Question Number	Scheme	Marks
6(a)	$\sin BOA = \frac{7.3}{9} \Rightarrow BOA = 0.946$	M1, A1 **(2)**
(b)	Attempts e.g. $\frac{1}{2}\times 9^2 \times (\pi + '0.946') = ...$ OR e.g. $\frac{1}{2}\times 7.3 \times \sqrt{9^2 - 7.3^2}$	M1
	Attempts e.g. $\frac{1}{2}\times 9^2 \times (\pi + '0.946') - \frac{1}{2}\times 7.3 \times \sqrt{9^2 - 7.3^2} = ...$	dM1
	$= 146$ (cm^2)	A1 **(3)**
(c)	Attempts e.g. $9 \times (\pi + '0.946') = ...$ OR $9 + 7.3 + \sqrt{9^2 - 7.3^2}$	M1
	Attempts e.g. $9 \times (\pi + '0.946') + 9 + 7.3 + \sqrt{9^2 - 7.3^2} = ...$	dM1
	$= 58.4$ (cm)	A1 **(3)**
		(8 marks)

Work must be seen or used in the correct part to score

(a)

M1: A correct method to find the size of angle *BOA*. This mark can be scored for a correct equation which does not need to be rearranged. e.g. $\sin BOA = \frac{7.3}{9}$ or $\frac{9}{\sin\left(\frac{\pi}{2}\right)} = \frac{7.3}{\sin BOA}$ scores M1 Allow to work in degrees for this mark i.e. may see $\sin 90°$ instead.

Alternatively uses e.g. Pythagoras' theorem with the lengths in the correct places (but condone slips in rearranging) and forms a different correct equation using another trigonometric identity

A1: awrt 0.946

Note in (b) and (c) they may attempt to find areas or lengths and subtract from the area of the circle / the circumference of the circle.

(b)

M1: Attempts to find the area of sector *DOBCD* **OR** the area of triangle *OAB*

For sector *DOBCD* look for e.g. $\frac{1}{2}\times 9^2 \times (\pi + "0.946") = ...$ May be implied by awrt 166

May split the sector into sections e.g. a semi-circle and a smaller sector. They need to combine these together correctly for this mark. If just a value is stated you may need to check this on your calculator.

For area of triangle *OAB* look for e.g. $\frac{1}{2}\times 7.3 \times \sqrt{9^2 - 7.3^2}$, $\frac{1}{2}\times 7.3 \times 9 \times \sin\left(\frac{\pi}{2} - "0.946"\right)$ May be implied by awrt 19.2

dM1: Attempts both areas **AND** subtracts the correct way round. It is dependent on the previous method mark. If just a value is stated you may need to check this on your calculator.

Note there are a variety of different approaches to finding these areas so the overall method should be correct but allow for slips in processing.

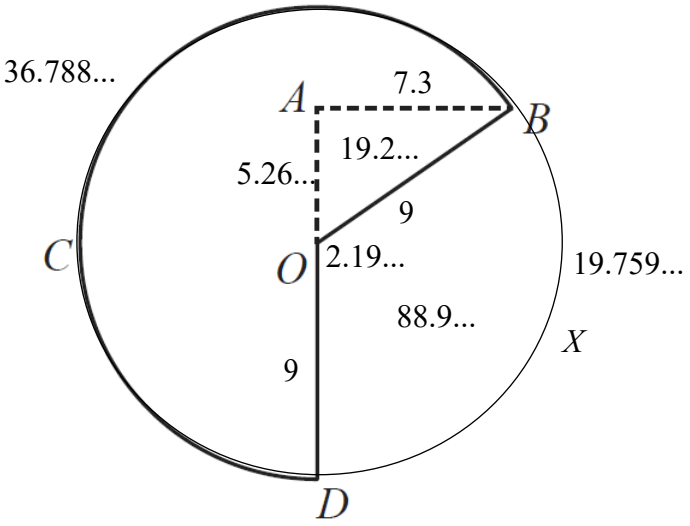
A1: awrt 146

(c)

M1: Attempts to find the length of arc *DCB* **OR** the combined length of *DA*+*AB*
For length of arc *DCB* look for e.g. $9\times(\pi+'0.946')=...$ May be implied by awrt 37.
May split the arc into sections e.g. a semi-circle and a smaller arc. They need to combine these together correctly for this mark. e.g. may use the length of arc *DXB* and subtracting from the circumference. If just a value is stated you may need to check this on your calculator.
For the length of *DA*+*AB* look for e.g. $9+7.3+\sqrt{9^2-7.3^2}$

dM1: Attempts all the required lengths and adds together. It is dependent on the previous method mark. Note there are a variety of different approaches to finding these lengths so the overall method should be correct but allowing for slips in processing. If just a value is stated you may need to check this on your calculator.

A1: awrt 58.4 (**Note that the perimeter of Figure 2 is 54.8**)



Question Number	Scheme	Marks
7 (a) (i)	States that gradient normal is -2 or gradient tangent is $\frac{1}{2}$	B1
	Substitutes $x=4$ into $\frac{1}{2}=\frac{k-\sqrt{x}}{2x^2}\Rightarrow\frac{k-2}{32}=\frac{1}{2}\Rightarrow k=18$ *	M1, A1*
(ii)	(Substitutes $x=4$ in $y+2x-5=0$ $\Rightarrow$)$y=-3$	B1
	Method of tangent $y+3=\frac{1}{2}(x-4)\Rightarrow y=\frac{1}{2}x-5$	M1, A1
		(6)
(b)	$f'(x)=\frac{18-\sqrt{x}}{2x^2}=9x^{-2}-\frac{1}{2}x^{-\frac{3}{2}}\Rightarrow\quad f(x)=-\frac{9}{x}+x^{-\frac{1}{2}}(+c)$	M1, A1, A1
	Uses $P(4,'-3')\Rightarrow'-3'=-\frac{9}{4}+\frac{1}{2}+c\Rightarrow c=...$	dM1
	$(f(x)=)-\frac{9}{x}+x^{-\frac{1}{2}}-\frac{5}{4}$	A1
		(5)
		(11 marks)

(a)(i) Attempts to substitute $k=18$ and $x=4$ into $f'(x)$ send to review

B1: States that gradient normal is -2 or gradient tangent is $\frac{1}{2}$. Alternatively, may be seen in a **correct** equation provided it is explicitly seen e.g. $\frac{1}{2}=\frac{k-2}{2\times4^2}$ or $-2=\frac{32}{\sqrt{4}-k}$

It is insufficient to just state e.g. gradient / $\frac{dy}{dx}=-2$ or hence gradient = $\frac{1}{2}$ as these are too vague.

M1: Substitutes $x=4$ into $\frac{1}{2}=\frac{k-\sqrt{x}}{2x^2}$ oe and proceeds to find a value for *k*. Condone slips in the rearrangement or slips when substituting in/evaluating provided the overall method was correct. Accept $16=k-2\Rightarrow k=...$ to score this mark.

A1*: $k=18$ with both previous marks scored and no errors seen. **Must be seen in (a)(i)**

Minimum acceptable:

e.g. $\frac{1}{2}=\frac{k-2}{32}\Rightarrow k=18$ scores B1M1A1* ($\frac{1}{2}$ seen within a correct equation proceeding to $k=18$)

e.g. $m=\frac{1}{2}$ $k-2=16\Rightarrow k=18$ scores B1M1A1* (separately states $\frac{1}{2}$ and forms a valid equation proceeding to $k=18$)

But $16=k-2\Rightarrow k=18$ scores B0M1A0* (never states $\frac{1}{2}$ or -2)