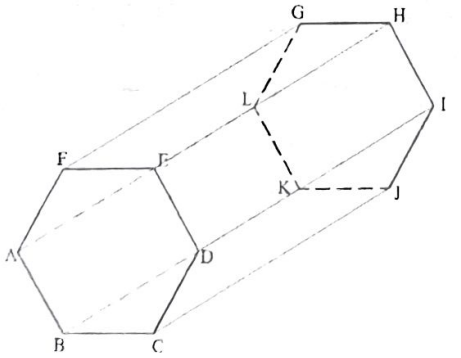
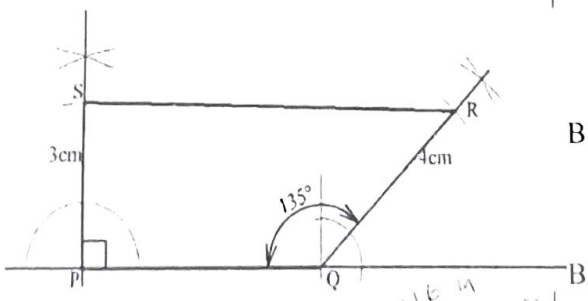
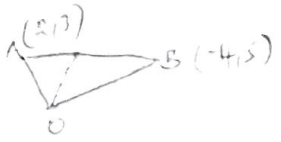
MATHEMATICS ALT. A 121/1 PAPER 1 MARKING SCHEME

No.	Marking Scheme	Marks	Comments
1.	$\frac{2\frac{1}{3}-\frac{6}{5}\text{ of }2}{\frac{1}{4}-\left(\frac{-1}{2}\right)^3} = \frac{\frac{35-36}{15}}{\frac{2+1}{8}}$	M1	Numerator
		M1	Denominator (Evidence of use of BODMAS should be seen for both numerator and denominator)
	$= \frac{-\frac{1}{15}}{\frac{3}{8}}$		
	$= -\frac{8}{45}$	A1	
		3	
2.	$7776 = 6^5$	B1	
	$6^{2n-3} = 6^5$		
	$2n-3=5$	M1	
	$n=4$	A1	
		3	
3.	Height h $= \sqrt{130^2-50^2}$	M1	
	$= 120$cm		
	Volume $= \frac{1}{3}\times 80\times 60\times 120$	M1	
	$= 192000\text{cm}^3$	A1	
		3	
4.		B1	Corresponding lines equal and parallel.
		B1	Hidden edges with broken lines.
		B1	Correctly drawn sketch of the solid.
		3	

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)	$RS = (7.9 \pm 0.1)cm$ $Actual\ RS = 7.9\times40m$ $= 316 \pm 4m$	M1 A1 4	
		7	



(4)

8.	Midpoint of AB M: $\left(\frac{2+-4}{2}, \frac{3+5}{2}\right)$ ← can be earned by working as continuation M is $(-1, 4)$	M1 A1 **2**	OR $\vec{OM} = \begin{pmatrix}2\\3\end{pmatrix} + \frac{1}{2}\begin{pmatrix}-6\\2\end{pmatrix}$ M1 $\begin{pmatrix}-1\\4\end{pmatrix}$ $(-1,4)$ A1 OR $OM = \vec{OB} + \frac{1}{2}BA$ $\begin{pmatrix}-4\\5\end{pmatrix} + \frac{1}{2}\left[\begin{pmatrix}2\\3\end{pmatrix} - \begin{pmatrix}4\\5\end{pmatrix}\right]$ M1 M $(-1,4)$ A1
9.	Distance covered by truck $= 245 - 60\times 3$ $= 65$km Time taken by truck = 11 − 9 = 2h Average speed of truck $= \frac{65}{2}$ $= 32.5$km/hr	M1 M1 M1 A1 **4**	OR RS = $(x+60)$km/h Time to ~~catch up~~ meet = $\frac{185}{x+60}$ $\frac{185}{x+60} = 2$ M1 M1 M1 $x = 32.5$ km/h A1
10.	$h = 5\sin 30°$ $= 2.5$cm Area $= 2.5\times 10$ $= 25\text{cm}^3$	M1 M1 A1 **3**	OR $\frac{1}{2}\times 10\times 5\times \sin 30$ M1 M1 $= 25\text{ cm}^2$ A1 OR $10\times 5\times \sin 30$ M1 M1 $= 25$ A1
11.	$\tan 60° = \sqrt{3}$ $\sin 30° = \frac{1}{2}$ $\sin 60° = \frac{\sqrt{3}}{2}$ $\therefore \frac{\sin 30° - \sin 60°}{\tan 60°} = \frac{\frac{1}{2} - \frac{\sqrt{3}}{2}}{\sqrt{3}}$ ← for each $= \frac{1-\sqrt{3}}{2\sqrt{3}}$ $= \frac{\sqrt{3}-3}{6}$ ← simplified	B1 M1 A1 **3**	Evidence of use of equilateral triangle should be seen.

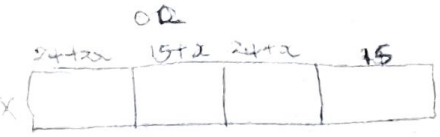
12.	$\begin{pmatrix} 5 & 3 \\ 3 & -4 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 35 \\ -8 \end{pmatrix}$ Det = - 20 – 9 = -29 ← determined. $\begin{pmatrix} x \\ y \end{pmatrix} = \frac{-1}{29}\begin{pmatrix} -4 & -3 \\ -3 & 5 \end{pmatrix}\begin{pmatrix} 35 \\ -8 \end{pmatrix}$ ← M1 $= \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ $x = 4$ $y = 5$ ← Extracted	B1 M1 A1 **3**	For Making $\begin{pmatrix} x \\ y \end{pmatrix}$ the subject.
13.	$(2x+1)^2 + (x-1)(x-3) = 4x^2 + 4x + 1 + x^2 - 4x + 3$ ← M1 $= 5x^2 + 4$ ← A1	M1 A1 **2**	for correct expansion and ascending powers $5x^2+4=0$ ignore the = 0 award M1
14.	$\frac{1}{0.0247} = \frac{1}{2.47} \times 10^2$ or 2.47×10^{-2} If Log used to get reciprocal award M1 $= 0.4049 \times 10^2$ $= 40.49$ ← B1 $\frac{\sqrt[3]{3.025}}{0.0247} = \sqrt[3]{3.025} \times 40.49$ ← M1 $= 58.56$ ← A1 or 58.55	B1 M1 A1 **3**	Evidence of use of mathematical tables should be seen.
15.	2000 dollars = 20000 × 101.9378 ← M1 = Ksh. 2038756 In S.A. rand = $\frac{20000 \times 101.93,78}{7.6326}$ ← M1 = 267112 rands ← A1	M1 M1 A1 **3**	

16.	Area of space $= 2\times(15+2x)x+2\times24\times x$	M1	Or equivalent (correct expression for area of space)
	$30x+4x^2+48x=270$		
	$4x^2+78x-270=0$		
	$4x^2-12x+90x-270=0$		
	$4x(x-3)+90(x-3)=0$		
	$4x(x-3)+90(x-3=0$		
	$(4x+90)(x-3)=0$	M1	quadratic formula: when $x=\frac{-78\pm102}{8}$ M1
	$x=-22.5$ *or* $x=3$		$x=3$ A1
	$x=3cm$	A1	
		3	

follow through

8

OR



$x(24+2x+15+2x+24+2x+15)=270$ M1

$24x+2x^2+15x+x^2+24x+2x^2+15x=270$

$4x^2+78x-270=0$

OR

$[(24+2x)(15+2x)]-(24\times15)=270$ M1

$78x+4x^2=270$

$4x^2+78-270=0$

OR

$2x(15+2x)+2(24x)=270$ not necessary to see 270

OR

$2(15x)+2(24+2x)x=270$

OR

$4x^2+(15x)2+(24x)2=270$

(7)

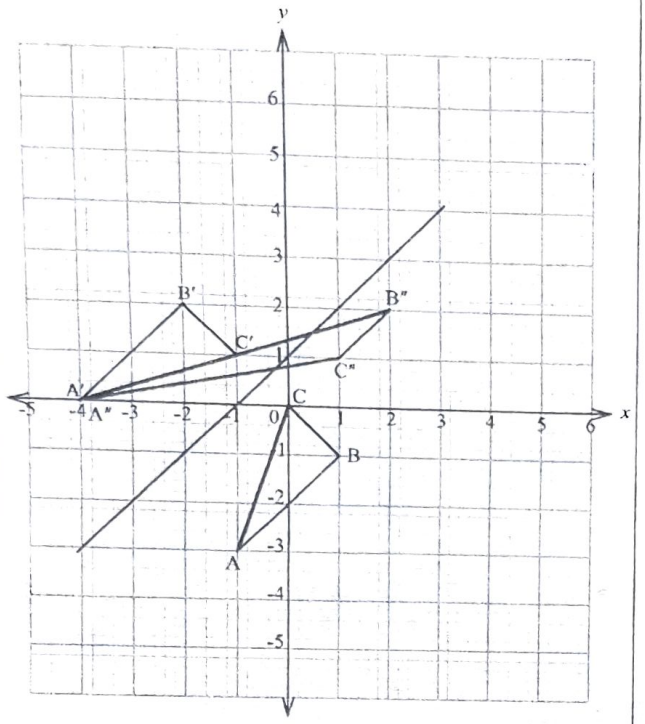
17. (a)	$\frac{h}{h+7.2}=\frac{6}{12}$	M1	OR $\pi RL(R+r)$ $L=9.372$ $\pi\times9.372(12+6)$ M1 A1 M1 530.06 A1
	$12h-6h=6\times7.2$ $6h=6\times7.2$ $h=7.2m$	A1	
	Curved surface area of tank. $=\Pi RL-\pi rL$ $=\pi\times12\times\sqrt{(144^2+12^2)}-\pi\times6\times\sqrt{(7.2^2+6^2)}$ followed through.	M1	
	$=706.65-176.66$ 706.18 − 176.73 **$=529.99m^2$**	A1	529.89
(b)	Volume $\frac{1}{3}\pi R^2H-\frac{1}{3}\pi r^2h$ (9.372 − 176.69)		OR $V=\frac{\pi h}{3}\left(\frac{R^3-r^3}{R-r}\right)$ $\frac{3.142\times9.372\left(12^3-6^3\right)}{3\times(12-6)}$ M1
	$=\frac{1}{3}\times\pi\times12^2\times14.4-\frac{1}{3}\pi\times6^2\times7.2$ (22/7) 217234 − 271.54	M1	for the correct expression
	$=1900.0\ m^3$ 1900.8 m^3		
	Capacity = 1900 × 1000 litres	M1	for correct conversion
	= 1900000 litres	A1	1900,800 L 1960.2876×1000 M1 1900382 L A1
(c)	Amount used by students per day.		
	$=40\times500$ = 20000 litres	M1	Expression of No. of litres used per day
	No. of days $=\frac{1900000}{20000}$	M1	95.4 A1
	= 95 days	A1	
		10	

18. (a)	Gradient of AB $= \frac{12-6}{7-3} = \frac{6}{4} = \frac{3}{2}$	B1	for correct gradient accept 6/4, 3/2, 1.5
	Equation of AB:		OR $y = 3/2x + c$
	$\frac{y-6}{x-3} = \frac{3}{2}$	M1	$6 = 3/2(3) + c$ M1
	$y = \frac{3}{2}x + \frac{3}{2}$	A1	$c = 3/2$. $y = 3/2x + 3/2$ or $2y = 3x + 3$ $y = 1.5x + 1.5$ 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	
	$y = -\frac{2}{3}x + \frac{37}{3}$ OR equivalent.	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		OR A(3,6) C(a,b)
	$-\frac{2}{3}x + 8 = -5x + 47$ one unknown eliminated	M1	$\frac{b-6}{a-3} = -2/3$ M1
	$13x = 117$ $x = 9$ $y = -5 \times 9 + 47 = 2$	A1	B(7,12) C(a,b) $\frac{b-12}{a-7} = -5$
	Coordinates of C are (9,2)	10	$2a + 3b = 24$ $5a + b = 47$ M1 $a = 9$ $b = 2$ C(9,2) A1

(9)

19. (a)	$S_{(2)} = 2^3 - 15(2)^2 + 63(2) - 10$	M1	for correct substitution
	$= 8 - 60 + 126 - 10$		
	$= 64$ ← for correct answer	A1	
(b)	$S_{(3)} = 3^3 - 15(3)^2 + 63(3) - 10$ ← For correct substitution	M1	
	$= 27 - 135 + 189 - 10$		
	$= 71$		
	Distance in 3rd second		
	$S_{(3)} - S_{(2)} = 71 - 64$ ← for subtraction of expressions	M1	
	$= 7$	A1	
(c)	$V = \frac{d}{s} = 3t^2 - 30t + 63 = 0$ ← correct $\frac{ds}{dt} = v$	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)

$$\begin{matrix} & A' & B' & C' \\ \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix} & \begin{pmatrix} -4 & -2 & -1 \\ 0 & 2 & 1 \end{pmatrix} & = \end{matrix} \begin{matrix} A'' & B'' & C'' \\ \begin{pmatrix} -4 & 2 & 1 \\ 0 & 2 & 1 \end{pmatrix} \end{matrix}$$

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

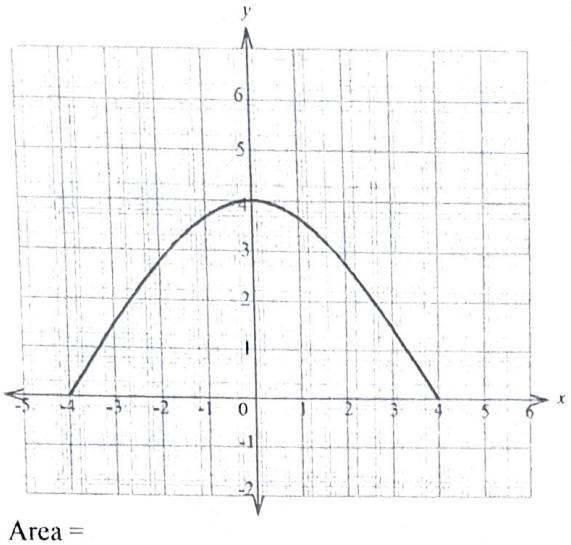
21. (a)	$AB = \sqrt{7.2^2 - 3.4^2}$ $= 6.3\text{cm}$	M1	
	Area of ΔABC $= \frac{1}{2} \times 6.3 \times 3.4$ $= 10.7\ \text{cm}^2$	M1 A1	
(b)	Area of ΔABC = Area of ΔBCD $\frac{1}{2} \times 3.4 \times 7.5 \times \sin\theta = 10.7$ $\text{Sin}\ \theta = \frac{10.7 \times 2}{3.4 \times 7.5}$ $\theta = 57.1°$ Obtuse Angle BCD = 180 - 57.1 $= 122.9$	M1 A1 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	or equivalent
		10	

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 on correctly plotted curve.



scale ✓ points ✓

don't allow rounded figures on the table (for (a))

Correct curve.
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 (Simplification.)

$= 21$ A1

$= 21$ sq units

(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 (correct integration)

$= 10\frac{2}{3} - -10\frac{2}{3}$ M1 (substitution of limits)

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

or 10·3 allow 10·33...

don't allow approximated decimal

$\left(4(4) - \frac{1}{12}(4)^3\right) - \left(4(-4) - \frac{1}{12}(-4)^3\right)$

$\left(16 - 5\frac{1}{3}\right) - \left(-16 + 5\frac{1}{3}\right)$

(d)

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

A1

$= \mathbf{1.5625\%}$ or $1\frac{9}{16}\%$ **10**

13

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:	
	Abira: Bwire: Chirchir	
	= 120000:180000:240000	B1
	= 2 : 3 : 4	
	Abira $= \frac{2}{9} \times \frac{45}{100} \times 225000$ $2/9 \times 101250$	
	= 22500	B1
	Bwire $= \frac{3}{9} \times \frac{45}{100} \times 225000$ $3/9 \times 101250$	
	= 33750	B1
	Chirchir $= \frac{4}{9} \times \frac{45}{100} \times 225000$ $4/9 \times 101250$	
	= 45000	B1
(c)	$\frac{20}{100} \times 225000 \times \frac{4}{9} + 240000$ (expression leading to 20,000)	M1
	20000 + 240000	M1
	= 260000	A1
		10

OR

$\frac{20}{100} \times 225000 \times \frac{4}{9} + 240000$ M1 M1

OR

$\frac{4}{9} \times 45000 + 240000$ M1 M1

OR

$\frac{4}{9}(240000 + 45000)$ M1 M1

260000 A1

14

24. (a) $y = \frac{1}{3}x^3 - 4x + 5$

When $x = 3$

$y = \frac{1}{3}(3)^3 - 4(3) + 5$ ← For correct substitution — M1

$= 2$ — A1

(b) Gradient at $x = 3$

$\frac{dy}{dx} = x^2 - 4$ ← gradient function — M1

at $x = 3$

$\frac{dy}{dx} = (3)^2 - 4$ ← sub. — M1

$= 5$ — A1

(c) At turning points

$\frac{dy}{dx} = x^2 - 4 = 0$ — M1

$(x-2)(x+2) = 0$ — M1 OR $\sqrt{x^2} = \sqrt{4}$ $x = 2$ or $x = -2$ M1

$x = 2$ 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 $\left(-2, 10\frac{1}{3}\right)$ ← Both points (should be as fraction) — A1

$\frac{d^2y}{dx^2} = 2x$

At $x = 2$, $\frac{d^2y}{dx^2} = 4$ (2, -1/3) Minimum point — check and state point → B1

OR

x	1	2	3
$\frac{dy}{dx}$	-3	0	5

At $x = -2$

$\frac{d^2y}{dx^2} = -4$ (-2, 10 1/3) Maximum point — B1

x	-3	-2	-1
$\frac{dy}{dx}$	5	0	-3

15

	$\therefore \left(2, -\frac{1}{3}\right)$ is a minimum point ⟶	B1	Checking for max or min
	And $\left(-2, 10\frac{1}{3}\right)$ is a maximum point ⟶	B1	
		10	