p>B1</p> <p>B1</p> <p>2</p>																																																	
8.	$2 \cos^\wedge x - 30h^\circ = -0.9$ $\cos^\wedge x - 30h^\circ = -0.45$ $\wedge x - 30h^\circ = \cos^{-1} 0.45$ $= 116.74^\circ$ $x = 146.74^\circ$		<p>M1</p> <p>A1</p> <p>B1</p> <p>3</p>																																																	

9.	$ \begin{array}{r} c^0 \ 1 \ mc \ 1 \ 0 \ m \\ 1 \ 0 \ 0 \ -1 \\ = c^0 \ -1 \\ -1 \ 0 \ m \end{array} $ $ \begin{array}{r} c^0 \ -1 \ mc \ 1 \ 1 \ -1 \ m \\ -1 \ 0 \ 3 \ 7 \ 4 \\ = c^0 \ -3 \ -7 \ -4 \ m \\ -1 \ -1 \ 1 \end{array} $ <p>coordinates: $R \approx 3, -1$, $S \approx 7, -1$ and $T \approx 4, 1$</p>	M1 M1 A1 3
10.	$ \begin{aligned} 2x^2 + 8x &= 15 \\ x^2 + 4x &= 7.5 \\ x^2 + 4x + c^{\frac{4}{2}} &= 7.5 + c^{\frac{4}{2}} \end{aligned} $ $ \begin{aligned} x + 2 &= \sqrt{11.5} \\ &= \pm 3.4 \\ &= 1.4 \text{ or } -5.4 \end{aligned} $	M1 M1 A1 3
11.	 <p>radius = 2.4 ! 0.1</p>	B1 B1 B1 3

12.	<p>Fraction of food per person per day</p> $\frac{1}{2000 \# 90}$ <p>Fraction for 2000 persons for 20 days</p> $= 2000 \# \frac{20}{2000 \# 90}$ $= \frac{2}{9}$ <p>Remaining fraction of food = $\frac{7}{9}$</p> <p>No of days to feed 2000 + 500 persons</p> $= \frac{7}{9} \cdot \frac{1 \# 2500}{180000}$ $\frac{7}{9} \# \frac{72}{1} = 56$	M1 A1 M1 A1 4	
13.	$\cos P = \frac{75^2 + 80^2 - 40^2}{2 \# 75 \# 80}$ $= \frac{10425}{12000} = 0.86875$ <p>$P = 30^\circ$</p> $\frac{SR}{\sin 68} = \frac{40}{\sin 30} \quad (SR = \frac{40 \sin 68}{\sin 30 \cos})$ $= 74 \text{ m}$	M1 M1 A1 3	
14.	<p>1st bracket \$ 10164 # $\frac{10}{100} = 1016.4$</p> <p>2nd bracket \$ $\wedge 19740 - 10164h \# \frac{15}{100} = 1436.4b^-$</p> <p>3rd bracket \$ $\wedge 21820 - 19740h \# \frac{20}{100} = 416b^-$</p> <p>Net tax = $\wedge 1016.4 + 1436.4 + 416h - 1162$</p> $= 1706.8$	M1 M1 M1 A1 4	
15.	$2p + 3r = 66 \dots (i)$ $7p + 2r = 129 \dots (ii)$ $4p + 6r = 132 \dots (iii)$ $21p + 6r = 317 \dots (iv)$ $17p = 255$ $p = 15$	M1 M1 A1 3	



cf: 4, 10, 18, 28, 37, 44, 48, 50

B1 can be implied

P1

C1

3

17.	<p>(a) $300000 \# 0.18$ $= 54000$</p> <p>(b) (i) $300000 + 54000 - 134000$ $= 220000$</p> <p>(ii) $220000 \# 1.18 - 134000$ $= 125600$</p> <p>(c) $125600 \# 1.18$ $= 148208$</p> <p>(d) Total interest charged: $\wedge 300000 + 22000 + 125600h \# 0.18$ $= 54000 + 39600 + 22608$ $= 116208$</p>	M1 A1 M1 A1 M1 A1 M1 A1 M1 A1 M1 or equivalent A1 10	
18.	<p>(a) (i) $U_{10} = 10 - \frac{1}{2}10 + 3$ $= 93$</p> <p>(ii) $U_{30} - U_{20} = \wedge 30 - \frac{1}{2}30 + 3h - \wedge 20 - \frac{1}{2}20 + 3h$ $= 873 - 383$ $= 490$</p> <p>(iii) $n_2 - n + 3 = 243$ $n_2 - n - 240 = 0$ $\wedge n + 15h \wedge n - 16h = 0$ $n = -15 \text{ or } n = 16$ $n = 16$</p> <p>(b) (i) Number after t hours $= 180 \# 3^t$</p> <p>(ii) Number to the nearest million after 20 hours $180 \# 3^{12}$ $= 95659380$ $= 96000000$</p>	M1 A1 M1 A1 M1 M1 A1 B1 M1 A1 10	

19.	<p>(a) Modal class: 4 - 5</p> <p>(b) $\frac{8}{36} \# 360c$ = 80c</p> <p>(c) mid values 0.5, 1.5, 2.5, 3.5, 4.5, 5.5, 6.5, 7.5 $fx = 1, 6, 7.5, 17.5, 36, 33, 32.5, 22.5$ $f_x = 1 + 6 + 7.5 + 17.5 + 36 + 33 + 32.5 + 22.5$</p> <p>$\text{mean} = \frac{156}{36}$ = $4\frac{1}{3}$</p> <p>(d)</p>	B1	
		M1	
		A1	
		M1	
		M1	
		M1	
		A1	
		S1	: scale and labelling
		B2	8 bars : (allow B1 for 5 - 7 bars :)
		10	

20.	(a) <table border="1" style="margin-bottom: 10px;"> <tr> <td>x</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr> <tr> <td>y</td><td>-12</td><td>-3</td><td>2</td><td>3</td><td>0</td><td>-7</td></tr> </table> (b)	x	-1	0	1	2	3	4	y	-12	-3	2	3	0	-7	B2
x	-1	0	1	2	3	4										
y	-12	-3	2	3	0	-7										
		S1 P1 C1 B1 B1 B1 M1 A1 10														

(c) (i) Roots of equation

$$x = 0.5.$$

or

$$x = 3$$

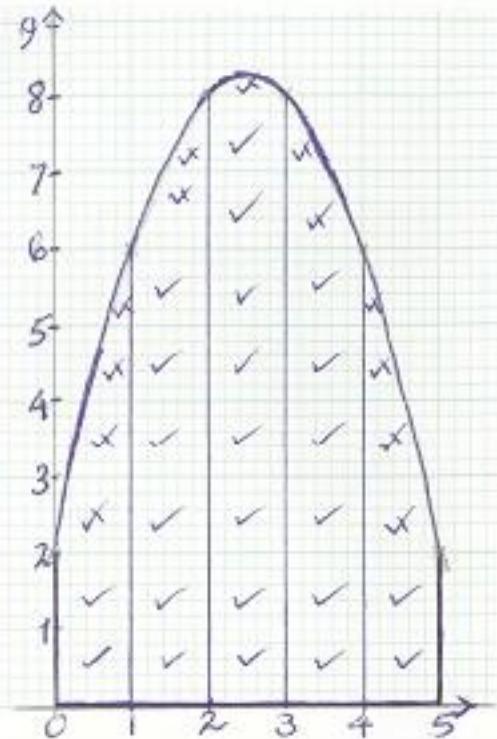
(ii) tangent line : drawn

$$\begin{aligned} \text{gradient: } & \frac{5 - 1}{2 - 0} \\ & = 3 \end{aligned}$$

	<p>21.</p> <p>(a) (i) $AB = OB - OA = 3i + 5j - (2i + j)$ $= 3i + 5j + 2i - j$ $= 5i + 4j$</p> <p>(ii) $CD = OD - OC = 2i - 4j - (8i - 12j)$ $= 2i - 4j + 8i + 12j$ $= 10i + 8j$</p> <p>(b) mid point of vector AD $= \frac{1}{2} [c - 2i - 4j] = \frac{1}{2} [c - 3j]$ $= c - 1.5i - 2j$ ` coordinates of mid point is $(0, -1.5)$</p> <p>(c) $BC = OC - OB = -8i - 12j - (3i + 5j)$ $= -11i - 17j$ ` $BC = \sqrt{1^2 + 17^2}$ $= \sqrt{121 + 289} = 20.2$</p>	M1 A1 M1 A1 M1 B1 M1 A1 10
22.	<p>(a) (i) Longitude difference $= 12^\circ + 60^\circ$ $= 72^\circ$</p> <p>Distance PR $= \frac{72}{360} \# 2 \# \frac{22}{7} \# 6370$ $= 8008 \text{ km}$</p> <p>(ii) Time difference $= \frac{72}{15} \text{ h}$ $= 4 \text{ h } 48 \text{ min}$ Local time at Q: $= 9.00 \text{ pm} - 4 \text{ h } 48 \text{ min}$ $= 4.13 \text{ pm}$</p> <p>(b) Distance travelled in 2 h $= 1001 \# 2 = 2002 \text{ km}$ ` $\frac{1}{360} \# 2 \# \frac{22}{7} \# 6370 = 2002$ $i = \frac{2002 \# 360 \# 7}{2 \# 22 \# 6370}$ $= 18^\circ$</p> <p>Position of T: $(18^\circ \text{N}, 60^\circ \text{W})$</p>	M1 M1 A1 M1 M1 A1 M1 A1 B1 M1 A1 B1 10

23.	<p>(a) (i) $R \propto \frac{C^2}{T}$ ($R = \frac{kC^2}{T}$)</p> <p>$R = 30, C = 6$ and $T = 2.4$</p> $30 = \frac{k6^2}{2}$ $k = \frac{30 \# 2.4}{36} = 2$ <p>(ii) $R = \frac{2C^2}{T}$</p> <p>(b) (i) when $R = 40$ and $C = 8$</p> $T = \frac{2 \# 8^2}{40}$ $= 3.2$ <p>(ii) New $R = \frac{2 \# 0.9 \# 8h^2}{1 .08 \# 3.2}$</p> $= 30$ <p>% change in R</p> $= \frac{40 - 30}{40} \# 100$ $= 25\%$	B1 M1 A1 B1 M1 A1 M1 A1 M1 A1 10
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24.



(a) (i) $24 + \frac{1}{2} \times 13h = 30 \frac{1}{2}$

(ii) $\frac{1}{2} \# 1^2 + 2 + 2^2 + 6 + 8 + 8 + 6h,$
 $= \frac{1}{2} \times 60h$
 $= 30 \text{ cm}^2$

(b) (i) % error = $\frac{\frac{5}{6} - 30}{30} \# 100$
 $= 2 \frac{26}{37}$
 $= 27.$

(ii) $1 \text{ cm} / 120 \text{ m}$
 $1 \text{ cm}^2 / 14400 \text{ m}^2$

$\therefore 30 \text{ cm}^2 / \frac{144000}{10000} \# \frac{185}{6}$
 $= 44.4 \text{ ha}$

M1 whole square and part square
 A1

B1 ordinates 2, 6, 8, 8, 6, 2
 M1 substitution into formula
 simplification

A1

M1

A1

B1

M1

A1

10

