

MARKING SCHEME

FORM III MATH TERM II

PAPER 2

Q1	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">No</th><th style="width: 40%;">Log.</th><th style="width: 40%;"></th></tr> </thead> <tbody> <tr> <td>1.46</td><td>0.1644</td><td></td></tr> <tr> <td>183</td><td>2.2625⁺</td><td></td></tr> <tr> <td></td><td style="border-top: 1px solid black;">2.4269</td><td>2.4269</td></tr> <tr> <td>0.97</td><td>1.9868</td><td></td></tr> <tr> <td>0.041</td><td>2.6128⁺</td><td></td></tr> <tr> <td></td><td style="border-top: 1px solid black;">2.5996</td><td style="border-top: 1px solid black;">2.5996</td></tr> <tr> <td></td><td></td><td style="border-top: 1px solid black;">3.8273</td></tr> </tbody> </table> $10^3 \times 6.719$ $= 6719$	No	Log.		1.46	0.1644		183	2.2625 ⁺			2.4269	2.4269	0.97	1.9868		0.041	2.6128 ⁺			2.5996	2.5996			3.8273	All logs ✓ M1 ✓ Addition and subtraction M1 A1 (Allow 6718.9)
No	Log.																									
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Q2	$4 - 2x < 4x - 9$ $13 < 6x$ $2.1667 < x$ $4x - 9 \leq x + 11$ $5x < 20$ $x \leq 4$ $x = 3, 4$	M1 separating inequalities M1 solving each A1																								

Q3

$$4N - N = \frac{M}{P + \frac{1}{4}}$$

$$3N \left(P + \frac{1}{4} \right) = M$$

$$3NP + \frac{3N}{4} = M$$

$$\frac{3N}{4} = M - 3NP$$

$$4 = \frac{3N}{M - 3NP}$$

Follow thro'

M1

M1

A1

Q4

$$3^{2x+2} = 3^5$$

$$2x+2=5$$

$$2x=3$$

$$x=1.5$$

M1

A1 Allow

 $1\frac{1}{2}$

Q5

$$8t + 6s = 4140 \text{ --- (i)}$$

$$4t + 12s = 3960 \text{ --- (ii)}$$

multiply (ii) by 2

$$8t + 24s = 7920$$

$$8t + 6s = 4140$$

$$18s = 3780$$

$$s = 210$$

$$8t + 6(210) = 4140$$

$$8t = 2880$$

$$t = 360$$

B1 for both

M1 for eliminating one unknown

A1 for both

Q6 Grad of $L_1 = \frac{8+4}{4+2} = 2$

Grad of $\perp = -\frac{1}{2}$

Midpoint of $L_1 = \left(\frac{-2+4}{2}, \frac{-4+8}{2}\right)$
 $= (1, 2)$

$\frac{y-2}{x-1} = -\frac{1}{2}$

$2y-4 = -x+1$

$2y+x = 5$

BI

MI

AI

Q7 (a) $\sqrt[3]{9.261} = 2.1 \text{ cm}$

BI

(b) $2.1 \times 4 = 8.4 \text{ cm}$

BI

(c) Area of 6 faces

$6 \times 2.1 \times 2.1 = 26.46 \text{ cm}^2$

MI AI

28

$$\frac{1+3\sqrt{2}}{1-\sqrt{3}} \times \frac{1+\sqrt{3}}{1+\sqrt{3}}$$

$$\frac{\text{Num}}{(1+3\sqrt{2})(1+\sqrt{3})}$$

$$= 1 + \sqrt{3} + 3\sqrt{2} + 3\sqrt{6}$$

Den

$$(1-\sqrt{3})(1+\sqrt{3})$$

$$= 1 + \sqrt{3} - \sqrt{3} - 3 = -2$$

$$\frac{1 + \sqrt{3} + 3\sqrt{2} + 3\sqrt{6}}{-2}$$

$$= \frac{-1 - \sqrt{3} - 3\sqrt{2} - 3\sqrt{6}}{2}$$

M1

M1

A1

29

$$10000 + 12 \times 3200 = 30000 \left(1 + \frac{r}{100}\right)^{12}$$

$$48400 = 30000 (1 + 0.01r)^{12}$$

$$1.6133 = (1 + 0.01r)^{12}$$

$$1 + 0.01r = \sqrt[12]{1.6133}$$

$$1 + 0.01r = 1.0407$$

$$0.01r = 0.0407$$

$$r = 4.07\%$$

M1

M1

A1

Q10

$$L.L \quad 2.65, 3.35$$

$$U.L \quad 2.75, 3.45$$

$$\text{Actual area} = 2.7 \times 3.4 \\ = 9.18$$

$$\text{Min area} = 2.65 \times 3.35 \\ = 8.8775$$

$$\text{Max area} = 3.45 \times 2.75 \\ = 9.4875$$

$$\text{Absolute error} = \frac{1}{2} (9.4875 - 8.8775) \\ = 0.305$$

$$\% \text{ error} = \frac{0.305}{9.18} \times 100 \\ = 3.322\%$$

M1 Max & min

M1

A1.

Q11

Total mass of boys

$$18 \times 64 = 1152$$

M1

$$\text{Boys + teacher} = 1152 + x$$

$$65 \times 19 = 1235$$

$$x + 1152 = 1235$$

M1

$$x = 1235 - 1152 \\ = 83$$

A1

Q12	Let the numbers be $x, x+2, x+4, x+6$ $x+x+2+x+4+x+6=88$ $4x+12=88$ $4x=76$ $x=19$ 19, 21, 23, 25	M1 A1 B1
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Q13	$\cos(2x-60) = 0.5$ $\cos^{-1}(2x-60) = 60^\circ$ $2x-60 = 60, 300, 420, 660$ $x = 60, 180^\circ, 240^\circ, 360^\circ$	B1 B1 (for $60^\circ, 180^\circ$) B1 ($240^\circ, 360^\circ$)
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Q14	$4 \log y^3 - 3 \log \sqrt[3]{x}$ $12 \log y - \log x$ $12 \times 3.143 - 2.421$ $= 35.295$	M1 M1 A1
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Q15 (a) $\begin{pmatrix} 4 \\ 5 \end{pmatrix} - 2\begin{pmatrix} 3 \\ 8 \end{pmatrix} - 3\begin{pmatrix} 7 \\ -4 \end{pmatrix}$

$$\begin{pmatrix} 4 \\ 5 \end{pmatrix} - \begin{pmatrix} 6 \\ 16 \end{pmatrix} - \begin{pmatrix} 21 \\ -12 \end{pmatrix} = \begin{pmatrix} -23 \\ 1 \end{pmatrix}$$

B1

(b) $PQ = \begin{pmatrix} 3 \\ 8 \end{pmatrix} - \begin{pmatrix} 4 \\ 5 \end{pmatrix} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$

$$QR = \begin{pmatrix} 7 \\ -4 \end{pmatrix} - \begin{pmatrix} 3 \\ 8 \end{pmatrix} = \begin{pmatrix} 4 \\ -12 \end{pmatrix} = -4\begin{pmatrix} -1 \\ 3 \end{pmatrix}$$

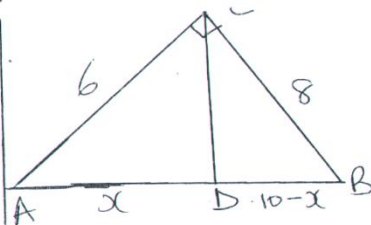
B1 both or
for PQ and PR

$$QR = -4PQ$$

or $PQ = -\frac{1}{4}QR$

B1

Q16



$$AB = \sqrt{6^2 + 8^2} = 10$$

B1

$$CD^2 = 6^2 - x^2 = 36 - x^2$$

$$CD^2 = 8^2 - (10-x)^2 = 64 - 100 + 20x - x^2$$

$$36 - x^2 = 64 - 100 + 20x - x^2$$

$$36 = -36 + 20x$$

$$72 = 20x$$

$$x = 3.6 \text{ cm}$$

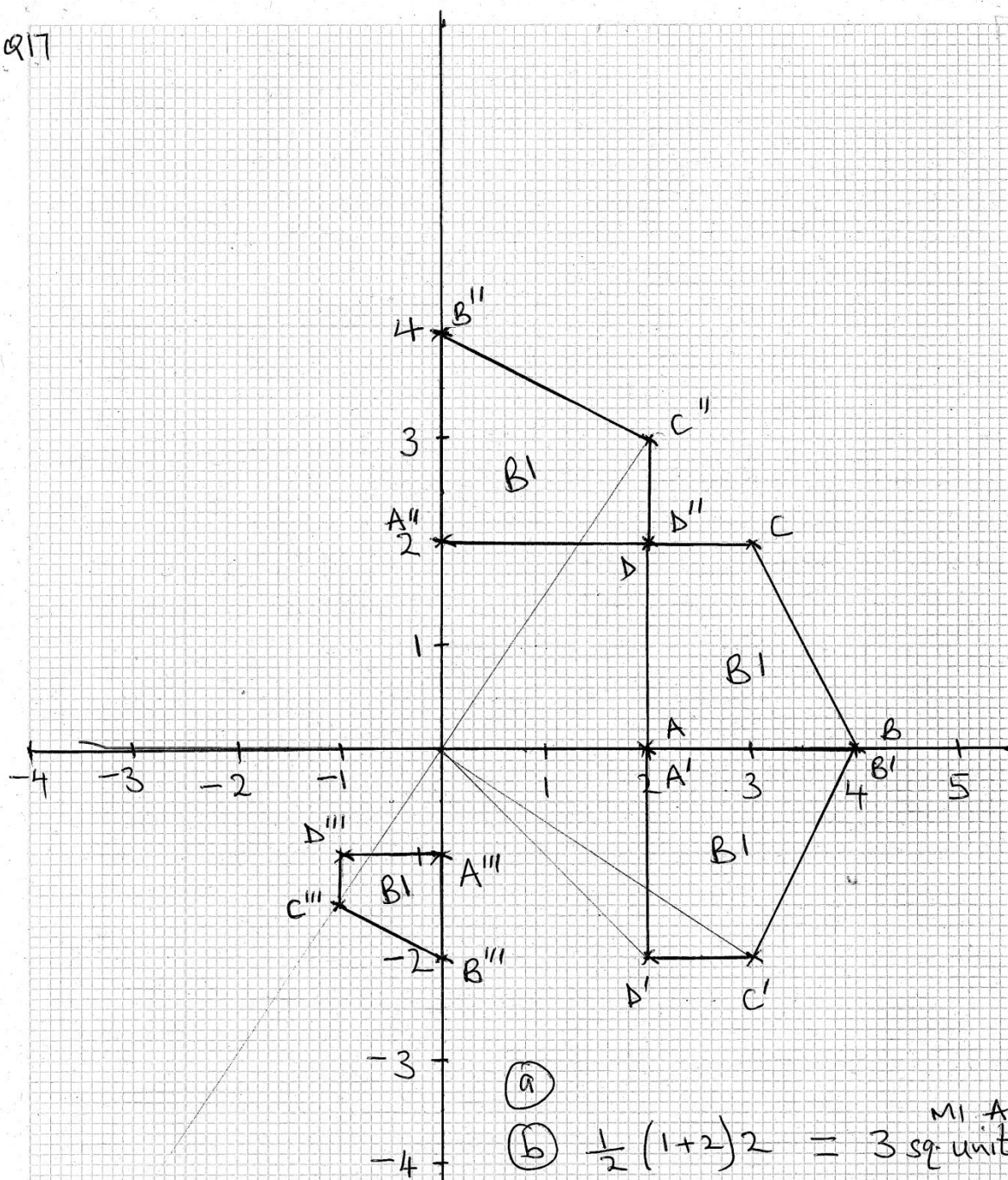
$$CD = \sqrt{6^2 - 3.6^2} = 4.8 \text{ cm}$$

M1 both eqns

M1 equating and simplifying

A1

Q17



(a)

(b) $\frac{1}{2}(1+2)2 = 3 \text{ sq. units}$ ^{MI A1}

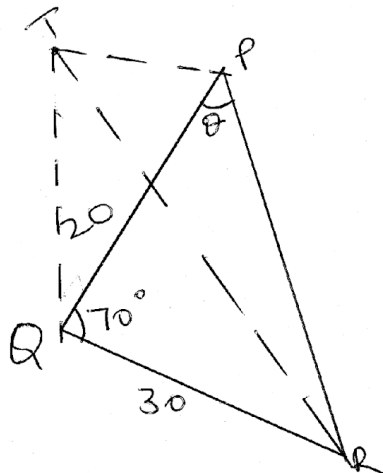
(c) A'(2,0) B'(4,0) C'(3,-2) D(2,-2) B1

(d) A''(0,2) B''(0,4) C''(2,3) D''(2,2) B1

(e)

(f) Reflection in the line y=x B1

Q18



$$(i) (i) A = \frac{1}{2} \times 20 \times 30 \sin 70 = 281.9 \text{ m}$$

M1 A1

$$(ii) PR^2 = 20^2 + 30^2 - 2(20 \times 30 \cos 70^\circ)$$

M1

$$400 + 900 - 410.4$$

$$= 889.6$$

$$PR = 29.83 \text{ m}$$

A1

$$(iii) \frac{29.83}{\sin 70^\circ} = \frac{30}{\sin \theta}$$

M1

$$\sin \theta = \frac{30 \sin 70}{29.83} = 0.9450$$

$$\theta = 70.92^\circ$$

A1

$$(b) (i) TP = \sqrt{20^2 + 10^2}$$

$$= 22.36 \text{ m}$$

B1

$$(ii) TR = \sqrt{10^2 + 30^2}$$

$$= 31.62 \text{ m}$$

B1

$$(iii) \frac{1}{2}(22.36 + 31.62 + 29.83) = 41.91$$

$$A = \sqrt{41.91(41.91 - 22.36)(41.91 - 31.62)(41.91 - 29.83)}$$

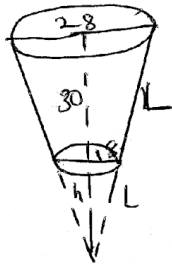
M1

$$= \sqrt{41.91 \times 19.55 \times 10.29 \times 12.08}$$

$$= 319.1 \text{ m}^2$$

A1

Q19



$$\textcircled{a} \textcircled{1} \quad \frac{18}{28} = \frac{h}{h+30}$$

$$28h = 18h + 540$$

$$h = 54 \text{ cm}$$

$$L+L = \sqrt{84^2 + 14^2}$$

$$= 85.16$$

$$\frac{18}{28} = \frac{L}{85.16} \therefore L = 54.75 \quad \text{M1}$$

$$L = 85.16 - 54.75 = 30.41 \text{ cm} \quad \text{A1}$$

$$\textcircled{11} V = \frac{1}{3} \times 14^2 \times \frac{22}{7} \times 84 = 17248.0$$

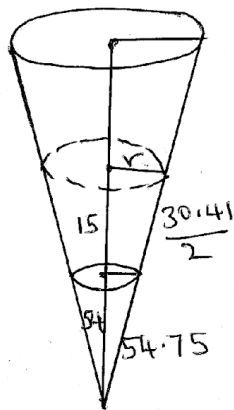
$$V = \frac{1}{3} \times 9^2 \times \frac{22}{7} \times 54 = \frac{4582.3}{12665.7 \text{ cm}^3}$$

M1 (both eqns)

M1 (subtraction)

$$\text{Capacity} = \frac{12665.7}{1000} = 12.6657 \text{ litres} \quad \text{A1}$$

⑥



$$\frac{9}{r} = \frac{54}{69}$$

$$r = 11.5 \text{ cm}$$

Base area

$$= \frac{22}{7} \times 9^2 = 254.6$$

M1

M1

C.S.A

$$A = \frac{22}{7} \times 11.5 \times (54.75 + 15.205)$$

$$= 2528.4$$

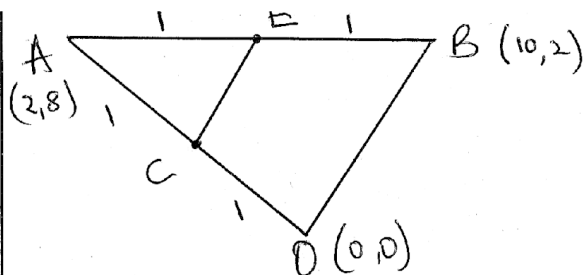
$$A = \frac{22}{7} \times 9 \times 54.75 = 1548.6$$

M1 (both)

$$\text{T.S.A} = 254.6 + 979.8 = 1234.4 \text{ cm}^2$$

A1

Q20



$$(a) (i) \quad OC = \frac{1}{2}OA = \frac{1}{2}\begin{pmatrix} 2 \\ 8 \end{pmatrix} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$$

$$C(1, 4)$$

B1

$$OE = OA + AE$$

$$= \begin{pmatrix} 2 \\ 8 \end{pmatrix} + \frac{1}{2}\begin{pmatrix} 10 - 2 \\ 2 - 8 \end{pmatrix}$$

$$= \begin{pmatrix} 2 \\ 8 \end{pmatrix} + \begin{pmatrix} 4 \\ -3 \end{pmatrix} = \begin{pmatrix} 6 \\ 5 \end{pmatrix}$$

$$E(6, 5)$$

B1

B1

$$(ii) \quad CE = \begin{pmatrix} 6 \\ 5 \end{pmatrix} - \begin{pmatrix} 1 \\ 4 \end{pmatrix} = \begin{pmatrix} 5 \\ 1 \end{pmatrix}$$

B1

$$|CE| = \sqrt{5^2 + 1^2} = 5.099$$

B1

$$|OB| = \sqrt{10^2 + 2^2} = 10.20$$

B1

$$(b) \quad CE = \begin{pmatrix} 5 \\ 1 \end{pmatrix} \quad OB = 2\begin{pmatrix} 5 \\ 1 \end{pmatrix}$$

$$\frac{CE}{OB} = \frac{1}{2} \therefore CE = \frac{1}{2}OB$$

B1

$$(c) (i) \quad OM = \begin{pmatrix} 6 \\ 5 \end{pmatrix} + 2\begin{pmatrix} 5 \\ 1 \end{pmatrix}$$

$$= \begin{pmatrix} 6 \\ 5 \end{pmatrix} + \begin{pmatrix} 10 \\ 2 \end{pmatrix} = \begin{pmatrix} 16 \\ 7 \end{pmatrix}$$

$$M(16, 7)$$

B1

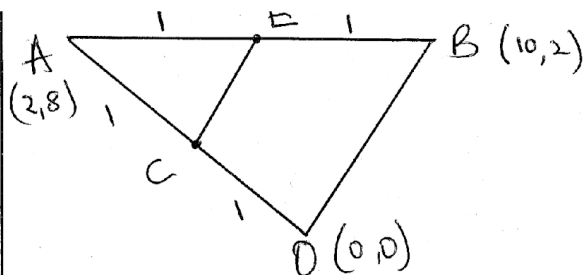
B1

$$(ii) \quad \begin{pmatrix} 7.5 \\ 6.5 \end{pmatrix} + \begin{pmatrix} -8 \\ -2 \end{pmatrix} = \begin{pmatrix} -0.5 \\ 4.5 \end{pmatrix}$$

$$M'(-0.5, 4.5)$$

B1

Q20



$$(a) (i) \quad DC = \frac{1}{2} DA = \frac{1}{2} \begin{pmatrix} 2 \\ 8 \end{pmatrix} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$$

$$C(1, 4)$$

B1

$$OE = OA + AE$$

$$= \begin{pmatrix} 2 \\ 8 \end{pmatrix} + \frac{1}{2} \begin{pmatrix} 10 - 2 \\ 2 - 8 \end{pmatrix}$$

B1

$$= \begin{pmatrix} 2 \\ 8 \end{pmatrix} + \begin{pmatrix} 4 \\ -3 \end{pmatrix} = \begin{pmatrix} 6 \\ 5 \end{pmatrix}$$

$$E(6, 5)$$

B1

$$(ii) \quad CE = \begin{pmatrix} 6 \\ 5 \end{pmatrix} - \begin{pmatrix} 1 \\ 4 \end{pmatrix} = \begin{pmatrix} 5 \\ 1 \end{pmatrix}$$

B1

$$|CE| = \sqrt{5^2 + 1^2} = 5.099$$

B1

$$|OB| = \sqrt{10^2 + 2^2} = 10.20$$

B1

$$(b) \quad CE = \begin{pmatrix} 5 \\ 1 \end{pmatrix} \quad OB = 2 \begin{pmatrix} 5 \\ 1 \end{pmatrix}$$

$$\frac{CE}{OB} = \frac{1}{2} \therefore CE = \frac{1}{2} OB$$

B1

$$(c) (i) \quad OM = \begin{pmatrix} 6 \\ 5 \end{pmatrix} + 2 \begin{pmatrix} 5 \\ 1 \end{pmatrix}$$

B1

$$= \begin{pmatrix} 6 \\ 5 \end{pmatrix} + \begin{pmatrix} 10 \\ 2 \end{pmatrix} = \begin{pmatrix} 16 \\ 7 \end{pmatrix}$$

$$M(16, 7)$$

B1

$$(ii) \quad \begin{pmatrix} 7.5 \\ 6.5 \end{pmatrix} + \begin{pmatrix} -8 \\ -2 \end{pmatrix} = \begin{pmatrix} -0.5 \\ 4.5 \end{pmatrix}$$

$$M'(-0.5, 4.5)$$

B1

321

$$\begin{aligned} \text{(a)} \quad & \frac{10800 \times 12}{20} \times \frac{115}{100} = \text{£ } 7452 \\ & \frac{500 \times 12}{20} = \text{£ } 300 \\ & \text{£ } 7152 \text{ p.a.} \end{aligned}$$

BI

$$\text{(b)} \quad 600 \times \frac{10}{100} \times 12 = \text{sh } 720 \text{ p.a.}$$

BI

Income £ p.a.	Rate	Amount of Tax	
1 - 2100	2 x 2100	4200	} MI
2101 - 4200	3 x 2100	6300	
4201 - 6300	4 x 2100	8400	} BI (for 852)
6301 - 7152	5 x 852	4260	
		23,160	AI
		sh p.a.	

$$\text{(L)} \quad \text{Gross tax} = \text{sh } 23160 \text{ p.a.}$$

$$\text{(II)} \quad 23160 - (720 + 1160 \times 12)$$

MI

$$23160 - 14640 = \text{sh } 8520 \text{ p.a.}$$

$$\frac{8520}{12} = \text{sh } 710 \text{ p.m.}$$

AI

$$\begin{aligned} \text{(d)} \quad & 10800 - (280 + 710) \\ & = \text{sh } 9810 \text{ p.m.} \end{aligned}$$

MI

AI

Q22 (a)

Marks	No. of Students (f)	Midpoint (x)	fx
30-34	3	32	96
35-39	7	37	259
40-44	4	42	168
45-49	11	47	517
50-54	4	52	208
55-59	5	57	285
60-64	6	62	372
	$\Sigma f = 40$		$\Sigma fx = 1905$
B1	B1	B1	B1

(b) modal class 45-49

B1

(c) (i) $\bar{x} = \frac{1905}{40} = 47.625$

MIAI

(ii) $\frac{15}{40} \times 100 = 37.5\%$

MIAI

(iii) $\frac{26}{40} = \frac{13}{20}$

B1

Q23

a)

E

9

8

7

6

5

4

2

4

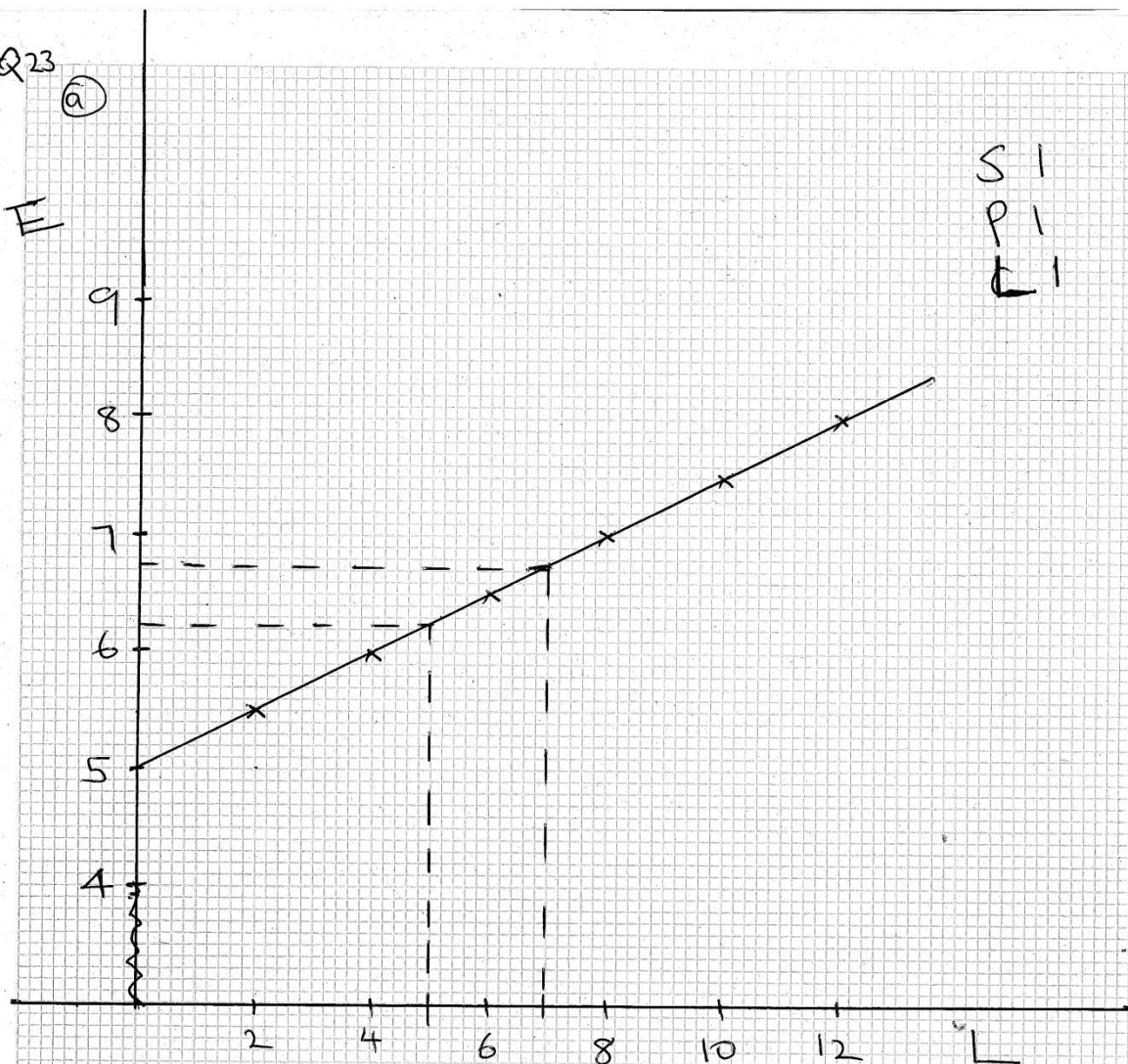
6

8

10

12

L

S 1
P 1
L 1

b) $E = k + hL$ B1

c) i) Gradient = $\frac{8-6}{12-4} = \frac{2}{8} = \frac{1}{4}$ M1 A1

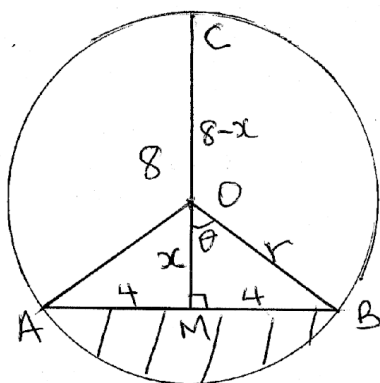
ii) E-intercept = 5 B1

d) $E = 5 + \frac{1}{4}L$ B1

e) i) $E = 6.75$ B1

ii) $L = 5$ B1

Q24



$$\begin{aligned} \text{(a)} \quad r &= 8-x \\ (8-x)^2 &= x^2 + 4^2 \\ 64 - 16x + x^2 &= x^2 + 16 \\ 64 - 16 &= 16x \\ x &= 3 \end{aligned}$$

$$\text{radius} = 8 - 3 = 5 \text{ cm}$$

$$\begin{aligned} \text{(b)} \quad \tan \theta &= \frac{4}{3} \\ \theta &= 53.13^\circ \\ \angle AOB &= 2 \times 53.13 \\ &= 106.26^\circ \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad \frac{106.26}{360} \times \frac{22}{7} \times 25 - \frac{1}{2} \times 25 \sin 106.26 \\ 23.19 - 12.0 \\ = 11.19 \end{aligned}$$

$$\begin{aligned} \text{(d)} \quad \frac{22}{7} \times 25 - 11.19 \\ = 78.57 - 11.19 \\ = 66.67 \end{aligned}$$

M1

M1

A1

M1

A1

M1 (both)

M1 (subtraction)

A1

M1 (Area of circle)

A1