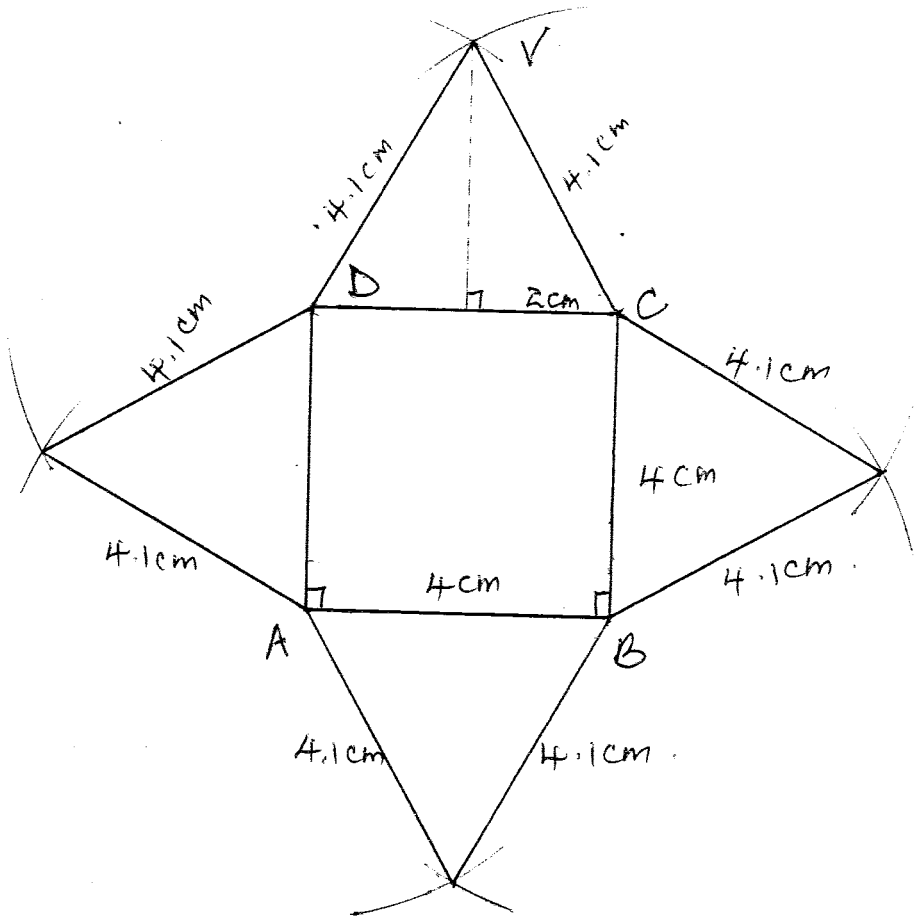
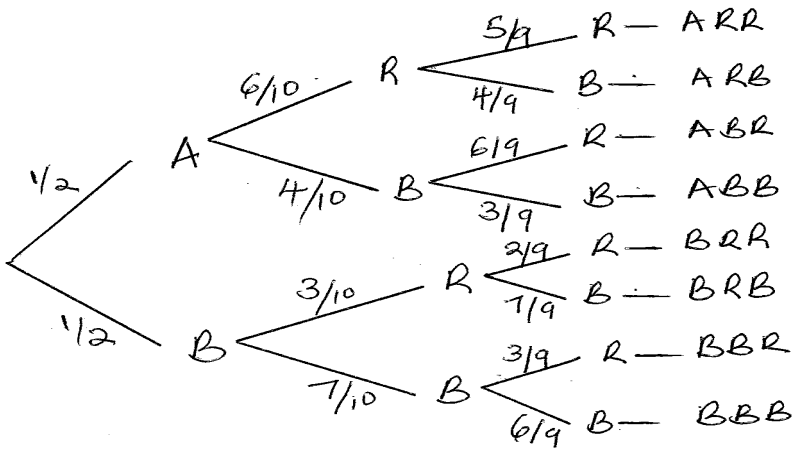
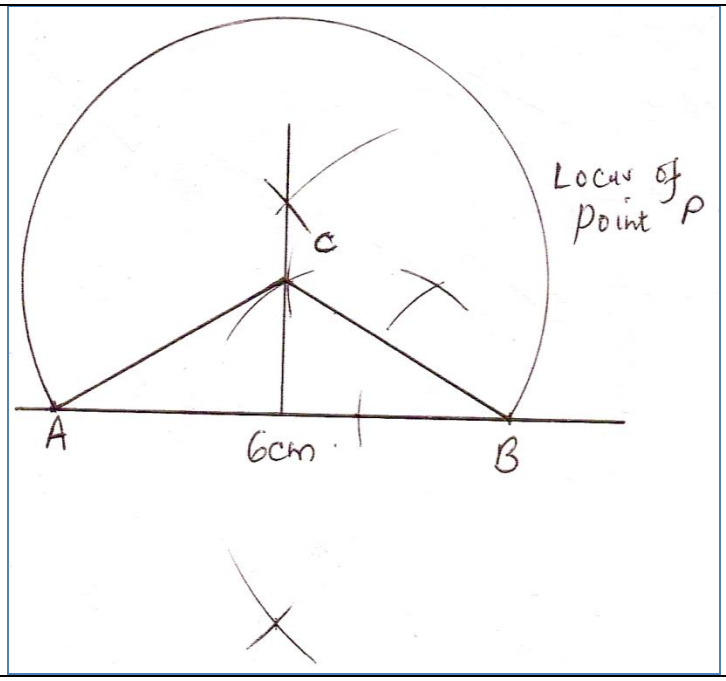
121 /2
MATHEMATICS
PAPER 2
MARCH/APRIL

1.	$\left(\frac{0.6812}{7.627 \times 0.3734}\right)^{\frac{1}{2}}$ NO: 0.6812; 7.627; 0.3734 LOG: $\bar{1}.8332$; 0.8824; $\bar{1}.5722$ $\bar{1}.8332 - (0.8824 + \bar{1}.5722) = \bar{1}.4546 - \bar{1}.3786$ $\frac{\bar{2}+1.3786}{2}$ $\bar{1}.6893$ 0.4890	B1 M1 M1 A1	Find ✓ reciprocal and ✓reading of log 5 All logs ✓ All operations +, - and ÷✓ Accept std form
		4 Mks	
2.	$d^3 = \frac{p^2 - 2q}{q - p^2}$ $d^3(q - p^2) = p^2 - 2q$ $\left(d^3 q + 2q\right) = p^2 + d^3 p^2$ $p^2\left(1 + d^3\right) = d^3 q + 2q$ $p = \pm\sqrt{\frac{d^3 q + 2q}{1 + d^3}}$	M1 M1 A1	
		3 Mks	
3.	$1 - 5 \times (5x) + 10 \times (5x)^2 - 10 \times (5x)^3$ $= 1 - 25x + 250x^2 - 1250x^3$ $1 - 5x = 0.95$ $-5x = -0.05$ $x = 0.01$ $1 - (25 \times 0.01) + (250 \times 0.01^2) - (1250 \times 0.01^3)$ $1 - 0.25 + 0.025 - 0.00125 = 0.77375$ $= 0.7738$	M1 A1 M1 A1	
		4 Mks	
4.	$log_2(x^2 - 9) = 3log_2 2 + log_2 x$ $log_2(x^2 - 9) = log_2 8 + log_2 x$ $log_2(x^2 - 9) = log_2 8x$ $x^2 - 9 = 8x$ $x^2 - 8x - 9 = 0$	M1	For ✓ dropping logs For ✓ x = ± 5 ⇒CAO

	$x^2 + x - 9x - 9 = 0$ $x(x+1) - 9(x+1) = 0$ $x = -1, x = 9$	M1 A1	
		3 Mks	
5.	$\frac{1}{2}x + 2 \leq 5 - \frac{1}{4}x$ $\frac{1}{2}x + \frac{1}{4}x \leq 5 - 2 \equiv \frac{3}{4}x \leq 3$ $x \leq 4$ $5 - \frac{1}{4}x < \frac{6}{8}x + 8$ $5 - 8 < \frac{1}{4}x + \frac{6}{8}x$ $-3 < x$ *hence the integral values* $-2, -1, 0, 1, 2, 3, 4$	B1 B1 B1	
		3 Mks	
6.	 $Area = 4 \times 4 + \frac{1}{2} \times 4 \times \sqrt{4.1^2 - 2^2}$	B1 B1	✓Net ✓labling

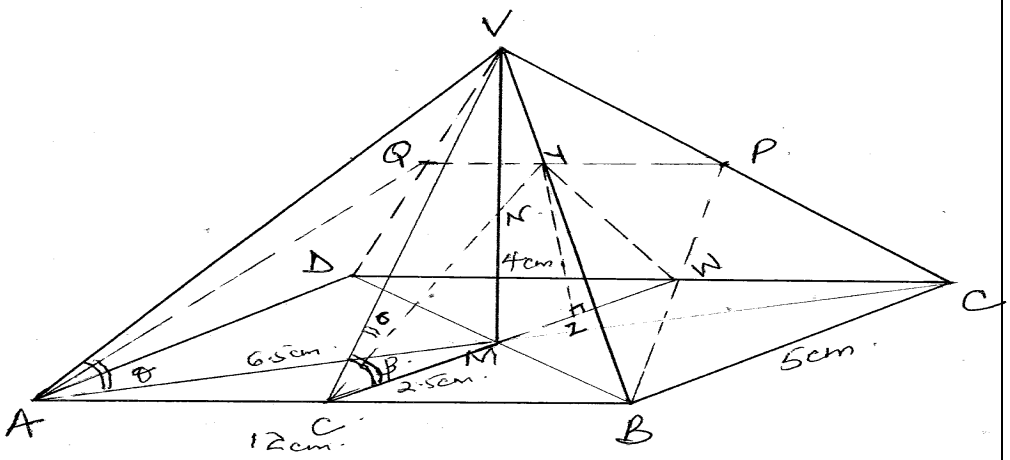
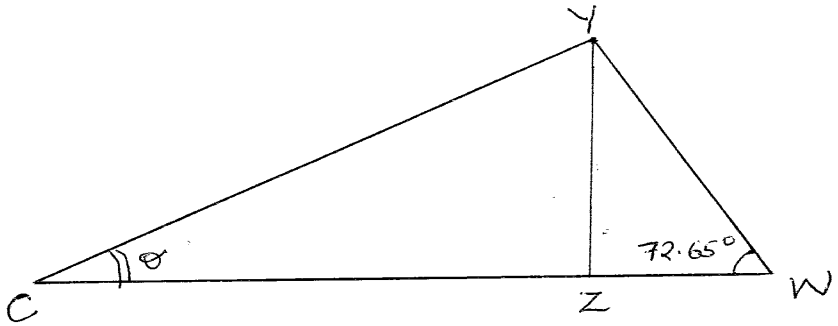
	$= 16 + 2 \times 3.579 = 16 + 7.158$ $= 23.158cm^2$	B1	
		3 Mks	
7.	a)  b) $1 - \left[\left(\frac{1}{2} \times \frac{6}{10} \times \frac{5}{9}\right) + \left(\frac{1}{2} \times \frac{3}{10} \times \frac{2}{9}\right)\right]$ $1 - \left(\frac{1}{6} + \frac{1}{30}\right)$ $1 - \frac{1}{5}$ $= \frac{4}{5}$	B1 M1 A1	Tree diagram
		3 Mks	
8.	$\frac{3}{2-\sqrt{8}} - \frac{2}{2+\sqrt{8}} = \frac{3}{2-2\sqrt{2}} - \frac{2}{2+2\sqrt{2}}$ $= \frac{3(2+2\sqrt{2}) - 2(2-2\sqrt{2})}{4-8}$ $\frac{6+6\sqrt{2}-4+4\sqrt{2}}{-4}$ $\frac{2+10\sqrt{2}}{-4} = -0.5 - 2.5\sqrt{2}$ $a = -0.5, b = -2.5, c = 2$	M1 M1 A1	
		3 Mks	
9.	a) Co – ordinate of A $Centre\ A = \left(\frac{13-3}{2}, \frac{3-9}{2}\right)$, $A(5, -3)$ b) $r = \sqrt{(5--3)^2 + (-3--9)^2} = \sqrt{8^2 + 6^2} = 10$	B1	Or equivalent

	$(x-5)^2+(y+10)^2=10^2$ $x^2-10x+25+y^2+6y+9=100$ $x^2-10x+y^2+6y-66=0$	B1 B1	
		3 Mks	
10.	$\begin{pmatrix}2 & 3\\1 & 2\end{pmatrix}$ $Det=((2\times 2)-(1\times 3))=1$ $inverse=\begin{pmatrix}2 & -3\\-1 & 2\end{pmatrix}$ $\frac{2x+3y=17}{\frac{2x+4y=20}{2}}=\begin{matrix}2x+3y=17\\x+2y=10\end{matrix}$ $\begin{pmatrix}2 & -3\\-1 & 2\end{pmatrix}\begin{pmatrix}2 & 3\\1 & 2\end{pmatrix}\begin{pmatrix}x\\y\end{pmatrix}=\begin{pmatrix}2 & -3\\-1 & 2\end{pmatrix}\begin{pmatrix}17\\10\end{pmatrix}$ $\begin{pmatrix}x\\y\end{pmatrix}=\begin{pmatrix}34-30\\-17+20\end{pmatrix}=\begin{pmatrix}4\\3\end{pmatrix}$ $x=4, y=3$	B1 B1 M1 A1	
		4 Mks	
11.	$3p=p\left(\frac{100+\frac{16}{2}}{100}\right)^{2n}$ $3=1.08^{2n}$ $log3=log1.08^{2n}$ $log3=2nlog1.08$ $2n=\frac{log3}{log1.08}=\frac{0.4771}{0.0334}$ $2n=14.284$ $n=7.142$ $hence\ n=7years$	M1 M1 M1 A1	
		3 Mks	
12.	$\left(\frac{0.5}{40}+\frac{0.5}{80}\right)\times 100$ $=\frac{3}{160}\times 100$ $=1\frac{7}{8}\%$	M1 A1	1.875%
		2 Mks	
13.	$b^2=12^2+10^2-2\times 10\times 12Cos120^0$ $b^2=144+100-240\times -0.5$	M1	

	$b^2 = 244 + 120 = 364$ $b = \sqrt{364}$ $= 19.08cm$ $AK = \frac{19.08}{2} = 9.54cm$	A1 B1	
		3 Mks	
14.	$6.4^2 = x(9.6 + x)$ $40.96 = x^2 + 9.6x$ $0 = x^2 + 9.6x - 40.96$ $x = \frac{-9.6 \pm \sqrt{9.6^2 - (4 \times 1 \times -40.96)}}{2 \times 1}$ $x = \frac{-9.6 \pm \sqrt{92.16 + 163.84}}{2}$ $x = \frac{-9.6 \pm \sqrt{256}}{2}$ $x = \frac{-9.6 \pm 16}{2} = \frac{16 - 9.6}{2}$ $\frac{6.4}{2}$ $x = 3.2cm$ $EC = 3.2 + 9.6 = 12.8cm$	M1 A1 B1	Or equivalent
		3 Mks	
15.	$L.S.F. = \sqrt[3]{\frac{2560}{5000}} = \frac{4}{5}$ $A.S.F = \left(\frac{4}{5}\right)^2 = \frac{16}{25}$ $Area\ of\ the\ bigger\ one = \frac{25 \times 256}{16}$ $= 400cm^2$	B1 M1 A1	
		3 Mks	
16.		B1 B1 B1	60^0✓ly constructed Triangle ABC Locus of P
		3 Mks	
17.	a) $Distance = \frac{60+60}{360} \times \frac{22}{7} \times 6370 \times 2$	M1	

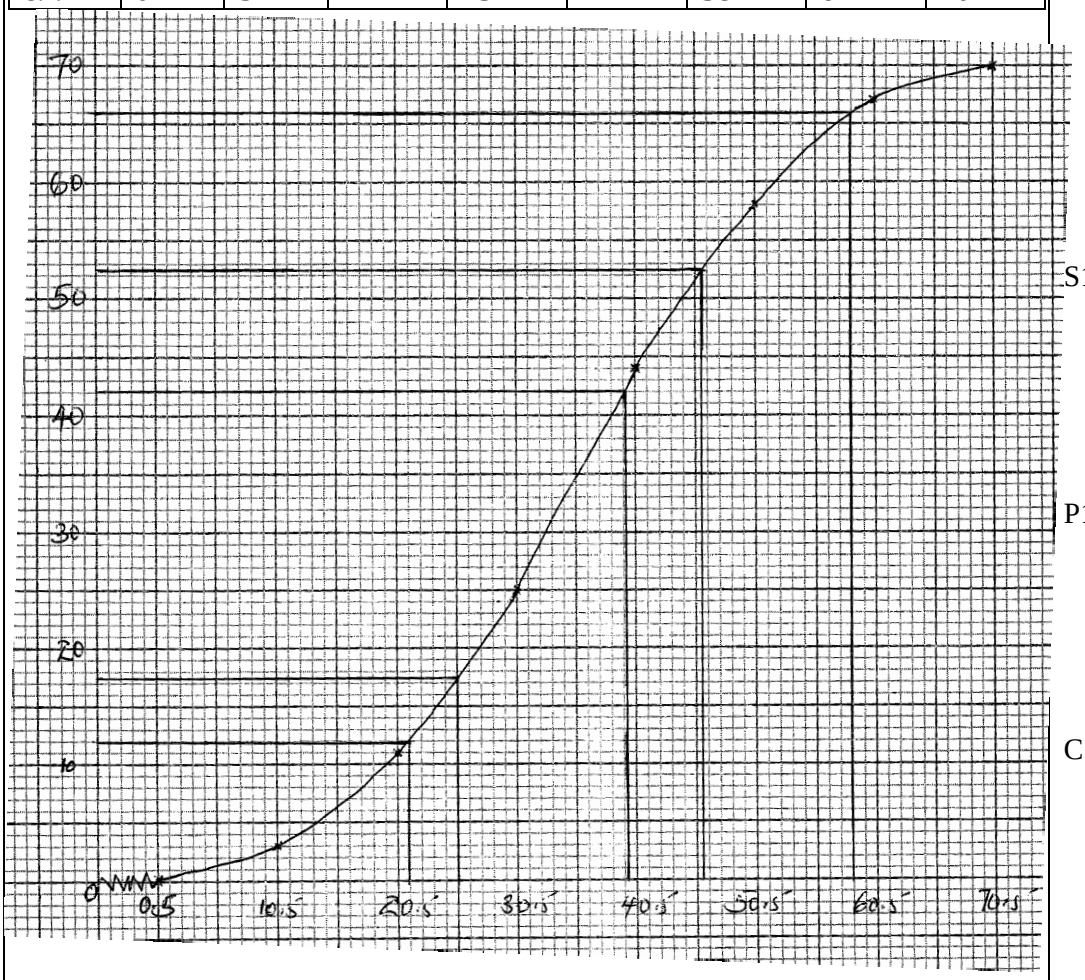
	$= 13{,}346\frac{2}{3}\ Km$	A1	
	b) $\emptyset \times 60^0 \times Cos60^0 = 480 \times 8$	M1	
	$\emptyset = \frac{480 \times 8}{60^0 \times 0.5} = 16 \times 8$	M1	
	$= 128^0$	A1	
	$C\left(60^0N, (128-62)^0W\right)$		
	$C\left(60^0N, 66^0W\right)$	B1	
	c) Time difference = $\frac{128 \times 4}{60}$ = 8hrs 32mins local time at C = 1730hrs – 8hrs 32 Min	M1	
	Local time C = 8.58 a.m	A1	
	d) Total distance moved = $(120 \times 60)nm + (128 \times 60 \times Cos\ 60)nm$	M1	
	$7200 + 3840$		
	$= 11{,}040nm$	A1	
		10 Mks	
18.	a) $A = \frac{k \times \sqrt{B}}{C^2}$ $4 = \frac{k \times \sqrt{64}}{5^2}$ $k = \frac{4 \times 25}{8} = \frac{100}{8}$ $= 12.5$ $A = \frac{12.5\sqrt{B}}{C^2}$	M1 M1 A1 B1	Value of the constant
	b) $A = \frac{12.5 \times \sqrt{16}}{10^2} = \frac{12.5 \times 4}{100} = \frac{50}{100}$	M1	
	$= 0.5$	A1	
	c) $Change\ in\ A = \frac{k \times \sqrt{\frac{100+44}{100}B}}{\left(\frac{100-20}{100}C\right)^2}$		

	$= \frac{k \times \sqrt{1.44B}}{(0.8C)^2}$ $A = \frac{1.2}{0.64}\frac{k\sqrt{B}}{C^2}$ $A = 1.875\ \frac{k\sqrt{B}}{C^2}$ $= 1.875$ $\%Change\ in\ A = \left(\frac{1.875-1}{1}\right) \times 100$ $= 0.875 \times 100$ $= 87.5\%\ Increase$	M1 A1 M1 A1	
		10 Mks	
19.	a) Portion filled in one minute $\frac{1}{6}+\frac{1}{24}+\frac{1}{36}-\frac{1}{72}=\frac{12+3+2-1}{72}$ $= \frac{2}{9}$ a) (i) Portion filled in 1½ min $\frac{2}{9}\times\frac{3}{2}=\frac{1}{3}$ (ii) work done in 1minutes 12 seconds. $\frac{1}{6}+\frac{1}{24}$ $=\frac{5}{24}\times 1\frac{12}{60}=\frac{5}{24}\times\frac{6}{5}$ $=\frac{1}{4}$ $Total\ work\ done\ in\ 2\ minute\ 42\ seconds$ $\frac{1}{3}+\frac{1}{4}$ $=\frac{7}{12}$ (c) Portion left unfilled after 2 minutes 42 seconds. $\left(1-\frac{7}{12}\right)\div\left(\frac{1}{36}-\frac{1}{72}\right)=\frac{5}{12}\div\frac{1}{72}=\frac{5}{12}\times 72$ $= 30\ minutes$ $Totaltime\ taken$ $= 2minutes\ 42\ seconds + 30\ minutes$ $= 32minutes\ and\ 42\ seconds$	M1 A1 B1 M1 M1 M1 A1 M1 M1 A1	

		10 Mks	
20.			
	a) $i)\ AC = \sqrt{12^2 + 5^2} = \sqrt{144 + 25} = \sqrt{169}$	M1	
	$= 13cm$	A1	
	$ii)\ Tan\ \theta\ (\angle VAM) = \frac{8}{6.5} = 1.2308$	M1	
	$\theta = 50.91^0$	A1	
	$iii)\ Tan\beta\ (\angle VCM) = \frac{8}{2.5} = 3.2$	M1	
	$\beta = 72.65^0$	A1	
	b) $CV = WV = \sqrt{8^2 + 2.5^2} = \sqrt{70.25} = 8.382cm$	B1	For CV or WY
	$WY = \frac{1}{2}WV = \frac{1}{2} \times 8.382 = 4.191cm$		
			
	c) $Sin72.67^0 = \frac{YZ}{4.191} YZ = 4.191 \times Sin72.65^0 = 4.191 \times 0.9545$		
	YZ= $4.000cm$		
	$Cos72.65^0 = \frac{ZW}{4.191}\ ZW = Cos72.65^0 \times 4.191 = 0.2982 \times 4.191$	M1	

	$ZW = 1.250$ $Hence\ CZ = 5 - 1.25 = 3.75cm$ $Tan\ \theta(\angle YCZ) = \frac{4}{3.75} = 1.067\ \theta = 46.86^0$ $Tan\ \sigma(\angle VCY) = 72.65^0 - 46.86^0$ $\sigma = 25.79^0$	M1 A1	
		10 Mks	
21.		B1	For the CF

Mass		1-10	11-20	21-30	31-40	41-50	51-60	61-70
f		3	8	14	19	14	9	3
UCB	0.5	10.5	20.5	30.5	40.5	50.5	60.5	70.5
c.f.	0	3	11	25	44	58	67	70



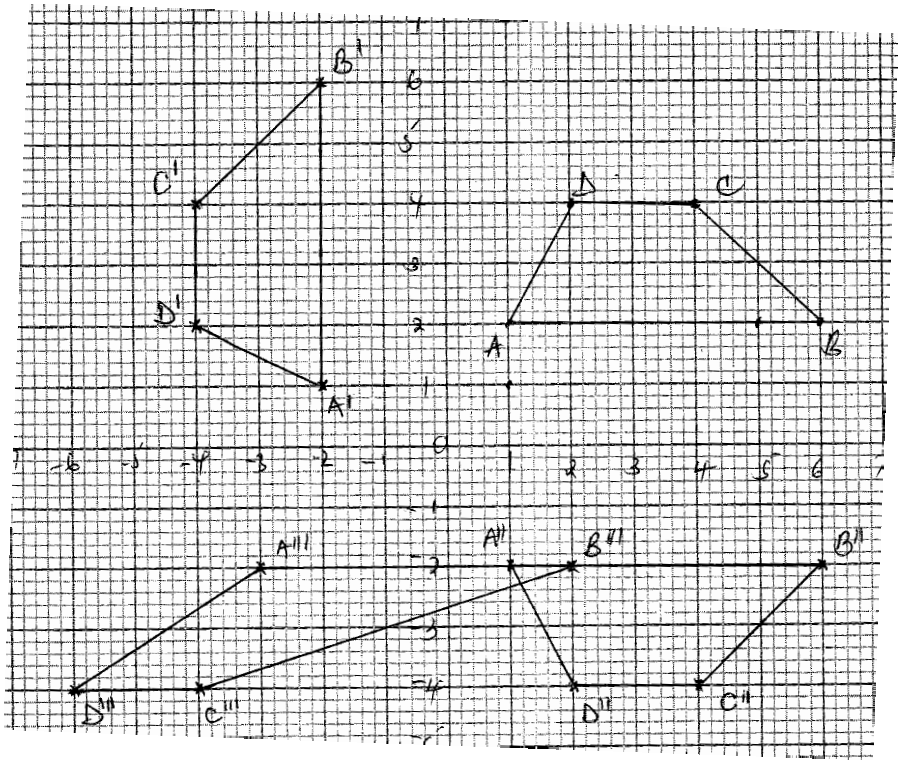
S1

P1

C1

i) The 60th percentile

	$\frac{60}{100} \times 70 = 42^{nd} Entry$ $60th\ percentile = 39.5g$ ii) The quartile deviation $Q_1 Entry = \frac{1}{4} \times 70 = 17.5^{th}\ Entry\ \ Q_1 = 25.5g$ $Q_3 Entry = \frac{3}{4} \times 70 = 52.5^{th}\ Entry\ \ Q_3 = 46.g$ quartile deviation $= \frac{20.5}{2}$ $= 10.25$ iii) The percentage of passion fruits to the nearest two decimal places whose masses lie in the range 21.5g to 58.5g. $\frac{66-12}{70} \times 100 = \frac{54}{70} \times 100$ $= 77.14\%$	B1 B1 M1 A1 M1 A1	For Q_1 or Q_3 $\frac{Q_3 - Q_1}{2} = \frac{46-25.5}{2}$
		10 Mks	
22.	a) $\frac{128}{2^{2x+2}} = \frac{4^{3x}}{128} \equiv \frac{2^7}{2^{2x}} = \frac{2^{2(3x)}}{2^7}$ $= 2^{7-(2x+2)} = 2^{6x-7}$ $7 - 2x - 2 = 6x - 7 \equiv 5 - 2x = 6x - 7$ $5 + 7 = 6x + 2x \equiv 12 = 8x$ $= x = 1.5$ b) $third = 2^{2\times1.5+2}, fourth = 128\ fifth = 4^{3\times1.5}$ $hence\ \ third = 32, fourth = 128\ fifth = 512$ $r = \frac{512}{128} or \frac{128}{32}$ $= 4$	M1 A1 M1 A1	

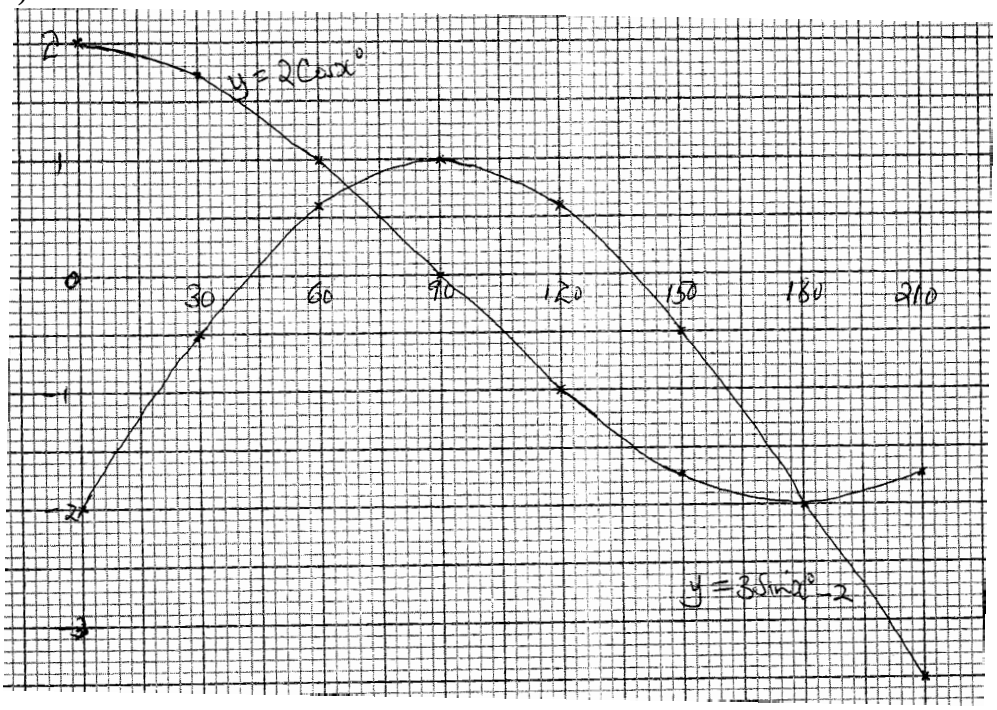
	c) $S_{10} = \frac{2(4^{10}-1)}{(4-1)} = \frac{2\times(1048576-1)}{3}$ $= \frac{2\times 1048575}{3}$ $= 699{,}050$ d) $a = 8\ d = 32-8 = 24\ S_{30} = \frac{30}{2}(2\times 8 + 24(30-1))$ $= 15(16 + 29\times 24) = 15\times 712$ $= 10{,}680$	M1 M1 A1 B1 M1 A1	
		10 Mks	
23.	a) $\begin{pmatrix}0 & -1\\ 1 & 0\end{pmatrix}\begin{pmatrix}A & B & C & D\\ 2 & 6 & 4 & 2\\ 2 & 2 & 4 & 4\end{pmatrix}=\begin{pmatrix}A' & B' & C' & D'\\ -2 & -2 & -4 & -4\\ 1 & 6 & 4 & 2\end{pmatrix}$ $A'B'C'D'$ on the grid  (b) $\begin{pmatrix}0 & 1\\ 1 & 0\end{pmatrix}\begin{pmatrix}A' & B' & C' & D'\\ -2 & -2 & -4 & -4\\ 1 & 6 & 4 & 2\end{pmatrix}$ $=\begin{pmatrix}A'' & B'' & C'' & D''\\ 1 & 6 & 4 & 2\\ -2 & -2 & -4 & -4\end{pmatrix}$ $A''B''C''D''$ on the grid	B1 B1 B1 M1 A1 B1	Object ✓ly plotted and drawn Image 1 ✓ly plotted and drawn

	(c)(i) $\begin{pmatrix}1 & K\\0 & 1\end{pmatrix}\begin{pmatrix}6\\-2\end{pmatrix}=\begin{pmatrix}2\\-2\end{pmatrix}$ $\equiv 6-2K=2,$ $-2K=-4$ $HENCE\ K=2$ $\begin{pmatrix}1 & 2\\0 & 1\end{pmatrix}$ Shear matrix (ii) $\begin{pmatrix}1 & 2\\0 & 1\end{pmatrix}\begin{pmatrix}A'' & B'' & C'' & D''\\1 & 6 & 4 & 2\\-2 & -2 & -4 & -4\end{pmatrix}=\begin{pmatrix}A''' & B''' & C''' & D'''\\-3 & 2 & -4 & -6\\-2 & -2 & -4 & -4\end{pmatrix}$ $A'''B'''C'''D'''$ on the grid	M1 A1 B1 B1	
		10 Mks	
24.	a) To complete the table below by filling the blank spaces		

x^0	0	30	60	90	120	150	180	210
$y=3\ Sin\ x^0-2$	-2	-0.5	0.60	**1**	**0.60**	**-0.5**	**-2**	**-3.5**
$y=2Cos\ x^0$	2	1.73	1	**0**	**-1**	-1.73	**-2**	**-1.73**

B2 — B_1 for 6✓

b)



S1
P1 $y=3\ Sin\ x^0-2$
C1 For $y=3\ Sin\ x^0-2$
P1 For $y=2Cos\ x^0$
C1 For $y=2Cos\ x^0$

c)
$y=3\ Sin\ x^0-2Cos\ x^0=2$
$y=3\ Sin\ x^0-2=2Cos\ x^0$
$x_1=67.5^0, x_2=180^0$ — B1

d) State the amplitude of
a) $y=3\ Sin\ x^0-2=3$ — B1
b) $y=2Cos\ x^0=2$ — B1

		10 Mks	