(c)	Area of sector $=\frac{1}{2}\times 1.8^2\times(2\pi-0.84)$ $(=\text{awrt } 8.8)$ (NB $2\pi-0.84=5.44318...$) **or** Area of triangle $=\frac{1}{2}\times 1.8\times\text{"4.9"}\times\sin 0.84$ $(=\text{awrt } 3.3)$ Or Area of triangle $=\frac{1}{2}\times 1.8\times 3.9\times\sin(\pi-0.84-\text{"0.351"})$ $(=\text{awrt } 3.3)$	M1
	Total Area $=\frac{1}{2}\times 1.8^2\times(2\pi-0.84)+\frac{1}{2}\times 1.8\times\text{"4.9"}\times\sin 0.84=...$	**d**M1
	= 12.1 (m^2)	A1
		(3)
(d)	Arc $BCD=$ $1.8\times(2\pi-0.84)$ $(=9.8)$	M1
	'9.8'+3.9+"4.86"−1.8=... or e.g. $2\pi\times 1.8-0.84\times 1.8+\text{"4.86"}-1.8+3.9=...$	**d**M1
	Perimeter of shop sign = 16.8 (m)	A1
		(3)
		(11 marks)

Notes

(c)

M1: Correct attempt at the area of sector *DOBCD* **or** the area of triangle *ADO* following through their *AO* from part (b). There may be other methods seen for these areas e.g.

The area of the sector may be seen as $\pi\times 1.8^2-\frac{1}{2}\times 1.8^2\times 0.84$

The area of the triangle may be seen as $\frac{1}{2}\times 1.8\times 3.9\times\sin(\pi-0.84-\text{"0.351"})$ or

$\frac{1}{2}\times(1.8\cos 0.84+3.9\cos\text{"0.351"})\times 1.8\sin 0.84$ or $=\frac{1}{2}\times 3.9\times\text{"4.86"}\times\sin\text{"0.351"}$

dM1: Complete and correct attempt at the area of the shop sign e.g.

$\frac{1}{2}\times 1.8^2\times(2\pi-0.84)+\frac{1}{2}\times 1.8\times\text{"4.9"}\times\sin 0.84$

Depends on the previous mark.

A1: For awrt 12.1 Units are not required but if any are given they must be correct.

Note that it is also possible via Circle + Triangle – Minor sector

e.g. $\pi\times 1.8^2+\frac{1}{2}\times 1.8\times\text{"4.9"}\times\sin 0.84-\frac{1}{2}\times 1.8^2\times 0.84$

In these cases, the scheme can be applied in the same way i.e. M1 for area of Circle – Minor sector or area of triangle and **d**M1 for a complete and correct method Circle + Triangle – Minor sector

Must come from correct work in part (a) unless they re-start.

(d)

M1: Attempt to find the length of the major arc using a correct method.

Accept $1.8\times(2\pi-0.84)$ or equivalent e.g. $2\pi\times 1.8-0.84\times 1.8$

dM1: Complete and correct method for the perimeter.

A1: Awrt 16.8 Units are not required but if any are given they must be correct.

Must come from correct work in parts (a) and (b) unless they re-start.

Attempts using **degrees** are acceptable and values and example working are as follows:

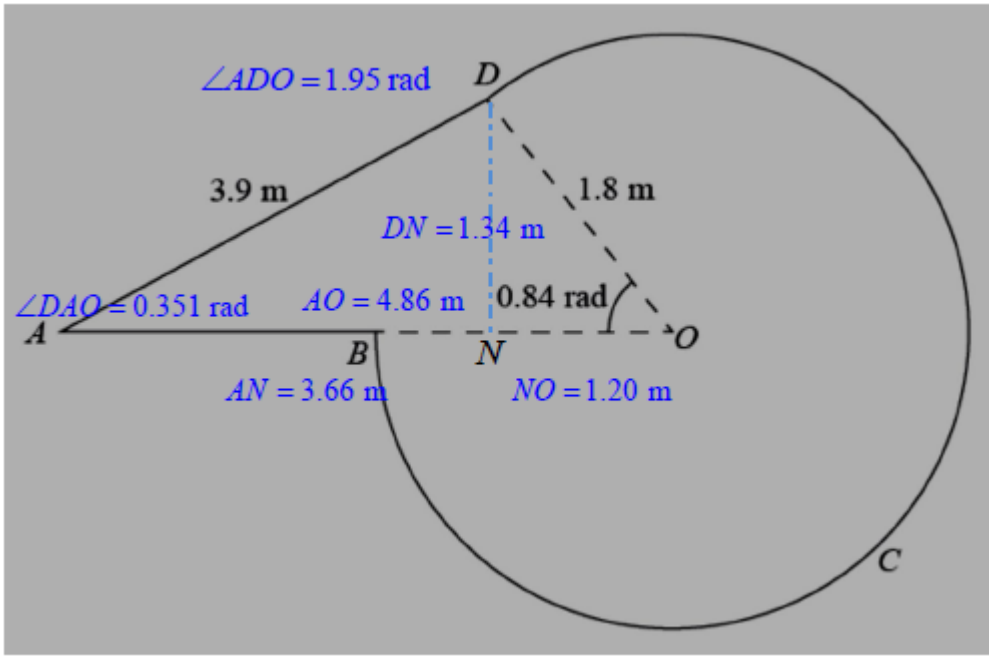
(a) M1: $\frac{\sin DAO}{1.8}=\frac{\sin 48}{3.9}$ A1: $DAO=20.1^\circ$ = awrt 0.351

(b) M1: $ADO=\pi-48^\circ-$ their 20.1° M1: $AO^2=1.8^2+3.9^2-2\times1.8\times3.9\cos"111.8^\circ"$

(c) M1: $\frac{360^\circ-48^\circ}{360}\times\pi\times1.8^2$ **or** $\frac{1}{2}\times1.8\times4.9\sin48^\circ$ dM1 $\frac{360^\circ-48^\circ}{360}\times\pi\times1.8^2+\frac{1}{2}\times1.8\times4.9\sin48^\circ$

(d) M1: Arc length $\frac{360^\circ-48^\circ}{360}\times2\pi\times1.8$

Diagram for reference:



Question Number	Scheme	Marks
7(a)	$\left(\mathrm{f}(x)=\right)\int\left(3\sqrt{x}-\frac{9}{x\sqrt{x}}+\frac{4}{3}\right)\mathrm{d}x=\int\left(3x^{\frac{1}{2}}-9x^{-\frac{3}{2}}+\frac{4}{3}\right)\mathrm{d}x$ $=\frac{3x^{\frac{3}{2}}}{\frac{3}{2}}-\frac{9x^{-\frac{1}{2}}}{-\frac{1}{2}}+\frac{4}{3}x\ \ (+c)$	M1 A1 A1
	$x=9, y=20\rightarrow 20=\frac{3(9)^{\frac{3}{2}}}{\frac{3}{2}}-\frac{9(9)^{-\frac{1}{2}}}{-\frac{1}{2}}+\frac{4}{3}(9)+c\Rightarrow c=...$	**d**M1
	$\left(\mathrm{f}\left(x\right)=\right)2x^{\frac{3}{2}}+18x^{-\frac{1}{2}}+\frac{4}{3}x\ -52$	A1
		(5)

(a) Notes

M1: Evidence of integration, so $x^n\rightarrow x^{n+1}$ at least once on a correct index.

It is for $3\sqrt{x}\rightarrow ...x^{\frac{3}{2}}$ or $\frac{9}{x\sqrt{x}}\rightarrow ...x^{-\frac{1}{2}}$ or $\frac{4}{3}\rightarrow\frac{4}{3}x$

Allow unprocessed indices e.g. $3\sqrt{x}\rightarrow ...x^{\frac{1}{2}+1}$ or $\frac{9}{x\sqrt{x}}\rightarrow ...x^{-\frac{3}{2}+1}$ or $\frac{4}{3}\rightarrow\frac{4}{3}x^{0+1}$

A1: One correct term which may be unsimplified but indices must be processed.

A1: Fully correct unsimplified or simplified expression.
The "+ *c*" is not required and f(x) = is not required.
Ignore any spurious notation e.g. integral symbols.

dM1: Uses $x = 9$ and $y = 20$ in a changed expression to find their c.
Dependent upon the first method mark.

A1: $\left(\mathrm{f}(x)=\right)2x^{\frac{3}{2}}+18x^{-\frac{1}{2}}+\frac{4}{3}x\ -52$

Allow simplified equivalents e.g. $\left(\mathrm{f}(x)=\right)2x\sqrt{x}+\frac{18}{\sqrt{x}}+\frac{4}{3}x\ -52$

f(x) = is not required so just look for the correct expression.
Apply isw once a correct expression is seen.

If they find their constant in (b), allow the marks for that work to be scored here.

(b)	$f'(9)=10$	B1
	Gradient of normal is $-\frac{1}{f'(9)}$	M1
	$(y-20)="-\frac{1}{10}"(x-9)$ or $y="-\frac{1}{10}"x+c \Rightarrow 20="-\frac{1}{10}"\times 9+c \Rightarrow c=...$	**d**M1
	$x+10y-209=0$	A1
		(4)
		9 marks

(b) Notes

B1: For $f'(9)=10$ which may be implied by the gradient of normal = $-\frac{1}{10}$

M1: For gradient of normal = $-\frac{1}{\text{their } f'(9)}$ where $f'(9)$ is an attempt to substitute $x = 9$ into the given $f'(x)$

dM1: Correct method for the equation of the normal using $x = 9$, $y = 20$ and a changed $f'(9)$ with the values correctly placed.
If they use $y = mx + c$ they must proceed as far as finding a value for c.
Dependent upon the previous method mark.

A1: cso $x+10y-209=0$ or any integer multiple of this equation in the required form.