MATHEMATICS PAPER 3 FORM 3 TERM THREE 2018

MARKING SCHEME

Q1

No	Log.	
1.46	0.1644	
183	2.2625 +	
	2.4269	2.4269
0.97	$\bar{1}$.9868	$\bar{2}$.5996 −
0.041	$\bar{2}$.6128 +	3.8273
	$\bar{2}$.5996	

$10^3 \times 6.719$
$= 6719$

All logs ✓ M1

✓ Addition and subtraction M1

A1 (Allow 6718.9)

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

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A1

Q3	$4N - N = \frac{M}{P + \frac{1}{Y}}$	Follow thro'
	$3N\left(P + \frac{1}{Y}\right) = M$	M1
	$3NP + \frac{3N}{Y} = M$	
	$\frac{3N}{Y} = M - 3NP$	M1
	$Y = \frac{3N}{M - 3NP}$	A1
Q4	$3^{2x+2} = 3^5$	M1
	$2x + 2 = 5$ $2x = 3$ $x = 1.5$	A1 Allow $1\frac{1}{2}$
Q5	$8t + 6S = 4140$ ---(I) $4t + 12S = 3960$ --(II)	B1 for both
	multiply (II) by 2 $8t + 24S = 7920$ $8t + 6S = 4140$	
	$18S = 3780$ $S = 210$	M1 for eliminating one unknown
	$8t + 6(210) = 4140$ $8t = 2880$ $t = 360$	A1 for both

Q6	Grad of $L_1 = \frac{8+4}{4+2} = 2$	
	Grad of $\perp$ $= -\frac{1}{2}$	B1
	Midpoint of L_1 $\left(\frac{-2+4}{2}, \frac{-4+8}{2}\right)$ $= (1, 2)$	
	$\frac{y-2}{x-1} = -\frac{1}{2}$	M1
	$2y - 4 = -x + 1$	
	$2y + x = 5$	A1
Q7	(a) $\sqrt[3]{9.261} = 2.1$ cm	B1
	(b) $2.1 \times 4 = 8.4$ cm	B1
	(c) Area of 6 faces	
	$6 \times 2.1 \times 2.1 = 26.46 cm^2$	M1 A1
	$x = 3, 4$	A1

98	$\frac{1+3\sqrt{2}}{1-\sqrt{3}} \times \frac{1+\sqrt{3}}{1+\sqrt{3}}$ $\frac{\text{Num}}{(1+3\sqrt{2})(1+\sqrt{3})}$ $= 1+\sqrt{3}+3\sqrt{2}+3\sqrt{6}$ $\frac{\text{Den}}{(1-\sqrt{3})(1+\sqrt{3})}$ $= 1+\sqrt{3}-\sqrt{3}-3 = -2$ $\frac{1+\sqrt{3}+3\sqrt{2}+3\sqrt{6}}{-2}$ $= \frac{-1-\sqrt{3}-3\sqrt{2}-3\sqrt{6}}{2}$	M1 M1 A1
99	$10000 + 12 \times 3200 = 30000\left(1+\frac{r}{100}\right)^{12}$ $48\,400 = 30000\,(1+0.01r)^{12}$ $1.6133 = (1+0.01r)^{12}$ $1+0.01r = \sqrt[12]{1.6133}$ $1+0.01r = 1.0407$ $0.01r = 0.0407$ $r = 4.07\%$.	M1 M1 A1
	$x = 3, 4$	A1

Q10

L.L 2.65 , 3.35

U.L 2.75 , 3.45

Actual area $= 2.7 \times 3.4$

$= 9.18$

Min area $= 2.65 \times 3.35$

$= 8.8775$

Max area $= 3.45 \times 2.75$ M1 Max & min

$= 9.4875$

Absolute error $= \frac{1}{2}(9.4875 - 8.8775)$ M1

$= 0.305$

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

$= 3.322\%$ A1.

Q11

Total mass of boys

$18 \times 64 = 1152$ M1

Boys + teacher $= 1152 + x$

$65 \times 19 = 1235$

$x + 1152 = 1235$ M1

$x = 1235 - 1152$

$= 83$ A1

$5x - 20$

$x \leq 4$ M1 solving each

$x = 3, 4$ A1

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

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

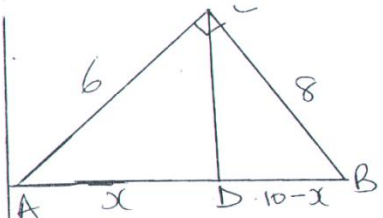
$QR = \begin{pmatrix}7\\-4\end{pmatrix} - \begin{pmatrix}3\\8\end{pmatrix} = \begin{pmatrix}4\\-12\end{pmatrix}$

$= -4\begin{pmatrix}-1\\3\end{pmatrix}$ 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

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

$= 36 - x^2$

$CD^2 = 8^2 - (10-x)^2$

$= 64 - 100 + 20x - x^2$ M1 both eqns

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

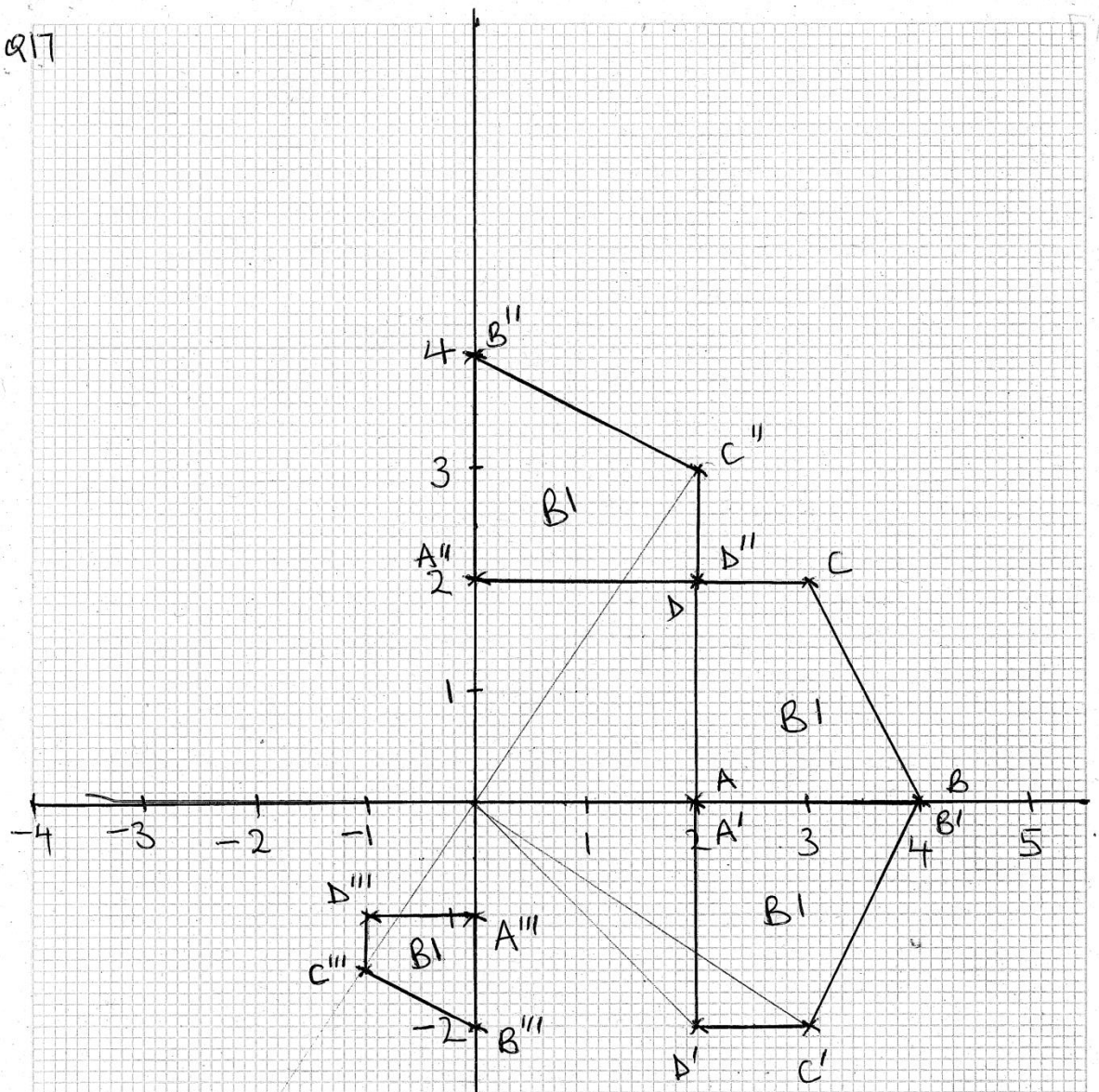
$36 = -36 + 20x$ M1 equating and simplifying

$72 = 20x$

$x = 3.6\text{cm}$

$CD = \sqrt{6^2 - 3.6^2} = 4.8\text{cm}$ A1

Q17



(a)

(b) $\frac{1}{2}(1+2)2 = 3$ sq. units M1 A1

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

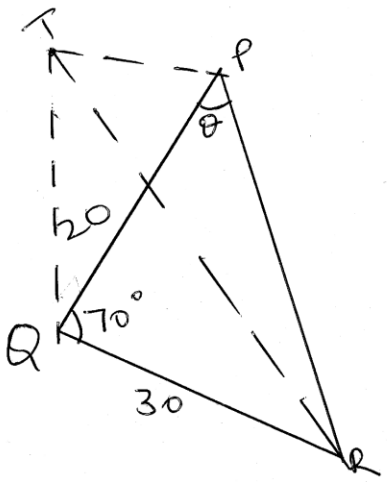
(d) $A''(0,2)$ $B''(0,4)$ $C''(3,3)$ $D''(2,2)$ B1

(e)

(f) Reflection in the line $y=x$ B1 B1

| $x = 3, 4$ | A1 |

Q18



(a) (i) $A = \frac{1}{2} \times 20 \times 30 \sin 70 = 281.9 m$ M1 A1

(ii) $PR^2 = 20^2 + 30^2 - 2(20 \times 30 \cos 70°)$ M1

$400 + 900 - 410.4$

$= 889.6$

$PR = 29.83m$. A1

(iii) $\frac{29.83}{\sin 70°} = \frac{30}{\sin \theta}$ M1

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

$\theta = 70.92°$ A1

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

$= 22.36m$ B1

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

$= 31.62m$ B1

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

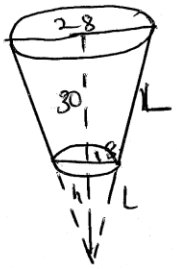
$A = \sqrt{41.91(41.91 - 22.36)(41.91 - 31.62)(41.91 - 29.83)}$ M1

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

$= 319.1 m^2$ A1

$x = 3, 4$ A1

Q19



(a) (i) $\frac{18}{28} = \frac{h}{h+30}$ M1

$28h = 18h + 540$

$h = 54\text{cm}$

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

$= 85.16$

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

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

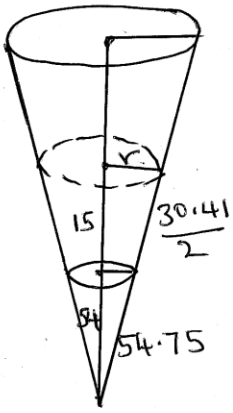
(ii) $V = \frac{1}{3} \times 14^2 \times \frac{22}{7} \times 84 = 17248.0$ M1 (both eqns)

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

12665.7cm^3 M1 (subtraction)

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

(b)



$\frac{9}{r} = \frac{54}{69}$ M1

$r = 11.5\text{cm}$

Base area

$= \frac{22}{7} \times 9^2 = 254.6$ M1

C.S.A

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

$= 2528.4$

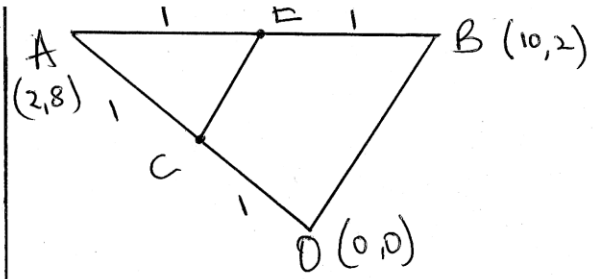
$A = \frac{22}{7} \times 9 \times 54.75 = 1548.6$

979.8 M1 (both)

T.S.A $= 254.6 + 979.8 = 1234.4\text{cm}^2$ A1

$x = 3, 4$ A1

Q20



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

$C\ (1,4)$ B1

$OE = OA + AE$

$= \begin{pmatrix}2\\8\end{pmatrix} + \frac{1}{2}\begin{pmatrix}10\\2\end{pmatrix} - \begin{pmatrix}2\\8\end{pmatrix}$ B1

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

$E\ (6,5)$ B1

(ii) $CE = \begin{pmatrix}6\\5\end{pmatrix} - \begin{pmatrix}1\\4\end{pmatrix} = \begin{pmatrix}5\\1\end{pmatrix}$ B1

$|CE| = \sqrt{5^2+1^2} = 5.099$ B1

$|OB| = \sqrt{10^2+2^2} = 10.20$ B1

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

$\frac{CE}{OB} = \frac{1}{2}$ $\therefore CE = \frac{1}{2}OB$ B1

(c) (i) $OM = \begin{pmatrix}6\\5\end{pmatrix} + 2\begin{pmatrix}5\\1\end{pmatrix}$ B1

$= \begin{pmatrix}5\\6\end{pmatrix} + \begin{pmatrix}2.5\\0.5\end{pmatrix} = \begin{pmatrix}7.5\\6.5\end{pmatrix}$

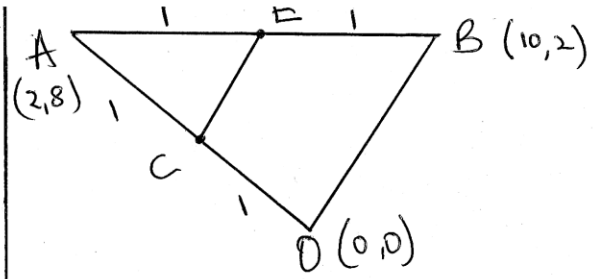
$M\ (7.5, 6.5)$ B1

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

$M'(-0.5, 4.5)$ B1

$x = 3, 4$ A1

Q20



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(c) (i) $OM = \begin{pmatrix}6\\5\end{pmatrix} + 2\begin{pmatrix}5\\1\end{pmatrix}$ B1

$= \begin{pmatrix}5\\6\end{pmatrix} + \begin{pmatrix}2.5\\0.5\end{pmatrix} = \begin{pmatrix}7.5\\6.5\end{pmatrix}$

$M\ (7.5, 6.5)$ B1

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$M'(-0.5, 4.5)$ B1

$x = 3, 4$ A1

21 (a) $\frac{10800 \times 12}{20} \times \frac{115}{100} = £\ 7452$

$\frac{500 \times 12}{20} = -\ 300$

£ 7152 p.a B1

(b) $600 \times \frac{10}{100} \times 12 = sh\ 720$ p.a B1

(c)

Income £ p.a	Rate	Amount of Tax	
1 – 2100	2 × 2100	4200	M1
2101 – 4200	3 × 2100	6300	
4201 – 6300	4 × 2100	8400	B1 (for 852)
6301 – 7152	5 × 852	4260	M1
		23,160 sh p.a	A1

(i) Gross tax = sh 23160 p.a

(ii) $23160 - (720 + 1160 \times 12)$ M1

$23160 - 14640 = sh\ 8520$ p.a

$\frac{8520}{12} = sh\ 710$ p.m A1

(d) $10800 - (280 + 710)$ M1

$= sh\ 9810$ p.m A1

$x = 3, 4$ A1

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) $\bar{x} = \frac{1905}{40} = 47.625$ M1A1

(ii) $\frac{15}{40} \times 100 = 37.5\%$ M1A1

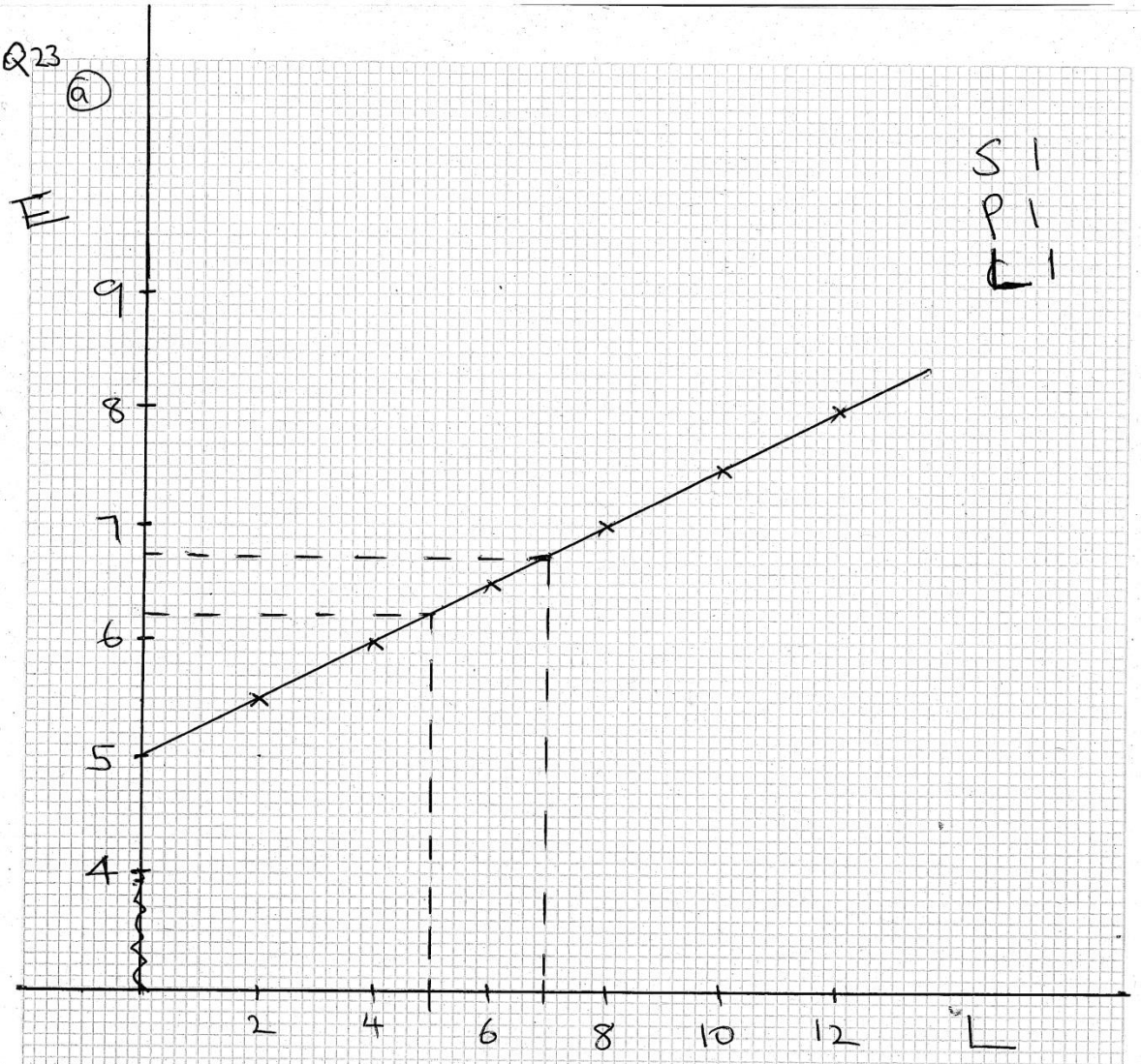
(iii) $\frac{26}{40} = \frac{13}{20}$ B1

$5x - 20$

$x \leq 4$ M1 solving each

$x = 3, 4$ A1

Q23 (a)



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

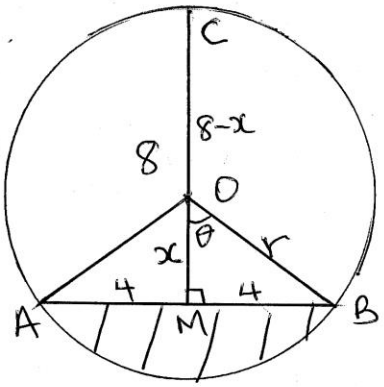
(d) $E = 5 + \frac{1}{4}L$ B1

(e) (i) $E = 6.75$ B1

(ii) $L = 5$ B1

| $x = 3, 4$ | A1

Q24



(a) $r = 8-x$

$(8-x)^2 = x^2+4^2$ M1

$64-16x+x^2 = x^2+16$

$64-16 = 16x$ M1

$x = 3$

radius $= 8-3 = 5$ cm A1

(b) $\tan\theta = \frac{4}{3}$

$\theta = 53.13°$

$\angle AOB = 2\times 53.13$ M1

$= 106.26°$ A1

(c) $\frac{106.26}{360}\times\frac{22}{7}\times 25 - \frac{1}{2}\times 25\sin 106.26$ M1 (both)

M1 (subtraction)

$23.19 - 12.0$

$= 11.19$ A1

(d) $\frac{22}{7}\times 25 - 11.19$ M1 (Area of circle)

$= 78.57 - 11.19$

$= 66.67$ A1

$x = 3, 4$ A1