MASENO SCHOOL, BUTULA BOYS, ST MARY'S YALA & KISUMU BOYS

JULY/AUGUST MOCK

121/2 – MATHEMATICS Paper 2 (Alt. A)

MARKING SCHEME

CONFIDENTIAL

Examiner's Name .....

School.....

Date of Marking .....

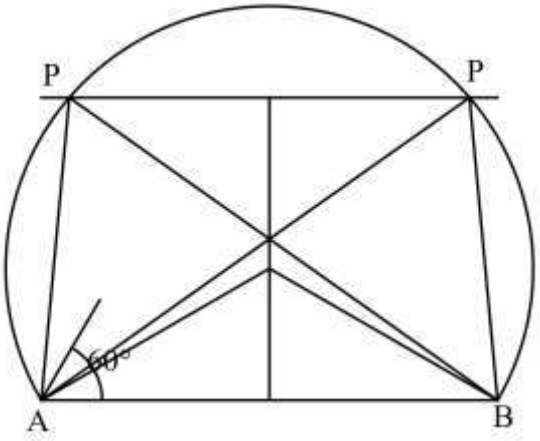
Marking Guidelines

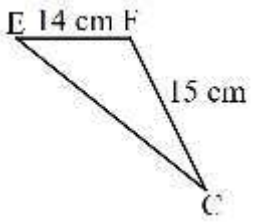
- Examiners are advised to follow the marking scheme strictly.
- All marks to be awarded as indicated against each step.
- Examiners are advised to follow through the candidate's work whenever a legitimate alternative method is used and award full marks accordingly.
- Cross – check final answers against method marks.
- For unclear or ambiguous solution, consult with the **team leader**.

SECTION I (50 marks)

NO.	WORKINGS	MARKS	COMMENTS
1	Maximum area $= 12.55 \times 9.65 = 121.1075$ Minimum area $= 12.45 \times 9.55 = 118.8975$ Absolute error $= \dfrac{121.1075 - 118.8975}{2}$ $= 1.105$ Percentage error $= \dfrac{1.105}{120} \times 100$ $= 0.9208\%$	M1 M1 A1	$\left(\dfrac{0.05}{12.5} + \dfrac{0.05}{9.6}\right) \times 100$ M1M1 $= \dfrac{221}{240} \approx 0.9208$ A1
	TOTAL MARKS	**3**	
2	$\dfrac{5}{\sqrt{3}-\sqrt{2}} - \dfrac{5}{\sqrt{3}+\sqrt{2}} = \dfrac{5\left(\sqrt{3}+\sqrt{2}\right) - 2\left(\sqrt{3}-\sqrt{2}\right)}{\left(\sqrt{3}-\sqrt{2}\right)\left(\sqrt{3}+\sqrt{2}\right)}$ $= \dfrac{5\sqrt{3}+5\sqrt{2}-2\sqrt{3}+2\sqrt{2}}{\left(\sqrt{3}\right)^2 - \left(\sqrt{2}\right)^2}$ $= 3\sqrt{3} + 7\sqrt{2}$ $\therefore a = 7,\ b = 3$	M1 A1 B1	
	TOTAL MARKS	**3**	
3	In 1 minute $= \dfrac{1}{6} + \dfrac{1}{4} - \dfrac{1}{8} = \dfrac{7}{24}$ In $1\dfrac{1}{2}$ minutes $= \dfrac{3}{2} \times \dfrac{7}{24} = \dfrac{7}{16}$ $1 - \dfrac{7}{16} = \dfrac{9}{16}$ 1 minute $= \dfrac{1}{6} + \dfrac{1}{4} = \dfrac{2+3}{12} = \dfrac{5}{12}$ $\therefore \dfrac{9}{16} \div \dfrac{5}{12} \times 1 = 1.35$ Total time $= 1.35 + 1.5 = 2.85$ minutes	M1 M1 A1	
	TOTAL MARKS	**3**	
4	$\log_4\left(\dfrac{x^2+4x+4}{3x-2}\right) = \log_4 4$ $\dfrac{x^2+4x+4}{3x-2} = 4$ $x^2 + 4x + 4 = 12x - 8$ $x^2 - 8x + 12 = 0$ $(x-2)(x-6) = 0$ $x = 2$ or $x = 6$	M1 M1 A1	
	TOTAL MARKS	**3**	

No.	WORKINGS	MARKS	COMMENTS
5	(a) $=32-\frac{80}{3}x+\frac{80}{9}x^2-\frac{40}{27}x^3+\frac{10}{81}x^4-\frac{1}{243}x^5$	B1	
	(b) $=32-\frac{80}{3}(0.3)+\frac{80}{9}(0.3)^2-\frac{40}{27}(0.3)^3$	M1	
	$=24.76$	A1	
	TOTAL MARKS	**3**	
6	$6(1-\sin^2 x)+\sin x-4=0$		
	$6-6\sin^2 x+\sin x-4=0$		
	$6\sin^2 x-\sin x-2=0$	M1	✓ Equation
	$(2\sin x+1)(3\sin x-2)=0$		
	$\sin x=-\frac{1}{2}$ or $\frac{2}{3}$	A1	
	$x=41.81^\circ,\ 138.19^\circ,\ 210^\circ,\ 330^\circ$	B1	✓ All values
	TOTAL MARKS	**3**	
7	$k\left(n+\frac{2}{d}\right)=m$	M1	
	$n+\frac{2}{d}=\frac{m}{k}$		
	$\frac{2}{d}=\frac{m}{k}-n=\frac{m-kn}{k}$	M1	
	$d=\frac{2k}{m-kn}$	A1	
	TOTAL MARKS	**3**	
8	$\begin{pmatrix}-1\\5\\-6\end{pmatrix}=\frac{5}{2}\begin{pmatrix}2\\-4\\3\end{pmatrix}-\frac{3}{2}\mathbf{OB}$	M1	✓ Eqn leading to **OB**
	$\frac{3}{2}\mathbf{OB}=\frac{5}{2}\begin{pmatrix}2\\-4\\3\end{pmatrix}-\begin{pmatrix}-1\\5\\-6\end{pmatrix}=\begin{pmatrix}6\\-15\\13.5\end{pmatrix}$		
	$\mathbf{OB}=\frac{2}{3}\begin{pmatrix}6\\-15\\13.5\end{pmatrix}=\begin{pmatrix}4\\-10\\9\end{pmatrix}$	A1	✓ Vector **OB**
	$\therefore \mathrm{B}(4,-10,9)$	B1	✓ Coordinates of B
	TOTAL MARKS	**3**	

NO.	WORKINGS	MARKS	COMMENTS
9	$P = ky^2 + \frac{h}{y}$ $6 = 4k + \frac{h}{2} \quad \Rightarrow 8k + h = 12$ $10 = 16k + \frac{h}{4} \quad \Rightarrow 64k + h = 40$ $\Rightarrow -56k = -28 \ \therefore k = \frac{1}{2},\ h = 8$ $P = \frac{1}{2}y^2 + \frac{8}{y}$ $P = \frac{1}{2}(8)^2 + \frac{8}{8} = 33$	M1 A1 B1	✓ Linear eqns formed ✓ CAO
	TOTAL MARKS	**3**	
10		B1 B1 B1 B1	$12 = \frac{1}{2} \times 6 \times h$ $h = 4$ cm ✓ Constant distance locus ✓ Constant angle locus ✓ Location of P
	TOTAL MARKS	**4**	
11	$1800000(1.12)^n = 4500000(0.95)^{3n}$ $\left(\frac{1.12}{0.95^3}\right)^n = 2.5$ $1.3063^n = 2.5$ $n = \frac{\log 2.5}{\log 1.3063}$ $n = 3.429 \approx 3.4$ yrs	M1 M1 A1	
	TOTAL MARKS	**3**	
12	Area of $\Delta A'B'C' = \frac{1}{2} \times 6 \times 5 = 15$ sq. units $\lvert\mathbf{T}\rvert = (2 \times 1) - (-1 \times 3) = 5$ Area of $\Delta ABC = \frac{15}{5}$ $= 3$ sq. units	M1 M1 A1	
	TOTAL MARKS	**3**	

NO.	WORKINGS	MARKS	COMMENTS
13	(a) $\angle \text{ROT} = 90^\circ + 26^\circ = 116^\circ$ $\angle \text{RST} = \frac{1}{2} \times 116^\circ$ $\angle \text{RST} = 58^\circ$ (b) $\frac{12}{\sin 58^\circ} = 2r$ $r = \frac{12}{2\sin 58^\circ} = 7.075 \approx 7.1 \text{ cm}$	 M1 A1 M1 A1	
	TOTAL MARKS	**4**	
14	$x^2 + y^2 + 4x + \text{k}y = 12$ $(x+2)^2 + \left(y + \frac{k}{2}\right)^2 = 12 + 4 + \frac{k^2}{4}$ $16 + \frac{k^2}{4} = 5^2$ $\frac{k^2}{4} = 9 \Rightarrow k^2 = 36 \therefore k = 6 \text{ or } -6$ Possible centres are $(-2,-3)$ and $(-2,3)$	 M1 A1 B1	
	TOTAL MARKS	**3**	
15	$\text{CE} = \sqrt{15^2 - 6^2 + 20^2} = 24.27 \text{ cm}$ $14^2 = 24.27^2 + 15^2 - 2 \times 24.27 \times 15 \times \cos\theta$ $\cos\theta = 0.8488$ $\theta = 31.92^\circ$	M1 M1 A1	
	TOTAL MARKS	**3**	
16	$y = \int (3x^2 + 4x - 5)\,dx$ $y = x^3 + 2x^2 - 5x + c$ When $x = 1,\ y = -4$ $-4 = (1)^3 + 2(1)^2 - 5(1) + c$ $-4 = 1 + 2 - 5 + c$ $c = -2$ $y = x^3 + 2x^2 - 5x - 2$	 M1 M1 A1	
	TOTAL MARKS	**3**	

17 (a) $\dfrac{(600\times 50)+(420\times 30)}{50+30}=\dfrac{30000+12600}{80}$ — M1

$=\dfrac{42600}{80}=532.50$ — A1

S.P per bag $=\dfrac{120}{100}\times 532.50$ — M1

$=$ Ksh 639 — A1

(b) $600x+420y=528(x+y)$ — M1

$600x-528x=528y-420y$

$72x=108y$ — M1

$2x=3y$

$\Rightarrow x:y=3:2$ — A1

(c) Type A:Type B $=\left(\dfrac{5}{8}+\dfrac{3}{5}\right):\left(\dfrac{3}{8}+\dfrac{2}{5}\right)$ — M1

$=\dfrac{49}{40}:\dfrac{31}{40}=49:31$

Percentage of type A $=\dfrac{49}{80}\times 100$ — M1

$=61.25\%$ — A1

	TOTAL MARKS	**10**	

18 (a) (i)

x	d	f	fd	fd^2
52	−10	5	−50	500
57	−5	8	−40	200
62	0	15	0	0
67	5	10	50	250
72	10	8	80	800
77	15	4	60	900
		50	100	2650

B1 fd

B1 fd^2

$\bar{x}=62+\dfrac{100}{50}$ — M1

$\bar{x}=64$ — A1

(ii) S.D $=\sqrt{\dfrac{2650}{50}-\left(\dfrac{100}{50}\right)^2}$ — M1

S.D $=\sqrt{53-4}=\sqrt{49}=7$ — A1

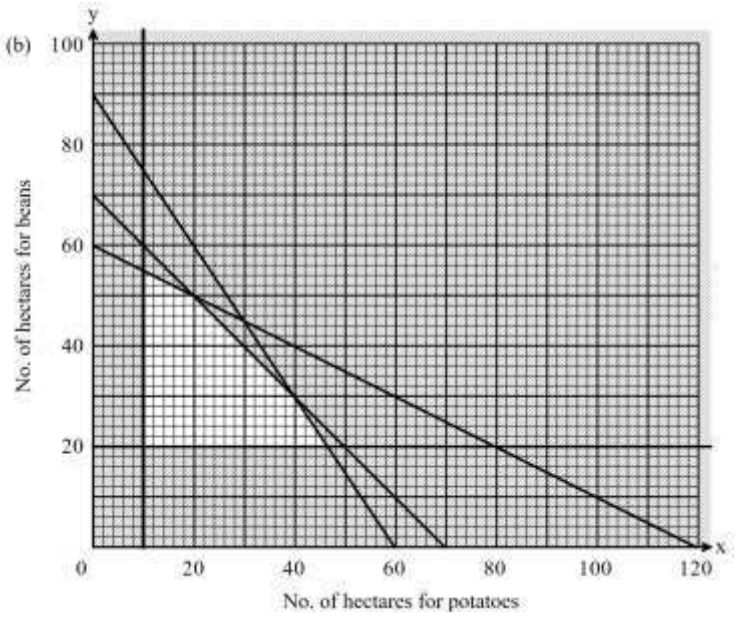
(b) $64.5+\dfrac{5(x-28)}{10}>68$ — M1

$x-28>7$ — M1

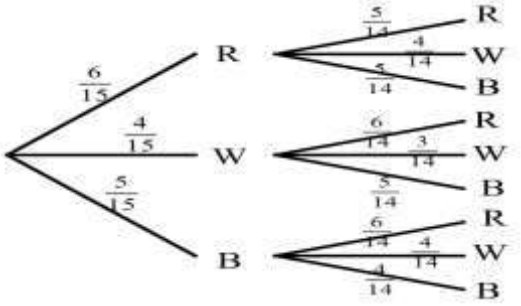
$x>35$ — A1

$\Rightarrow$ from 36 to 50 =15 students — B1

	TOTAL MARKS	**10**	

19	(a) $a+4d=60$ $a+9d=45$ $\Rightarrow -5d=15$ $d=-3,\ a=72$ (b) $\frac{n}{2}\left[144+(-3)(n-1)\right]<0$ $\frac{n}{2}(144-3n+3)<0 \Rightarrow \frac{n}{2}(147-3n)<0$ $147-3n<0 \Rightarrow -3n<-147$ $n>49$ $\therefore$ The least number of terms is 50 $S_{50}=\frac{50}{2}(144+49\times -3)$ $S_{50}=-75$ (c) $\left.\begin{matrix}T_5=72+4(-3)=60\\T_{10}=72+9(-3)=45\end{matrix}\right\}\Rightarrow r=\frac{45}{60}=\frac{3}{4}$ $T_6=60\times\left(\frac{3}{4}\right)^5$ $T_6=14\frac{61}{256}$	M1 M1 A1 M1 M1 A1 M1 A1 M1 A1	but $\frac{n}{2}\neq 0$
	TOTAL MARKS	**10**	
20	(a) $x+y\leq 70$ $2x+4y\leq 240$ or $x+2y\leq 120$ $3000x+2000y\leq 180000$ or $3x+2y\leq 180$ $x\geq 10, y\geq 20$	B1 B1 B1 B1	
	(b)  	B1 B1 B1 B1 B1	
	(c) $15\ 000(40)+10\ 000(30)$ = Ksh 900 000	M1 A1	
	TOTAL MARKS	**10**	

21



B2

(b)(i) $\left(\frac{6}{15}\times\frac{5}{14}\right)+\left(\frac{4}{15}\times\frac{6}{14}\right)+\left(\frac{5}{15}\times\frac{6}{14}\right)$ M1

$\frac{1}{7}+\frac{4}{35}+\frac{1}{7}=\frac{2}{5}$ A1

(ii) $\left(\frac{6}{15}\times\frac{5}{14}\right)+\left(\frac{4}{15}\times\frac{3}{14}\right)+\left(\frac{5}{15}\times\frac{4}{14}\right)$ M1

$\frac{1}{7}+\frac{2}{35}+\frac{2}{21}=\frac{31}{105}$ A1

(iii) $\left(\frac{6}{15}\times\frac{5}{14}\right)+\left(\frac{6}{15}\times\frac{5}{14}\right)+\left(\frac{5}{15}\times\frac{6}{14}\right)+\left(\frac{5}{15}\times\frac{4}{14}\right)$ M1

$\frac{1}{7}+\frac{1}{7}+\frac{1}{7}+\frac{2}{21}=\frac{11}{21}$ A1

(iv) $\left(\frac{6}{15}\times\frac{5}{14}\right)+\left(\frac{4}{15}\times\frac{5}{14}\right)+\left(\frac{5}{15}\times\frac{6}{14}\right)+\left(\frac{5}{15}\times\frac{4}{14}\right)+\left(\frac{5}{15}\times\frac{4}{14}\right)$ M1

$\frac{1}{7}+\frac{2}{21}+\frac{1}{7}+\frac{2}{21}+\frac{2}{21}=\frac{4}{7}$ A1

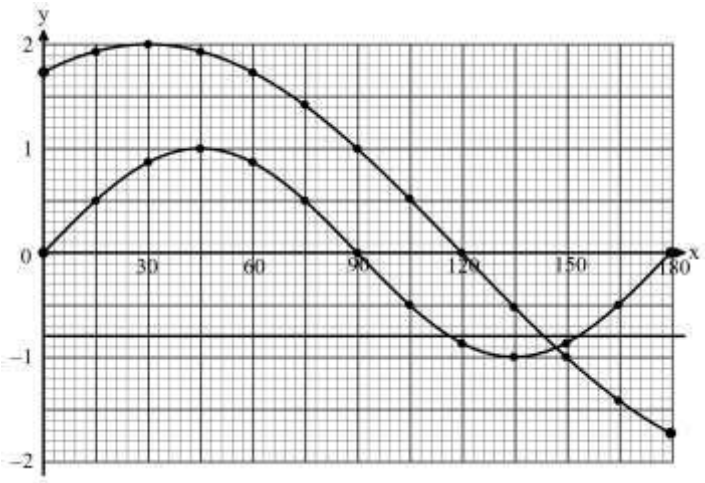
		TOTAL MARKS	**10**	

22

x°	0	15	30	45	60	75	90	105	120	135	150	165	180
$\sin 2x$	0	0.50	0.87	1.00	0.87	0.50	0	−0.50	−0.87	−1.00	−0.87	−0.50	0.00
$2\cos(x-30^\circ)$	1.73	1.93	2.00	1.93	1.73	1.42	1.00	0.52	0	−0.52	−1.00	−1.42	−1.73

B1

B1



P1

C1

P1

C1

L1

(c) (i) 147° B1

(ii) $2-1=1$ B1

(iii) 144° B1

		TOTAL MARKS	**10**	

23	(a) (i) Distance $= \frac{\theta}{360} \times 2 \times \frac{22}{7} \times 6370 = 8008$ km	M1	
	$\theta = \frac{8008 \times 360 \times 7}{2 \times 22 \times 6370} = 72^\circ$	M1	
	Latitude of A $= 72 - 12 = 60^\circ\text{S} \Rightarrow \text{A}(60^\circ\text{S}, 110^\circ\text{W})$	A1	
	(ii) Long. difference $= 160^\circ + 110^\circ = 270^\circ$	B1	90^o seen
	$\Rightarrow \frac{90}{360} \times 2 \times \frac{22}{7} \times 6370 \times \cos 60^\circ$	M1	
	$= 5005$ km	A1	
	(b) (i) Time difference $= 270 \times 4 = 1080$ min $= 18$ hrs		
	Local time at C = Mon 0730 hrs + 18 hrs	M1	
	= Tuesday 0130 hrs	A1	
	(ii) Time taken from A to C $= \frac{5005}{550} = 9$ hrs 6 min		
	$\therefore$ Arrival time at C = Tuesday 0130 hrs + 9 hrs 6 min	M1	
	= Tuesday 1036 hrs	A1	
	TOTAL MARKS	**10**	
24	(a) (i) $\begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 2 \\ 3 \end{pmatrix} = \begin{pmatrix} 8 \\ 3 \end{pmatrix} \Rightarrow \begin{pmatrix} 2+3k \\ 3 \end{pmatrix} = \begin{pmatrix} 8 \\ 3 \end{pmatrix}$	M1	
	$2 + 3k = 8 \Rightarrow k = 2$		
	Matrix $= \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$	A1	
	(ii) $\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 5 & 4 \\ 2 & -1 \end{pmatrix} = \begin{pmatrix} 9 & 2 \\ 2 & -1 \end{pmatrix}$	M1	
	$\therefore$ B′(9, 2), C′(2, −1)	A1	
	(b) (i) $\begin{pmatrix} -2 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 8 & 9 & 2 \\ 3 & 2 & -1 \end{pmatrix} = \begin{pmatrix} -16 & -18 & -4 \\ 3 & 2 & -1 \end{pmatrix}$	M1	
	$\therefore$ A″(−16, 3), B″(−18, 2), C″(−4, −1)	A1	
	(ii) A stretch, y − axis invariant/parallel to x − axis, scale factor -2.	B2	
	(c) $\begin{pmatrix} -2 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} -2+0 & -4+0 \\ 0+0 & 0+1 \end{pmatrix} = \begin{pmatrix} -2 & -4 \\ 0 & 1 \end{pmatrix}$	M1	
	Inverse $= -\frac{1}{2}\begin{pmatrix} 1 & 4 \\ 0 & -2 \end{pmatrix} = \begin{pmatrix} -0.5 & -2 \\ 0 & 1 \end{pmatrix}$	A1	
	TOTAL MARKS	**10**	