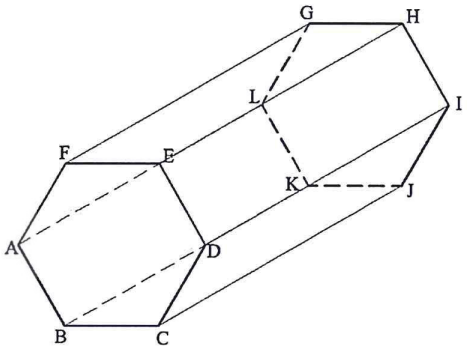
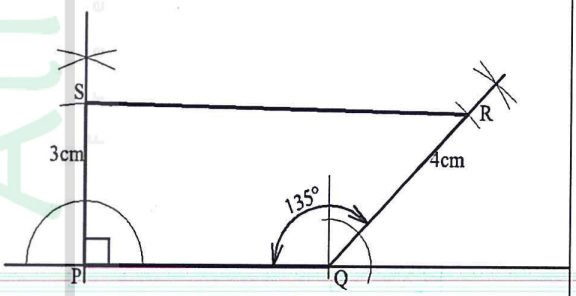
4.3 MATHEMATICS ALTERNATIVE A (121)

4.3.1 Mathematics Alternative A Paper 1 (121/1)

No.	Marking Scheme	Marks	Comments
1.	$\frac{2\frac{1}{3}-\frac{6}{5}of2}{\frac{1}{4}-\left(\frac{-1}{2}\right)^3}=\frac{\frac{35-36}{15}}{\frac{2+1}{8}}$ $=\frac{-\frac{1}{15}}{\frac{3}{8}}$ $=-\frac{8}{45}$	M1 M1 A1 **3**	Numerator Denominator (Evidence of use of BODMAS should be seen for both numerator and denominator)
2.	$7776=6^5$ $6^{2n-3}=6^5$ $2n-3=5$ $n=4$	B1 M1 A1 **3**	
3.	Height h $=\sqrt{130^2-50^2}$ $=120$cm Volume $=\frac{1}{3}\times80\times60\times120$ $=192000\text{cm}^3$	M1 M1 A1 **3**	
4.		B1 B1 B1 **3**	Corresponding lines equal and parallel. Hidden edges with broken lines. Correctly drawn sketch of the solid.

5.	$30 = 3\times2\times5$ $36 = 2\times2\times3\times3$ $84 = 2\times2\times3\times7$ $G.C.D. = 2\times3$ $= 6$ No of pieces obtained $= \frac{30}{6}+\frac{36}{6}+\frac{84}{6}$ $= 25$	M1 A1 M1 A1 **4**	
6.	Let the number be xy $x+y=13$ $(10y+x)-(10x+y)=9 \ \ or \ \ -x+y=1$ $x+y=13$ $y-x=1$ $2y=14$ $y=7$ $x=6$ Number is 67.	M1 M1 A1 B1 **4**	Formation of equations
7. (a)		B1 B1	Construction of 90° and 135° Completion of quadrilateral
(b)	$RS = (7.8 \pm 0.1)cm$ $Actua\times 40m$ $= 312 \pm 4m$	M1 A1 **4**	
8.	Midpoint of AB M: $\left(\frac{2+-4}{2}, \frac{3+5}{2}\right)$ M is $(-1, 4)$	M1 A1 **2**	

9.	Distance covered by truck $= 245 - 60\times 3$ $= 65\text{km}$ Time taken by truck $= 11 - 9 = 2\text{h}$ Average speed of truck $= \frac{65}{2}$ $= 32.5\text{km/hr}$	M1 M1 M1 A1 **4**	$\text{RS} = (x+60)\text{km/h}$ Time to catch up $= \frac{185}{x+60}$ $\frac{185}{x+60} = 2$ $x = 32.5\text{ km/h}$
10.	$h = 5\sin 30^\circ$ $= 2.5\text{cm}$ Area $= 2.5\times 10$ $= 25\text{cm}^3$	M1 M1 A1 **3**	
11.	$\left.\begin{array}{l}\tan 60° = \sqrt{3}\\ \sin 30° = \frac{1}{2}\\ \sin 60° = \frac{\sqrt{3}}{2}\end{array}\right\}$ $\therefore \frac{\sin 30° - \sin 60^\circ}{\tan 60^\circ} = \frac{\frac{1}{2} - \frac{\sqrt{3}}{2}}{\sqrt{3}}$ $= \frac{1-\sqrt{3}}{2\sqrt{3}}$ $= \frac{\sqrt{3}-3}{6}$	B1 M1 A1 **3**	Evidence of use of equilateral triangle should be seen.
12.	$\begin{pmatrix}5 & 3\\ 3 & -4\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}35\\ -8\end{pmatrix}$ Det = - 20 – 9 = -29 $\begin{pmatrix}x\\ y\end{pmatrix} = \frac{-1}{29}\begin{pmatrix}-4 & -3\\ -3 & 5\end{pmatrix}\begin{pmatrix}35\\ -8\end{pmatrix}$ $= \begin{pmatrix}4\\ 5\end{pmatrix}$	B1 M1	

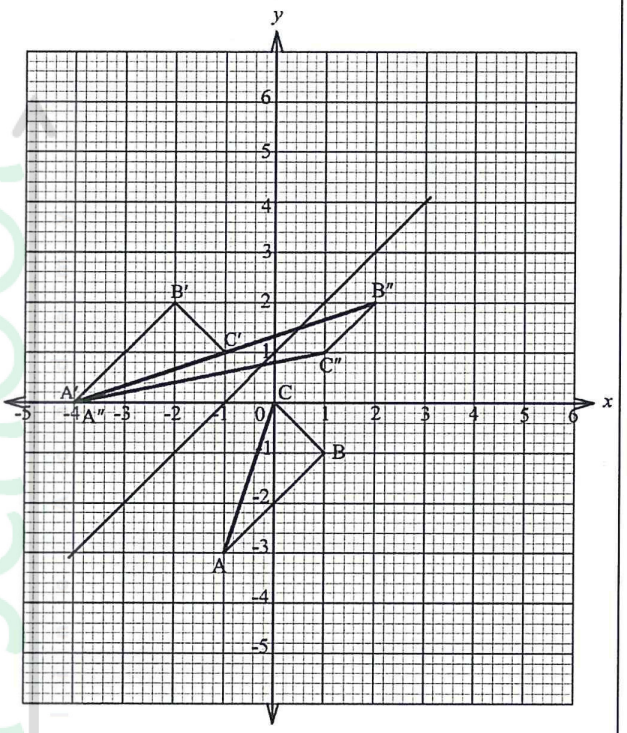
	$x=4$ $y=5$	A1 **3**	
13.	$(2x+1)^2+(x-1)(x-3)=4x^2+4x+1+x^2-4x+3$ $=5x^2+4$	M1 A1 **2**	
14.	$\frac{1}{0.0247}=\frac{1}{2.47}\times10^2$ $=0.4049\times10^2$ $=40.49$ $\frac{\sqrt[3]{3.025}}{0.0247}=\sqrt[3]{3.025}\times40.49$ $=58.56$	B1 M1 A1 **3**	Evidence of use of mathematical tables should be seen.
15.	20000 dollars = 20000 × 101.9378 = Ksh. 2038756 In S.A. rand $=\frac{20000\times101.93.78}{7.6326}$ = 267112 rands	M1 M1 A1 **3**	
16.	Area of space $=2\times(15+2x)x+2\times24\times x$ $30x+4x^2+48x=270$ $4x^2+78x-270=0$ $4x^2-12x+90x-270=0$ $4x(x-3)+90(x-3)=0$ $4x(x-3)+90(x-3=0$ $(4x+90)(x-3)=0$ $x=-22.5$ *or* $x=3$ $x=3cm$	M1 M1 A1 **3**	Or equivalent

17. (a)	$\frac{h}{h+7.2}=\frac{6}{12}$ $12h-6h=6\times7.2$ $6h=6\times7.2$ $h=7.2m$	M1 A1	
	Curved surface area of tank. $=\Pi RL-\pi rL$ $=\pi\times12\times\sqrt{(14.4^2+12^2)}-\pi\times6\times\sqrt{(7.2^2+6^2)}$ $=706.65-176.66$ **$=529.99m^2$**	 M1 A1	
(b)	Volume $\frac{1}{3}\pi R^2H-\frac{1}{3}\pi r^2h$ $=\frac{1}{3}\times\pi\times12^2\times14.4-\frac{1}{3}\pi\times6^2\times7.2$ $=1900.0\ m^3$ Capacity = 1900 × 1000 litres **= 1900000 litres**	 M1 M1 A1	
(c)	Amount used by students per day. = 40 × 500 = 20000 litres No. of days = $\frac{1900000}{20000}$ **= 95 days**	 M1 M1 A1	
		10	

18. (a)	Gradient of AB $= \frac{12-6}{7-3} = \frac{6}{4} = \frac{3}{2}$	B1	
	Equation of AB:		
	$\frac{y-6}{x-3} = \frac{3}{2}$	M1	
	$y = \frac{3}{2}x + \frac{3}{2}$	A1	
(b)	Midpoint of AB		
	$M\left(\frac{3+7}{2}, \frac{12+6}{2}\right)$		
	$= (5, 9)$	B1	
	Equation of perpendicular bisector of AB:		---- for gradient
	$m_2 \times \frac{3}{2} = -1 \Rightarrow m_2 = -\frac{2}{3}$	B1	
	$\frac{y-9}{x-5} = \frac{-2}{3}$	M1	
	$y = -\frac{2}{3}x + \frac{37}{3}$	A1	
(c)	Equations of AC: $\frac{y-6}{x-3} = \frac{-2}{3}$	M1	
	$y = -\frac{2}{3}x + 8$		Attempt to solve the equation simultaneously
	At Point of intersection		
	$-\frac{2}{3}x + 8 = -5x + 47$	M1	
	$13x = 117$		
	$x = 9$		
	$y = -5 \times 9 + 47 = 2$	A1	
	Coordinates of C is (9,2)	**10**	

19. (a)	$S_{(2)} = 2^3 - 15(2)^2 + 63(2) - 10$ $= 8 - 60 + 126 - 10$ $= 64$	M1 A1	
(b)	$S_{(3)} = 3^3 - 15(3)^2 + 63(3) - 10$ $= 27 - 135 + 189 - 10$ $= 71$	M1	
	Distance in 3rd second $S_{(3)} - S_{(2)} = 71 - 64$	M1	
	$= 7$	A1	
(c)	$V = \frac{ds}{dt} = 3t^2 - 30t + 63 = 0$	M1	
	$t^2 - 10t + 21 = 0$	M1	
	$(t-3)(t-7) = 0$		
	$t = 3$ *or* $t = 7$	A1	
(d)	Acceleration $= \frac{dv}{dt} = 6t - 30$	M1	
	$= 6(5) - 30$		
	$= 0$	A1	
		10	

20.



(a) Correct position of the vertices of $A'B'C'$ — B1

Correctly complete triangle $A'B'C'$ drawn — B1

(b) (i)

$$\begin{matrix} & A' & B' & C' \end{matrix} \qquad \begin{matrix} A'' & B'' & C'' \end{matrix}$$

$$\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} -4 & -2 & -1 \\ 0 & 2 & 1 \end{pmatrix} = \begin{pmatrix} -4 & 2 & 1 \\ 0 & 2 & 1 \end{pmatrix}$$

M1 A1

Triangle A″B″C″ correctly drawn — B1

(ii) It's a shear, — B1

The x axis invariant — B1

point $B'(-2, 2)$ is mapped onto $B''(2, 2)$ — B1

(iii) Area of triangle $A'B'C' = \frac{1}{2} \times (3+1) \times 2 - 1.5 - 0.5$

$= 4 - 2$

$= 2$ sq units — B1

Area of $A''B''C''$ = *Area of* $A'B'C'$

= 2 square units — B1

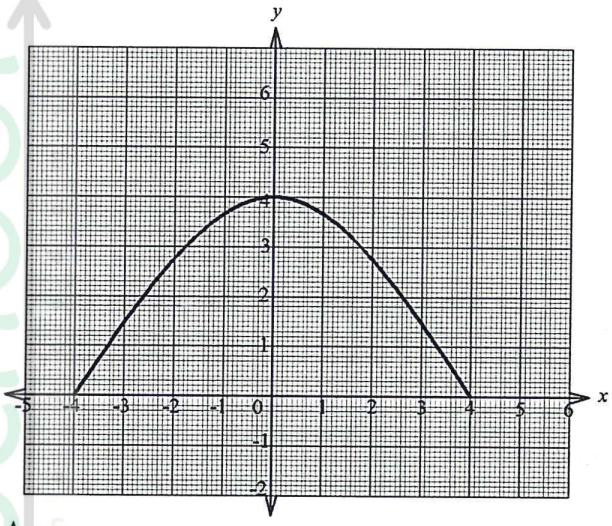
10

21. (a)	$AB = \sqrt{7.2^2 - 3.4^2}$ $= 6.3\text{cm}$	M1	
	Area of ΔABC $= \frac{1}{2} \times 6.3 \times 3.4$ $= 10.7\ \text{cm}^2$	M1 A1	
(b)	Area of ΔABC = Area of ΔBCD $\frac{1}{2} \times 3.4 \times 7.5 \times \sin\theta = 10.7$	M1	
	$\text{Sin}\ \theta = \frac{10.7 \times 2}{3.4 \times 7.5}$ $\theta = 57.1°$	A1	
	Obtuse Angle BCD = 180 - 57.1 $= 122.9$	B1	
(c)	$BD^2 = 7.5^2 + 3.4^2 - 2 \times 3.4 \times 7.5 \cos 122.9$ $= 95.51$ BD = 9.8cm	M1 A1	
(d)	Angle BDC: $\frac{3.4}{Sin\,\theta} = \frac{9.8}{Sin\,122.9}$ $\text{Sin}\ \theta = \frac{3.4 \sin 122.9}{9.8}$ $\Theta = 16.9°$	M1 A1	
		10	or equivalent

22. (a)

x	-4	-3	-2	-1	0	1	2	3	4
y	0	1.75	3	3.75	4	3.75	3	1.75	0

B1 — Correct table may be implied



C1

(b) Area =

$\frac{1}{2}\times 1\{0+0+2(1.75+3+3.75+4+3.75+3+1.75)\}$ M1

$= \frac{1}{2}\times 1\times 2\times 21$ M1

$= 21$ sq units A1

(c) $Area = \int_{-4}^{4}\left(4 - \frac{1}{4}x^2\right)dx$

$= \left[4x - \frac{1}{12}x^3\right]_{-4}^{4}$ M1

$= 10\frac{2}{3} - -10\frac{2}{3}$ M1

$= 21\frac{1}{3}$ sq units A1

(d) $\%\ \text{error} = \left(\frac{21\frac{1}{3} - 21}{21\frac{1}{3}}\right)\times 100$ M1 A1

= 1.5625%

10

23. (a) (i)	$\frac{20}{100} \times 225000$	M1	
	= 45000	A1	
(ii)	$\frac{35}{100} \times 225000$		
	= 78750	B1	
(b)	Amount for each contribution ratio contributions:		
	Abiro: Bwire: Chirchir		
	= 120000:180000:240000	B1	
	= 2 : 3 : 4		
	Abila $= \frac{2}{9} \times \frac{45}{100} \times 225\,000$		
	= 22500	B1	
	Bwire $= \frac{3}{9} \times \frac{45}{100} \times 225000$		
	= 33750	B1	
	Chirchir $= \frac{4}{9} \times \frac{45}{100} \times 225000$		
	= 45000	B1	
(c)	$\frac{20}{100} \times 225000 \times \frac{4}{9} + 240000$	M1	
	20000 + 240000	M1	
	= 260000	A1	
		10	

24. (a)	$y = \frac{1}{3}x^3 - 4x + 5$ When $x = 3$ $y = \frac{1}{3}(3)^3 - 4(2) + 5$ $= \mathbf{2}$	 M1 A1	
(b)	Gradient at $x = 3$ $\frac{dy}{dx} = x^2 - 4$ at $x = 3$ $\frac{dy}{dx} = (3)^2 - 4$ $= 5$	 M1 M1 A1	
(c)	At turning points $\frac{dy}{dx} = x^2 - 4 = 0$ $(x-2)(x+2) = 0$ $x = 2$ or -2 (When $x = 2$, $y = -\frac{1}{3}$) and ($x = -2$, $y = 10\frac{1}{3}$) Turning points are $\left(2, -\frac{1}{3}\right)$ and $\left(-2, 10\frac{1}{3}\right)$ $\frac{d^2y}{dx^2} = 2x$ At $x = 2$, $\frac{d^2y}{dx^2} = 4$ At $x = -2$ $\frac{d^2y}{dx^2} = -4$ $\therefore \left(2, -\frac{1}{3}\right)$ is a minimum point And $\left(-2, 10\frac{1}{3}\right)$ is a maximum point	 M1 M1 A1 B1 B1 **10**	 Checking for max or min