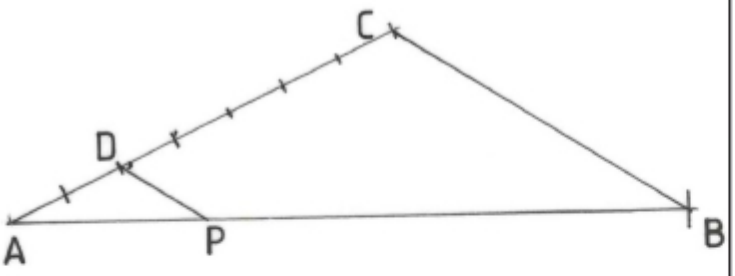
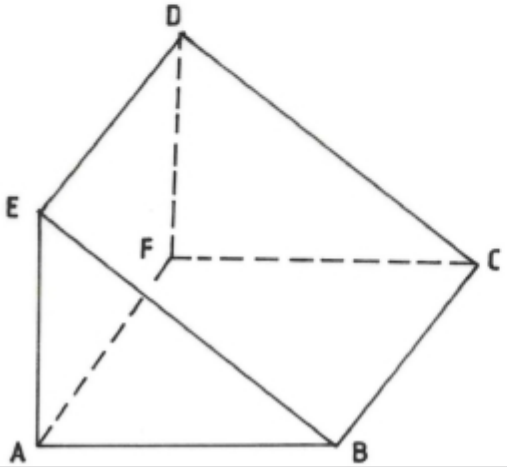
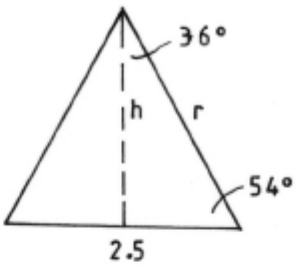
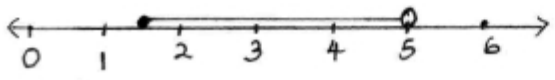
4.3 MATHEMATICS (121 AND 122)

4.3.1 Mathematics Alternative A Paper 1 (121/1

1.	$\frac{36}{-12} - \frac{-108}{-27}$ $= -3 - 4$ $= -7$	M1 A1 2	
2.	(a) Mode $= 22$ (b) Median 15, 15, 16, 19, 19, 20, 20, 21, 22, 22, 22, 26, 27, 28 median $= \frac{20+21}{2}$ $= 20.5$	B1 M1 A1 3	
3.	<table><tr><th>No.</th><th>Log</th></tr><tr><td>1.794 0.038 1.243</td><td>0.2538 $\bar{2}.5798$ $\bar{2}.8336$ 0.0945</td></tr><tr><td>0.3799</td><td>$\bar{2}.7391 \div 3$ $\bar{1}.5797$</td></tr></table>	M1 M1 M1 A1 4	all log √ + and - operations √ ÷3 √
4.	$\frac{(4m+3n)(4m-3n)}{(4m+3n)(m-n)}$ $= \frac{4m-3n}{m-n}$	M1 M1 A1 3	factorizing numerator √ factorizing denominator √
5.	Retailer 130% ⟶ 1560 100% ⟶ $\frac{1560 \times 100}{130}$ $= 1200$ Wholesaler 120% ⟶ 1200 100% ⟶ $\frac{1200 \times 100}{120}$ $= 1000$	M1 M1 A1 3	

6.		B1 B1 B1 3	construction of equal parts on AC draw DP//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 h $-$ 15 min $=$ 1845 h	M1 M1 A1 3	
8.	$x + 20 = 230°$ or $x + 20 = 310°$ $x = 210°$ or $x = 290°$	B1 B1 B1 3	for 230° or 310°
9.	(a) 2357_ 941 1416 (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 parrallel or lines AE and FD equal and parallel or lines CD, EB equal and parallel. completing the solid showing dotted lines.

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

15.	$h = 2.5 \tan 54^\circ = 3.441$ cm Area of pentagonal faces $= 2\left(\frac{1}{2} \times 5 \times 3.441 \times 5\right)$ $= 86.025$ Total area $= 86.025 + 5(12 \times 5)$ $= 386.0$	B1 M1 M1 A1 4	
16.	(a) $x - 5 \leq 3x - 8$ $-2x \leq -3$ $x \geq 1.5$ $3x - 8 < 2x - 3$ $x < 5$ $\therefore 1.5 \leq x < 5$ (b) 	 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	
	$= 5.25$ $\Longrightarrow$ 6 trips	A1	
	(ii) Expenses		
	buying price $= 1500 \times 630$ $= 945000$	M1	
	transport $= 2500 \times 6$ $= 15000$		
	Total $945000 + 15000$	M1	
	Selling price per bag:		
	$= \frac{960000 \times 1.26}{630}$	M1	
	$= 1920$	A1	
		10	

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

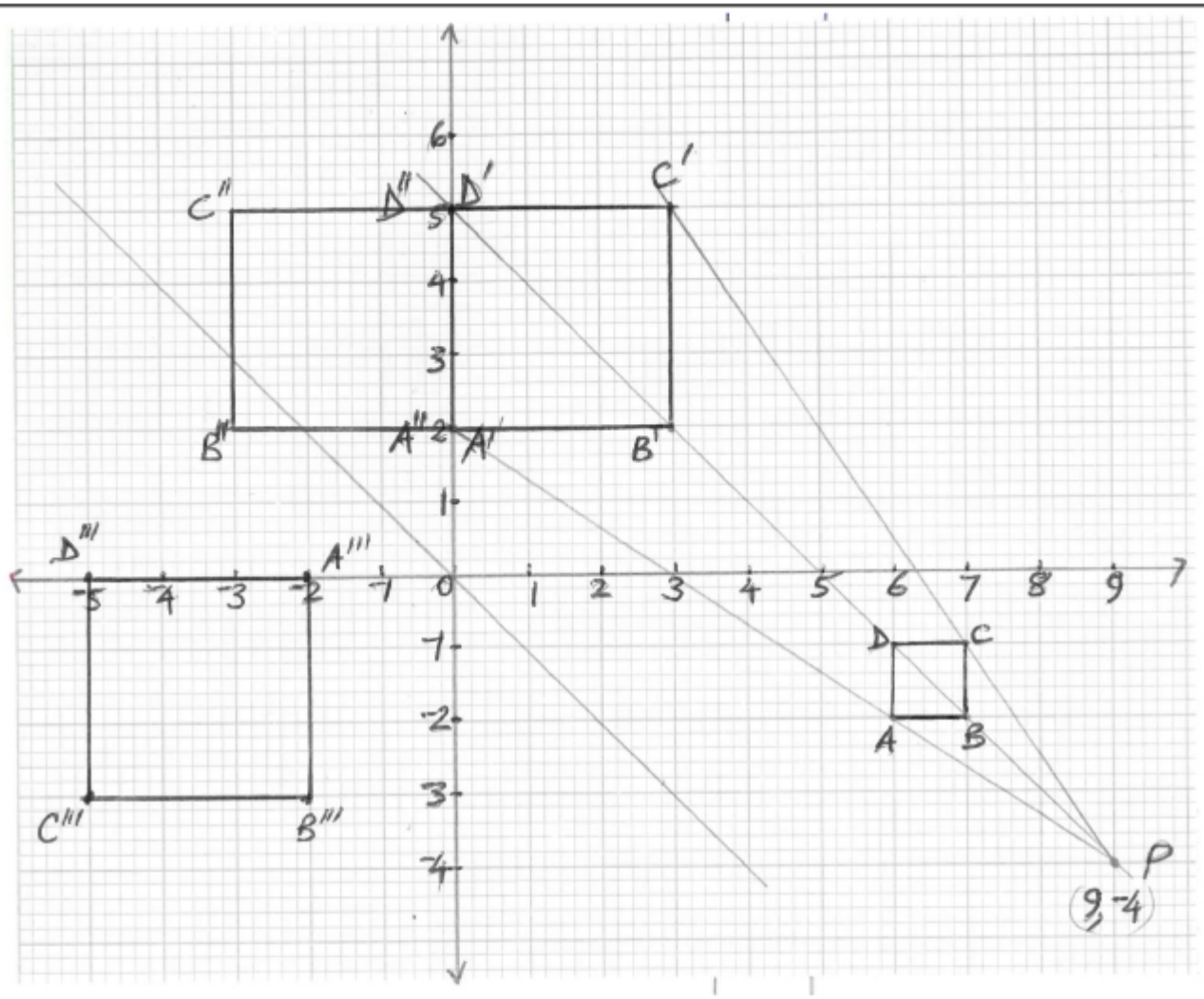
19.	(a) $2c + 9g = 98200$ $3c + 4g = 96000$	B1 B1	
	(b) Det. of $\begin{pmatrix} 2 & 9 \\ 3 & 4 \end{pmatrix} = -19$		
	$M' = -\frac{1}{19}\begin{pmatrix} 4 & -9 \\ -3 & 2 \end{pmatrix}$	B1	
	$-\frac{1}{19}\begin{pmatrix} 4 & -9 \\ -3 & 2 \end{pmatrix}\begin{pmatrix} 2 & 9 \\ 3 & 4 \end{pmatrix}\begin{pmatrix} c \\ g \end{pmatrix} = -\frac{1}{19}\begin{pmatrix} 4 & -9 \\ -3 & 2 \end{pmatrix}\begin{pmatrix} 98200 \\ 96000 \end{pmatrix}$	M1	
	$-\frac{1}{19}\begin{pmatrix} -19 & 0 \\ 0 & -19 \end{pmatrix}\begin{pmatrix} c \\ g \end{pmatrix} = -\frac{1}{19}\begin{pmatrix} -471200 \\ -102600 \end{pmatrix}$	M1	
	$\begin{pmatrix} c \\ g \end{pmatrix} = \begin{pmatrix} 24800 \\ 5400 \end{pmatrix}$ 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		
	$= \frac{132520 - 98200}{98200} \times 100\%$	M1	
	$= 34.95\%$	A1	
		10	

20.	(a) (i) Time taken by Juma $= \frac{x}{40}h$	B1	
	Time taken by Mutuku $= \frac{80-x}{60}$	B1	
	Let x km be distance from A		
	$\therefore \frac{x}{40} - \frac{80-x}{60} = \frac{1}{2}$	M1	
	$\frac{3x-2(80-x)}{120} = \frac{1}{2}$		
	$2(5x-160) = 120$	M1	
	$10x = 440$		
	$x = 44\ km$	A1	
	(ii) Time they met		
	$10.00\text{ am} + \frac{44}{40}\text{h}$		
	$= 10.00 + 1\text{ h } 6\text{ min}$	M1	
	$= 11.06\text{ am}$	A1	
	(b) Speed if Kamau delayed by 21 minutes		
	Kamau's time $= \left(\frac{44}{40} - \frac{21}{60}\right)\text{h}$	M1	
	$= \frac{3}{4}\text{h}$		
	$\therefore$ speed needed: $\frac{44}{\frac{3}{4}}$	M1	
	$= 58\frac{2}{3}$ km/h	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 $V = \frac{ds}{dt} = 3t^2 - 10t + 3$ when t = 5, $V = 3\times 5^2 - 10\times 5 + 3$ $= 28$	 B1 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 $= \frac{dv}{dt} = 6t - 10 = 0$ $t = \frac{10}{6} = 1\frac{2}{3}$ s	 M1 A1	
		10	

22.	(a) (i) $\underset{\sim}{OB} = \underset{\sim}{p} + \underset{\sim}{q}$	B1	
	(ii) $\underset{\sim}{AD} = -\underset{\sim}{p} + \frac{3}{5} \times 5\underset{\sim}{q}$	M1	
	$= -\underset{\sim}{p} + 3\underset{\sim}{q}$	A1	
	(iii) $\underset{\sim}{CB} = -5\underset{\sim}{q} + \underset{\sim}{p} + \underset{\sim}{q}$	M1	or equivalent
	$= -4\underset{\sim}{q} + \underset{\sim}{p}$	A1	
	(b) $\underset{\sim}{AX} = k(\underset{\sim}{AD})$		
	$= k(-\underset{\sim}{p} + 3\underset{\sim}{q})$	B1	
	$= -k\underset{\sim}{p} + 3k\underset{\sim}{q}$		
	also $\underset{\sim}{AX} = -\underset{\sim}{p} + r(\underset{\sim}{OB})$		
	$= -\underset{\sim}{p} + r(\underset{\sim}{p} + \underset{\sim}{q})$	B1	
	$= \underset{\sim}{p}(r-1) + r\underset{\sim}{q}$		
	$\underset{\sim}{p}(r-1) + r\underset{\sim}{q} = -k\underset{\sim}{p} + 3k\underset{\sim}{q}$	M1	
	$-k = r - 1$ *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) $\frac{r}{9} = \frac{4}{12}$	M1	
	$r = \frac{9 \times 4}{12} = 3\,cm$	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	