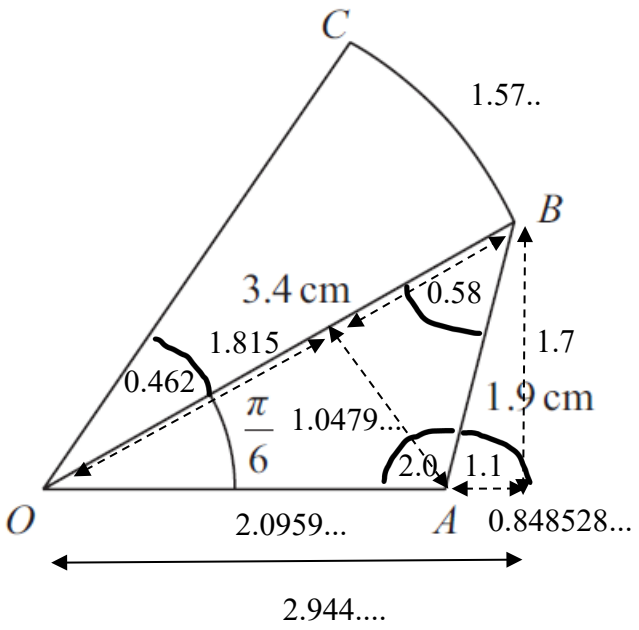
Question Number	Scheme	Marks
8(a)	$\dfrac{\sin OAB}{3.4}=\dfrac{\sin\left(\frac{\pi}{6}\right)}{1.9}\Rightarrow OAB=2.034$	M1A1A1
		(3)
(b)	$\text{Area}=\dfrac{1}{2}\times 3.4\times 1.9\times\sin\left(\pi-\dfrac{\pi}{6}-"2.034"\right)=\text{awrt}\,1.78\ \ (\text{cm}^2)$	M1A1
		(2)
(c)	Area of sector $OBC="1.78"\times\dfrac{3}{2}$ $(="2.67")$	M1
	$\dfrac{1}{2}\times 3.4^2\times\theta="\dfrac{1.78\times 3}{2}"$	M1
	$\theta=\text{awrt}\,0.462$ *	A1*
		(3)
(d)	$OA=\sqrt{3.4^2+1.9^2-2\times 3.4\times 1.9\times\cos\left(\pi-\dfrac{\pi}{6}-"2.034"\right)}$	M1
	$OA=\text{awrt}\,2.1\ \ (\text{cm})$	A1
	Length of arc $BC=0.462\times 3.4$ $(=1.57...)$	B1
	$\text{Perimeter}=3.4+1.9+"2.1"+0.462\times 3.4$	dM1
	$=\text{awrt}\ 9\,(\text{cm})$	A1
		(5)
		(13 marks)



Note that in all parts they may work in degrees and convert back where appropriate which is acceptable. If they do not then the method marks are still available. We do not need to see the conversion, but in calculations they cannot have a mix of radians and degrees in the same expression/equation

(a) Note the correct angle of awrt 2.034 scores full marks

M1 Correct equation using the sine rule with the sides and angles in the correct places.

A1 awrt 1.11 (principal angle may be implied by final answer)

A1 awrt 2.034 (calc 2.033751055)

Alt(a) – Using the cosine rule twice – must be seen in (a) to score

M1 Correct equation using the cosine rule with the sides and angles in the correct places i.e.

$1.9^2 = 3.4^2 + OA^2 - 2\times 3.4\times OA\times \cos\left(\frac{\pi}{6}\right)$ o.e.

A1 $OA =$ awrt 2.1

A1 awrt 2.034

(b) Note that those who find and use *OAB* as "1.108" instead of 2.034 can score max M1A0

M1 Correct expression to find the area of the triangle using their angle *OAB*.

Do not be concerned by the size (or sign) of the angle found by attempting $\pi - \frac{\pi}{6} -$ their *OAB*. Do look out for alternative ways of finding the area of the triangle.

Use the diagram on the previous page to help you. Condone slips in the rearrangement of any expressions provided they were seen to be correct initially.

A1 awrt 1.78 (condone lack of units). (calc 1.781564499)

(c) Note that those who find and use *OAB* as "1.108" instead of 2.034 can score max M1M1A0

M1 Attempts to find the area of the sector using the given ratio by dividing their area of the triangle from (b) by 2 and multiplying by 3. May be implied by their area of the sector – you may need to check this on your calculator.

M1 Sets $\frac{1}{2}\times 3.4^2\times\theta =$ their area for the sector (or rearranged equivalent)

Condone equating to incorrect areas, provided it is not their area of triangle *OAB*, which may have been found from an incorrect method or may appear with little or no working.

A1* Achieves the given answer (in radians) with no errors seen following a correct equation

i.e. $\frac{1}{2}\times 3.4^2\times\theta =$ awrt 2.6 or awrt $2.7 \Rightarrow \theta =$ awrt 0.462

Condone premature earlier rounding provided the method is sound and they achieve awrt 0.462 or state 0.462 following a correct method. (calc 0.4623437281)

(d) Note that those who find and use *OAB* as "1.108" instead of 2.034 to find length *OA* can score max M1A0B1dM0A0

M1 Attempts to find the length *OA*. There are various methods so score for the overall method condoning slips. Use the diagram on the previous page to help you. The expression for *OA* is sufficient. May be implied by awrt 2.1. If found in an earlier part it must be used in (d) to score. **Condone use of their angle *OAB* even if it is not obtuse for this mark.**

A1 awrt 2.1 (or may be implied by later work/the final answer) (calc 2.095958235)

B1 Correct expression or value for the length of the arc *BC*.
Allow to be implied by sight of 1.462×3.4 (if they have combined *OC* and arc *BC*)

dM1 A correct method to find the total perimeter. It is dependent on the previous M and B marks.
Condone slips, but the overall method/strategy must be correct. The expression is sufficient.
If their angle *OAB* is acute instead of obtuse and used to find *OA* (or other lengths) then this mark cannot be scored. (Note it is possible to find *OA* using the cosine rule and not use their answer to part (a))

A1 awrt 9 (cm) following a correct method

Question Number	Scheme	Marks
9(a)	$b=-1$	B1
	$\frac{9}{4}-(x-3)^2$	M1A1
		(3)
(b)	$\left(3, \frac{9}{4}\right)$	B1ftB1ft
		(2)
(c)(i)	$x=\frac{9}{2}$	B1
(ii)	$k=\frac{\pi}{3}$	B1
(iii)	6	B1
		(3)
(d)	$m=\frac{0-"\frac{9}{4}"}{"\frac{9}{2}"-"3"}=-\frac{3}{2}$	M1
	$y-0="-\frac{3}{2}"\left(x-"\frac{9}{2}"\right)$ or $y-"\frac{9}{4}"="-\frac{3}{2}"(x-"3")$	dM1
	$y=-\frac{3}{2}\left(x-\frac{9}{2}\right)$ or $y-\frac{9}{4}=-\frac{3}{2}(x-3)$ o.e.	A1
	$y>\cos\left(\frac{1}{3}\pi x\right),\ y<6x-\frac{27}{4}-x^2,\ y<-\frac{3}{2}x+\frac{27}{4}$	B1ftB1
		(5)
		(13 marks)

(a) **Note you may see values stated and an expression. The expression takes precedence.**

B1 $b=-1$ which may be embedded in their completed square form

M1 $...(x\pm3)^2$ or may state $c=\pm3$

A1 $\frac{9}{4}-(x-3)^2$ or $-(x-3)^2+\frac{9}{4}$ or equivalent in the required form e.g. $-1(x-3)^2+2.25$ (must see the expression – cannot just state values for *a*, *b* and *c*). isw once a correct expression where *a*, *b* and *c* are single values within the expression are seen

(b) **May be seen on the diagram. If there is a contradiction then the main body of the work takes precedence.**
Note their *a* and *c* in part (a) must be single values to follow through in part (b)
Correct coordinates can be found in (b) and score B1ftB1ft without using their part (a)

B1ft One correct coordinate or follow through their part (a). Allow to be written as e.g. $x=3$ or $y=\frac{9}{4}$ o.e.

B1ft $\left(3, \frac{9}{4}\right)$ o.e. or follow through their part (a) $(-c, a)$. Allow to be written as e.g. $x=3$ and $y=2.25$

(c)