MARANDA HIGH SCHOOL
MOCK PAPER 2 MATHEMATICS 2022
MARKING SCHEME

NO	WORKING	MARKS	COMMENTS
1.	$actual\ s.a = \frac{22}{7}\left(10^2 + 10(15)\right) = 785\frac{5}{7}cm^2$ $\max.\ s.a. = \frac{22}{7}\left(10.02^2 + 10.02(15.04)\right) = 789.1752cm^2$ $\min.\ s.a. = \frac{22}{7}\left(9.98^2 + 9.98(14.96)\right) = 782.2609cm^2$	B1	For either max. or min. surface area
	$\%error = \frac{789.1752 - 782.2609}{2 \times 785\frac{5}{7}} \times 100\%$	M1	Evaluation of % error
	$= 0.440\%$	A1	accuracy
		03	
2.	$let\ \log_2 p = r$ $r^2 - 4t + 3 = 0$ $(r-1)(r-3) = 0$ $r = 1\ or\ r = 3$	M1	Correct attempt to solve quadratic equation
	$\log_2 p = 1 \Rightarrow p = 2^1 = 2$ $\log_2 p = 3 \Rightarrow p = 2^3 = 8$	M1	Correct equations leading to P
		A1	accuracy
		03	
3.	$5\cos^2\phi + 2 = 3\left(1 - c\cos^2\phi\right) - 2\cos\phi$ $8\cos^2\phi + 2\cos\phi - 1 = 0$	M1	Equation in one type of trigonometric ratio
	$8\cos^2\phi + 4\cos\phi - 2\cos\phi - 1 = 0$ $(2\cos\phi + 1)(4\cos\phi - 1) = 0$	M1	Correct attempt to solve quadratic equation
	$\cos\phi = -\frac{1}{2}\ or\ \frac{1}{4}$	A1	Accuracy
	$\phi = 120^0, -120^0, 75.52^0\ and\ -75.52^0$	B1	All angles correct
		04	

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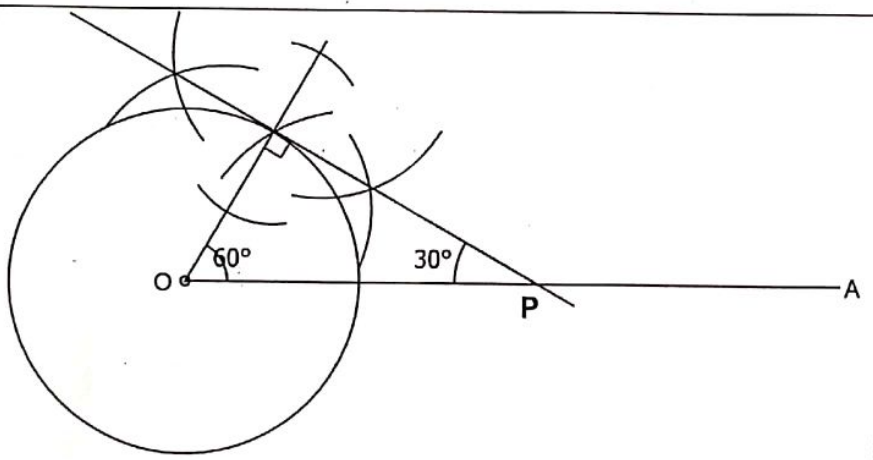
4.	$\frac{2}{\sin Z}=\frac{2\sqrt{3}-1}{\sin 60}$	M1	Correct equation in Z
	$\sin Z=\frac{2\sin 60}{2\sqrt{3}-1}=\frac{2\left(\frac{\sqrt{3}}{2}\right)}{2\sqrt{3}-1}$	M1	Rationalizing denominator
	$\sin Z=\frac{\sqrt{3}}{2\sqrt{3}-1}\times\frac{2\sqrt{3}+1}{2\sqrt{3}+1}=\frac{6+\sqrt{3}}{12-1}$		
	$=\frac{6+\sqrt{3}}{11}$	A1	Accuracy
		03	
5.		B1	Construction of angle 60° at O to meet circle at point X
		B1	Construction of perpendicular bisector at X to meet OA at P
		B1	Tangent drawn and P labelled
		03	
6.	$P^n=ar^2-s$	M1	Nth square on both sides
	$P^n+s=ar^2$		
	$r^2=\frac{P^n+s}{a}$	M1	Making r^2 the subject
	$r=\pm\sqrt{\frac{P^n+s}{a}}$	A1	accuracy
		03	

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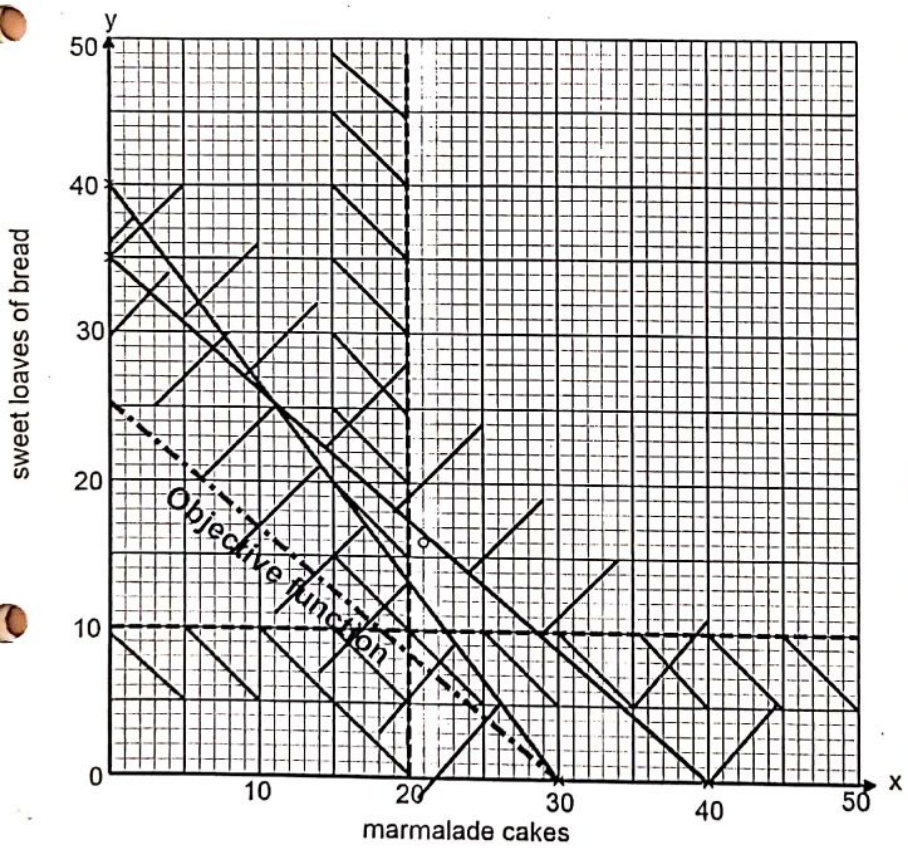
$\left(y-\frac{b}{y^2}\right)^6 = 1\bullet y^6\left(\frac{b}{y^2}\right)^0 - 6y^5\left(\frac{b}{y^2}\right)^1 + 15y^4\left(\frac{b}{y^2}\right)^2$ $= y^6 - 6by^3 + 15b^2$ $\Rightarrow 15b^2 = 735$ *hence* $b = \sqrt{\frac{735}{15}} = \pm 7$	B1 M1 A1	Simplified expansion Equation leading to b Accuracy
	03	
	B1 B1 B1	Any 1st two inequalities drawn correctly 2nd two inequalities drawn correctly Objective function drawn
21 *marmalade cakes and* 16 *sweet loaves of bread*	B1	point(21,16)

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9.	$gross\ tax = 5449 + 2256 = Ksh\,7\,705$ $1^{st}\ slab = 16680 \times \frac{10}{100} = Ksh\,1\,668$ $2^{nd}\ slab = 12220 \times \frac{15}{100} = Ksh\,1\,833$ $3^{rd}\ slab = y \times \frac{20}{100} = 7705 - (1668 + 1833) = 4204$ $\Rightarrow y = Ksh\,21\,020$ $gross\ income = 16680 + 12220 + 21020 + 15000$ $= Ksh\,64\,920$	B1 M1 M1 A1	Gross tax Getting tax paid in 1st two slabs Getting amount taxed in 3rd slab Gross income
		04	
10.	$time\ difference = 6.40 - 2.20 = 4h\,20\,\text{min} = 260\,\text{min}$ (a) $angle\ difference = \frac{260}{4} = 65^0$ $latitude\ of\ \mathbf{B}\ is\ 35^0\,\text{E}$ (b) $65 \times 60\cos\alpha = 2900$ $\cos\alpha = 0.7436$ $\alpha = \cos^{-1} 0.7436 = 42.0^0\ S$	M1 A1 M1 A1	Getting angle difference Accurate latitude Expression for getting angle Accuracy
		04	
11.	$P = k\frac{R^2}{\sqrt{Q-S}}$ $P_{new} = k\frac{(1.13R^2)}{\sqrt{0.8Q-0.8S}} = 1.4276k\frac{R^2}{\sqrt{Q-S}}$ $\%change = \frac{1.4276-1}{1} \times 100\%$ $= 42.76\%$	B1 M1 A1	Expression for new P Expression for % change Accuracy
		03	

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12.	$a = 52000, r = 1.11, n = 13$ $S_{13} = 52000\dfrac{(1.11^{13}-1)}{1.11-1}$ $= 1,363,005.16$ $\simeq Ksh\,1,363,000$	M1 A1	Expression for getting amount after 13 years Accuracy to the nearest thousands
		02	
13.	*average velocity between* $t = 1$ *and* $t = 5$ $= \dfrac{(27.5-11.5)m}{(5-1)s}$ $= 4m/s$	M1 A1	Correct pair of read offs used appropriately accuracy
		02	
14.	$HM = \sqrt{15^2+8^2+3^2} = 17.26\,cm$ $MB = \sqrt{15^2+3^2} = 15.30\,cm$ $HB = 10\,cm$ $10^2 = 17.26^2 + 15.30^2 - 2\times17.26\times15.30\cos M$ $\cos M = 0.8179$ $M = \cos^{-1}0.8179 = 35.12^0$	B1 M1 A1	Any two sides of triangle HMB correct Equation leading to M Accuracy
		03	
15.	$527000 = 1500000\left(1-\frac{r}{100}\right)^6$ $0.3513 = \left(1-\frac{r}{100}\right)^6$ $0.8400 = 1-\frac{r}{100}$ $r = 16$	M1 M1 A1	Right equation formed Getting 6th root of both sides Accuracy
		03	

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16.	$\lvert s\rvert = \sqrt{6^2 + (-2)^2 + (-3)^2} = 7 \text{ units}$ $k\lvert \mathbf{s}\rvert = \lvert \mathbf{r}\rvert \Rightarrow 7k = 3.5$ $k = \frac{1}{2}$ $\mathbf{r} = \frac{1}{2}\begin{pmatrix} 6 \\ -2 \\ -3 \end{pmatrix}$ $= \begin{pmatrix} 3 \\ -1 \\ -1.5 \end{pmatrix}$	M1 M1 A1	Evaluation of Modulus of s Equation leading to Column vector **r** **Accuracy**
		03	

17.	a)		
	$BT = \sqrt{8(8+4.5)}$	M1	Finding BT
	$BT = 10\ cm$	A1	Accuracy
	b)		
	$8^2 = 10^2 + 4^2 - 2\times10\times4\cos B$	M1	Equation leading to B
	$\cos B = 0.650$		
	$B = 49^0$	A1	Accuracy
	c)		
	$R = \frac{4}{2\sin 49^0}$	M1	Equation leading to R
	$R = 2.65\ cm$	A1	Accuracy
	d)		
	$segment = \frac{98}{360}\times\frac{22}{7}\times2.65^2 - \frac{1}{2}\times2.65\times2.65\sin98^0$	M1	Expression for segment
	$= 6.008 - 3.477$	M1	Difference
	$= 2.531$		
	$shaded = \frac{1}{2}\times4\times10\sin49^0 - 2.531$	M1	Expression for shaded region
	$= 15.09 - 2.531$		
	$= 12.56 cm^2$	A1	Accuracy
		10	

18.	(a) . *fraction done by both in 1hr* $= 1 \div \frac{10}{3}$ $= 1 \times \frac{3}{10}$ $= \frac{3}{10}$	M1 A1	Expression Accuracy
	(b) *In 1hr both plough* $\frac{3}{10}$ $\therefore$ *In* $\frac{7}{6}$ *hrs both plough* $\frac{7}{6} \times \frac{3}{10} = \frac{7}{20}$ *remainder* $= 1 - \frac{7}{20}$ $= \frac{13}{20}$	M1 M1 A1	Expression Difference Accuracy
	(c) *A*: *In* $6\frac{1}{2}$ *hrs tractor A ploughs* $\frac{13}{20}$ $\therefore$ *In1hr it ploughs* $\frac{1}{\frac{13}{2}} \times \frac{13}{20} = \frac{2}{13} \times \frac{13}{20} = \frac{1}{10}$ *hence A takes 10hrs ploughing alone* *B*: *In 1h B ploughs* $\frac{3}{10} - \frac{1}{10} = \frac{1}{5}$ *hence B takes 5hrs ploughing alone*	M1 A1 B1	Expression Accuracy Accuracy
	(d) *fraction done by* $A = \frac{1}{10} \times \left(6\frac{1}{2} + 1\frac{1}{6}\right) = \frac{23}{30}$ *Amount earned through tractor* $A = \frac{23}{30} \times 90000$ $=$ *Ksh* 69 000	M1 A1	Expression Accuracy
		10	

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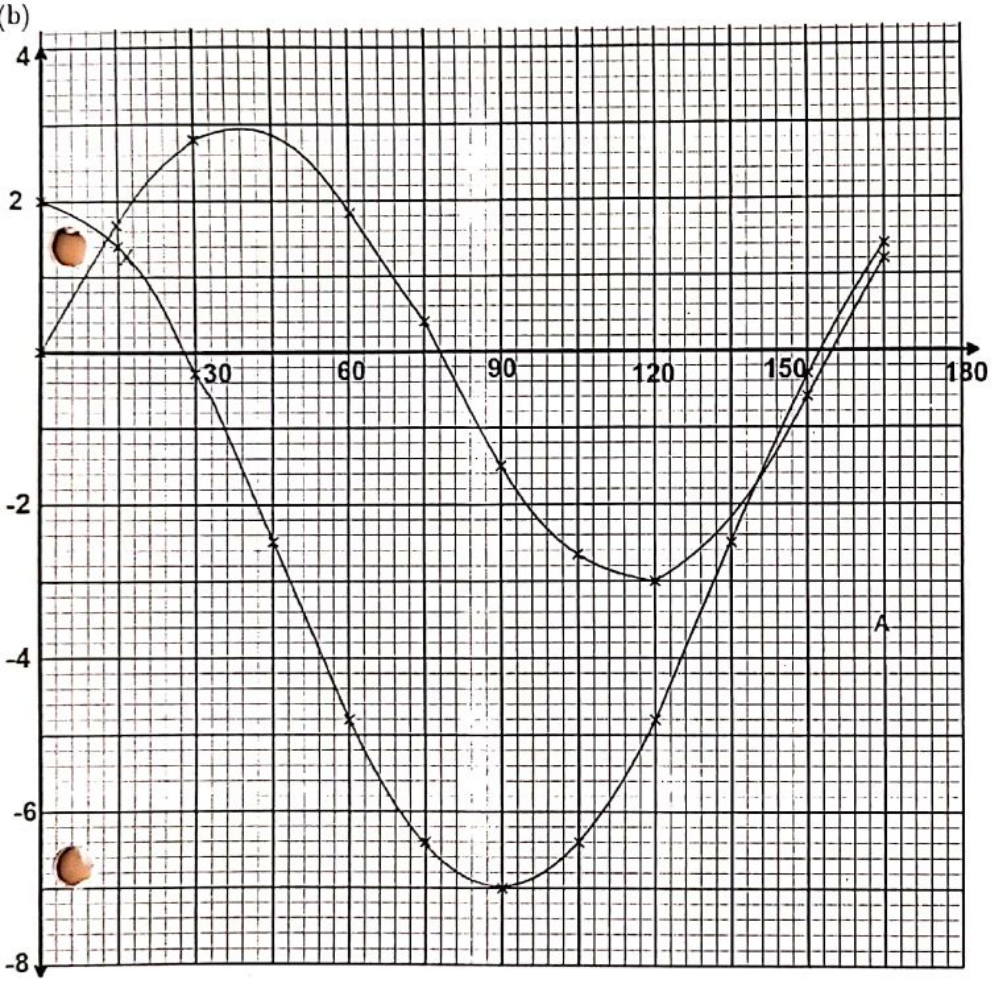
19. (a)

x^0	0	15	30	45	60	75	90	105	120	135	150	165
$y=\frac{9}{2}\cos(2x)^0-\frac{5}{2}$			-0.25		−4.8	−6.4		−6.4	−4.8		-0.25	
$y=3\sin\left(\frac{7}{3}x\right)^0$			2.8	2.9		0.3	−1.5			−2.1	−0.5	

B2 all values.

(b)



P1 – plotting 1st curve
C1 – 1st Curve Smooth
P1 – 2nd Curve Plotted
C1 – 2nd Curve Smooth

(c) $x=12^0\pm2$
$x=144^0\pm2$

B1 B1 for each value

(d)
Line $y=-5$ drawn — L1
$60^0<x<120^0$ — B1

TOTAL 10 MARKS

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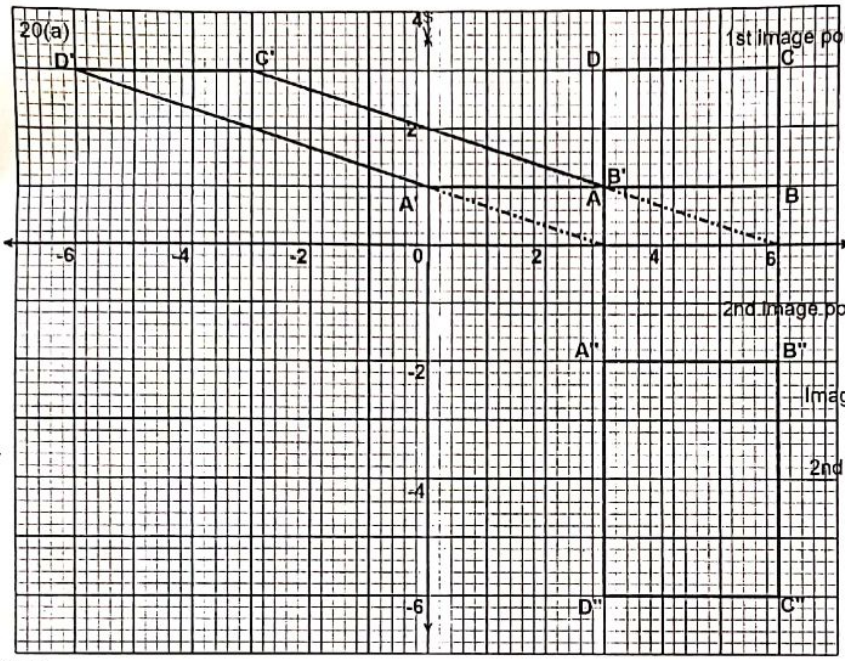
20. .



(b)

$$\begin{pmatrix}1 & k\\ 0 & 1\end{pmatrix}\begin{pmatrix}3 & 6\\ 1 & 1\end{pmatrix}=\begin{pmatrix}0 & 3\\ 1 & 1\end{pmatrix}\text{.....}M1$$

$3+k=0$

$\Rightarrow k=-3$

matrix is $\begin{pmatrix}1 & -3\\ 0 & 1\end{pmatrix}$.....$A1$

(c)(i)

$$\begin{pmatrix}1 & 0\\ 0 & -2\end{pmatrix}\begin{pmatrix}3 & 6 & 6 & 3\\ 1 & 1 & 3 & 3\end{pmatrix}=\begin{pmatrix}3 & 6 & 6 & 3\\ -2 & -2 & -6 & -6\end{pmatrix}\text{.....}M1$$

$A''(3,-2), B''(6,-2), C''(6,-6), D''(3,-6)$.....$A1$

(c)(iii)

Stretch parallel to y-axis/x-axis invariant, ...B1

stretch factor -2.....B1

TOTAL 10 MARKS

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21.	(a) P(BV) $\frac{2}{5}\times\frac{3}{4}\times 3000$ 900 *boys*	M1 A1	Expression Accuracy
	(b) P(BVC'C') or P(GVC'C') $\left(\frac{2}{5}\times\frac{3}{4}\times\frac{1}{5}\right)+\left(\frac{3}{5}\times\frac{7}{8}\times\frac{1}{9}\right)$ $\frac{6}{100}+\frac{21}{360}$ $\frac{71}{600}\times 3000$ 355 *students*	M1 M1 A1	Correct expression Accuracy
	(c) (i) P(GV'CC) $\frac{3}{5}\times\frac{1}{8}\times\frac{2}{25}$ $\frac{6}{1000}$ *or* 0.006	 M1 A1	 Expression Accuracy
	(ii) P(BV'CC) or P(GV'CC) $\left(\frac{2}{5}\times\frac{1}{4}\times\frac{2}{15}\right)+\left(\frac{3}{5}\times\frac{1}{8}\times\frac{2}{25}\right)$ $\frac{4}{300}+\frac{6}{1000}$ $\frac{29}{1500}$	 M1 M1 A1	 Correct expression Addition Accuracy
		10	

22. a) (i).

Class	c.f	f	x	d	fd	fd^2
26 – 30	4	4	28	–15	–60	900
31 – 35	18	14	33	–10	–140	1400
36 – 40	40	22	38	–5	–110	550
41 – 45	65	25	43	0	0	0
46 – 50	82	17	48	5	85	425
51 – 55	94	12	53	10	120	1200
56 – 60	100	6	58	15	90	1350
		$\sum f = 100$			$\sum fd = -15$	$\sum fd^2 = 5825$

B1 For class column

B1 For c.f. column

B1 For frequency column

(ii).

$Q_3 : \frac{3}{4} \times 100 = 75^{th} \rightarrow 48.25$

$Q_1 : \frac{1}{4} \times 100 = 25^{th} \rightarrow 37$

B1 For either Q_1 or Q_3 correct

$$semi-\text{interquartile range} = \frac{48.25 - 37}{2}$$

M1 Correct evaluation

$$= 5.625$$

A1 Accuracy

b) .

$$s.d. = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$$

B1 For fd column

B1 For fd^2 column

$$= \sqrt{\frac{5825}{100} - \left(\frac{-15}{100}\right)^2}$$

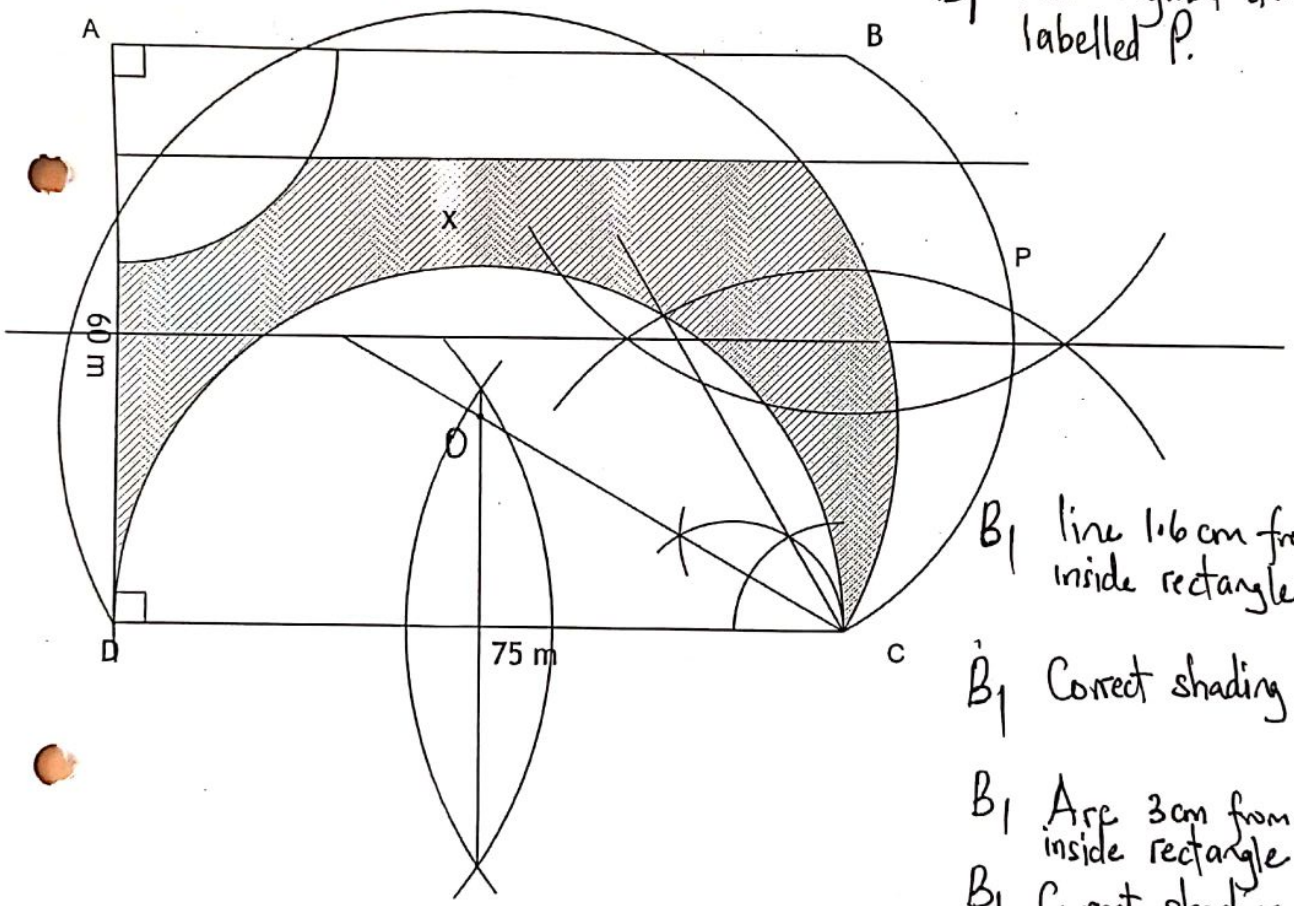
M1 Correct substitution

$$= 7.63$$

A1 Accuracy to 2 d.p.

10

23.



B_1 – bisector of BC

B_1 Angle 30° constructed at B or C inside rectangle

B_1 Minor segment drawn and labelled P.

B_1 line 1.6 cm from AB inside rectangle

B_1 Correct shading

B_1 Arc 3cm from A inside rectangle

B_1 Correct shading.

B_1 Arc with DC as diameter inside rectangle

B_1 Major arc drawn with correct centre O located.

B_1 Correct shading & labelled X

24.	(a) $x^2-3x-10=2x-4$ $x^2-5x-6=0$ $(x+1)(x-6)=0$ $x=-1 \text{ or } x=6$ $P(-1,-6)$ $Q(6,8)$	M1 M1 A1	Equating Correct attempt to solve quadratic equation Correct coordinates
	(b) $\int_{-1}^{5}(x^2-3x-10)dx-\int_{-1}^{2}(2x-4)dx$ $\left[\frac{x^3}{3}-\frac{3x^2}{2}-10x+c\right]_{-1}^{5}-\left[x^2-4x+c\right]_{-1}^{2}$ $\left[\left(\frac{125}{3}-\frac{75}{2}-50\right)-\left(-\frac{1}{3}-\frac{3}{2}+10\right)\right]-\left[(4-8)-(1+4)\right]$ $-54--9$ $\lvert-45\rvert$ 45	M1 M1 A1	Correct integration with limits Correct substitution accuracy
	$\int_{2}^{6}(2x-4)dx-\int_{5}^{6}(x^2-3x-10)dx$ $\left[x^2+4x+c\right]_{2}^{6}-\left[\frac{x^3}{3}-\frac{3x^2}{2}-10x+c\right]_{5}^{6}$ $[60-12]-\left[-42--\frac{275}{6}\right]$ $48-\frac{23}{6}$ $44\frac{1}{6}$ $area=45+44\frac{1}{6}=89\frac{1}{6}$	M1 M1 A1 B1	Correct integration with limits Correct substitution Accuracy Total area
		10	