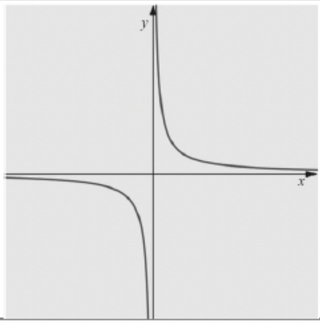
L6 Ma January Exam Teacher Y 23-24 SOLUTIONS [51]

1.

(a)	 Shape in quadrant 1 **or** 3	M1
	Shape and Position	A1
		(2)
(b)	Deduces that $x < 0$	B1
	Attempts $\frac{16}{x}...2 \Rightarrow x...\pm\frac{16}{2}$	M1
	$x < 0$ or $x \geqslant 8$	A1 cso
		(3)

2.

(a)	$x^2 + y^2 - 6x + 10y + k = 0$	
	$(x-3)^2 + (y+5)^2 \pm ... = ...$	M1
	Centre $(3, -5)$	A1
		(2)
(b)	Deduces that $k = 9$ is a critical point	B1ft
	Recognises that radius > 0 $"9" + "25" - k > 0$	M1
	$9 < k < 34$	A1
		(3)

3.

(a)		$\left(2+\frac{1}{3}kx\right)^6 = 2^6 + {}^6C_1 2^5\left(\frac{1}{3}kx\right) + {}^6C_2 2^4\left(\frac{1}{3}kx\right)^2 + \ldots$	M1	1.1a	Attempt at least 2 of these terms – products of binomial coefficients and correct powers of 2 and $\frac{1}{3}kx$	Using kx rather than ⅓kx mark as **MR -2**
		$64 + 64kx$	A1	1.1		
		$+\frac{80}{3}k^2x^2$	A1	1.1		
			[3]			
(b)		$(3-4x)\left(64+64kx+\frac{80}{3}k^2x^2+\ldots\right)$ $=192+\ldots+\left(80k^2-256k\right)x^2$	M1*	3.1a	Using two terms from the expansion in **(a)** to find the coefficient of x^2	
		$5k^2-16k-12=0 \Rightarrow k=\ldots$	M1dep*	2.1	Forming a 3TQ in k	Using $3\times$ their constant term from (a)
		$k=\frac{8+2\sqrt{31}}{5}$	A1	2.2a	**BC** must be positive root **only**	
			[3]			

4.

(a)	Angle $ACB = 33°$	B1
	Attempts $\{AB^2 =\}\ 8.2^2 + 15.6^2 - 2\times 8.2\times 15.6\cos 33°$	M1
	Distance = awrt 9.8 {km}	A1
		(3)
b)	• Explains that the road is not likely to be straight {and therefore the distance will be greater}. • Explains that there are likely to be objects in the way {that they must go around and therefore the distance travelled will be greater}. • The {bases of the} masts are not likely to lie in the same {horizontal} plane {and so the distance will be greater}.	B1

5.

(a)	Attempts both $y=8-10\times1+6\times1^2-1^3$ and $y=1^2-12\times1+14$	M1
	Achieves $y=3$ for both equations and gives a minimal conclusion / statement, e.g., $(1, 3)$ lies on both curves so they intersect at $x=1$	A1
		(2)
b)	(Curves intersect when) $x^2-12x+14=8-10x+6x^2-x^3$ $\Rightarrow x^3-5x^2-2x+6=0$	M1
	For the key step in dividing by $(x-1)$ $x^3-5x^2-2x+6=(x-1)(x^2+px\pm6)$	dM1
	$x^3-5x^2-2x+6=(x-1)(x^2-4x-6)$	A1
	Solves $x^2-4x-6=0$ $(x-2)^2=10\Rightarrow x=...$	ddM1
	$x=2-\sqrt{10}$ only	A1
		(5)

6.

(a)	States correct coordinate Condone no brackets	1.1b	B1	$(a-2, 2b)$
(b)	States correct coordinates Condone no brackets	1.1b	B1	$(a, 8b)$
(c)	States correct scale factor	1.1b	B1	$\frac{1}{3}$

7.

Complete method to find the RHS of an equation for l e.g., Attempts gradient = $\frac{80-60}{10}\{=2\}$ and uses intercept = 60	M1
$\{y=\}2x+60$	A1
Deduces the RHS of the equation for C is $\{y=\}ax(x-6)$ and attempts to use $(10,80)$ to find the value of a	M1
Equation of C is $\{y=\}2x(x-6)$	A1
$2x(x-6)\leqslant y\leqslant 2x+60$	B1ft

N.B. Inequalities could be given separately.

8.

(a)	Deduces that the gradient of line l_2 is $-\frac{5}{3}$	B1
	Complete attempt to find the equation of line l_2 e.g., $y-0=-\frac{1}{"m_1"}(x-8)$	M1
	$5x+3y=40$ *	A1*
		(3)
(b)	Deduces $A(-10,0)$	B1
	Attempts to solve $y=\frac{3}{5}x+6$ and $5x+3y=40$ simultaneously to find the y coordinate of their point of intersection	M1
	y coordinate of C is $\frac{135}{17}$ o.e.	A1
	Complete attempt at area $ABC=\frac{1}{2}\times(8+"10")\times"\frac{135}{17}"$	dM1
	$=\frac{1215}{17}$	A1

9.

(a)(i)	Obtains $(3,17)$ Condone position vectors, missing brackets or x = 3 and y = 17	1.1b	B1	$(3,17)$
(a)(ii)	Obtains gradient of PQ PI correct gradient used in equation of perpendicular bisector.	1.1b	B1	$m_{PQ}=\frac{19-15}{12--6}=\frac{4}{18}$ $y-17=-\frac{9}{2}(x-3)$ $2y-34=-9x+27$ $9x+2y=61$
	Forms an equation of a line Either using the negative reciprocal of their gradient **or** their midpoint	3.1a	M1	
	Forms an equation of a line using the negative reciprocal of their gradient **and** their midpoint	1.1a	M1	
	Obtains $9x+2y=61$ OE in the required form.	2.1	A1	
(b)(i)	Solves simultaneously using their $9x+2y=61$ from (a)(ii) with $2x-5y=-30$ to obtain the centre of the circle PI by $(5,8)$ or x = 5, y = 8	3.1a	M1	Centre $(5,8)$ $(x-5)^2+(y-8)^2=r^2$ $(12-5)^2+(19-8)^2=170$ $(x-5)^2+(y-8)^2=170$
	Uses *P* or Q and their centre to find the radius or radius^2	3.1a	M1	
	Obtains $(x-5)^2+(y-8)^2=170$ ACF Eg $x^2-10x+y^2-16y=81$	1.1b	A1	
(b)(ii)	States 4 Must have the correct centre and correct radius or radius^2	2.2a	R1	4