Question	Scheme	Marks
8(a)	With θ being the angle subtended by arc *AB* and ϕ being the angle subtended by arc *CD*	
	$15 = 9 \times \theta \Rightarrow \theta = \frac{5}{3} = (1.67)$	**M1**
	Therefore $\phi = \frac{2\pi}{3} - \frac{5}{3} = (0.4277...)$	**dM1**
	So length of arc *CD* = $84 \times \left(\frac{2\pi}{3} - \frac{5}{3} \right) = 35.929... = 35.9\,\text{cm}$ (1 d.p.)* CSO	**A1***
		(3)
(b)	Perimeter $= 3 \times (15 + 35.9...) + 6 \times (84 - 9)$	**M1**
	= awrt 603 cm (602.787…)	**A1**
		(2)
(c)	FOR EXAMPLE Area of a "blade" is $\frac{1}{2} \times 84^2 \times "\left(\frac{2\pi - 5}{3} \right)"$ = awrt (1510)	**M1**
	Area of sector of inner circle between "blades" is $\frac{1}{2} \times 9^2 \times "\frac{5}{3}"$ = (67.5)	**dM1** **A1**
	Total area is $3\left(\frac{1}{2} \times 84^2 \times "\left(\frac{2\pi}{3} - \frac{5}{3} \right)" + \frac{1}{2} \times 9^2 \times "\frac{5}{3}" \right) = ...(4729.577764\,\text{cm}^2)$	**ddM1**
	So area is awrt 0.473 m^2 or awrt 4730 cm^2	**A1**
		(5)
		(10 marks)
Notes:		

(a)

M1: Correct use of the arc length formula to find the angle subtended by arc *AB*.

Attempts $15 = 9 \times \theta \Rightarrow \theta = ...$ Don't be concerned by what the angle is called

dM1: Correct method to find the angle subtended by arc *CD* using their angle for arc *AB*.

Note that $\phi = \frac{1}{3}\left(2\pi - 3 \times \frac{5}{3} \right)$ is also correct. It is dependent upon the previous M

A1*: CSO Arrives at 35.9 with a correct value to at least 2 d.p. (rounded or truncated) seen first.

Alternatively sight of $84 \times \left(\frac{2\pi}{3} - \frac{5}{3} \right)$ or $84 \times \text{awrt } 0.4277$ followed by $35.9(\text{cm})$ is fine

Note that there are equivalent methods such as $84 \times \frac{2\pi}{3} - 84 \times \frac{5}{3} = 35.9$ or $\frac{2\pi}{3} \times 84 - 140 = 35.9$

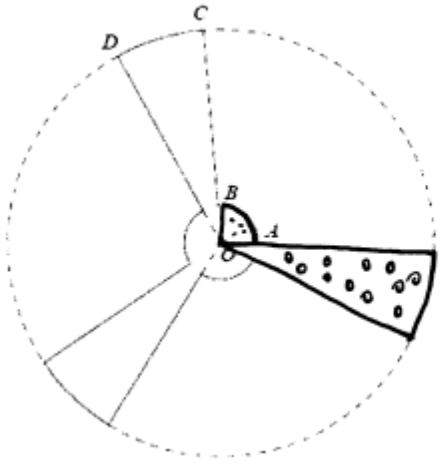
(b)

M1: Correct method to find the perimeter, it should include all six arcs and radial edges.

Look for $3 \times 15 + 3 \times 35.9 + 6 \times ...$ If no method is seen it is implied by awrt 603

A1: For awrt 603 (cm). The units need not be given.

(c) This part is now being marked M1 dM1 A1 ddM1 A1
Please look through all of the solution first. The marks can be awarded in the following way.
M1: A correct attempt at any relevant area
dM1: A correct attempt at a corresponding area that can be combined with the first area in some way to find the area of the fan. FT on angles found in part (a). Dependent upon previous mark
A1: Both areas correct. They do not need to be calculated but the angles must be correct to 3sf
ddM1: A correct combination of areas to find the area of the fan
A1: awrt 0.473 m^2 or awrt 4730 cm^2. Must include the units. ISW after a correct answer



Main method

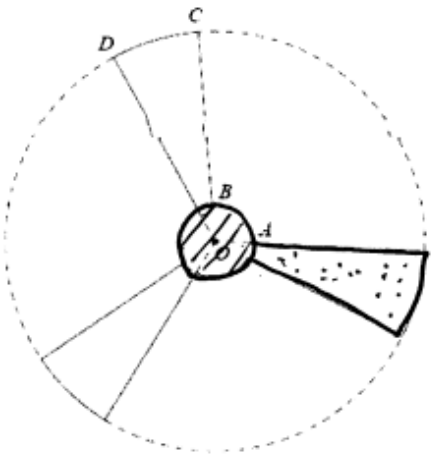
M1 : One relevant area eg $\frac{1}{2} \times 9^2 \times \text{"}\frac{5}{3}\text{"}$

dM1 : Corresponding area $\frac{1}{2} \times 84^2 \times \left(\frac{2\pi}{3} - \text{"}\frac{5}{3}\text{"}\right)$

A1 : Both correct

ddM1 : 3x + 3x

A1 : Awrt 0.473 m^2 or 4730 cm^2



Alt I

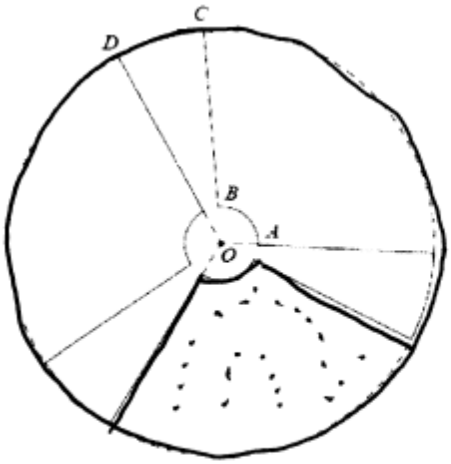
M1 : One relevant area Eg $\pi \times 9^2$

dM1 : Corresponding area $\frac{1}{2} \times 84^2 \left(\frac{2\pi}{3} - \frac{5}{3}\right) - \frac{1}{2} \times 9^2 \times \left(\frac{2\pi}{3} - \frac{5}{3}\right)$

A1 : Both correct

ddM1 : + 3x

A1 : Awrt 0.473 m^2 or 4730 cm^2



Alt II

M1 : one relevant area Eg $\pi \times 8^2$

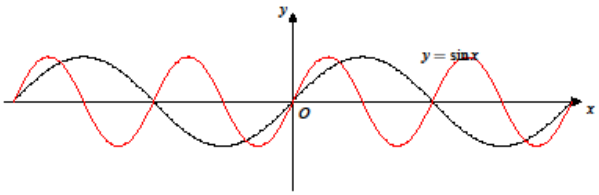
dM1 : Corresponding area $\frac{1}{2} \times 8^2 \times \frac{5}{3} - \frac{1}{2} \times 3^2 \times \frac{5}{3}$

A1 : Both correct

ddM1 : ○ − 3 × ◔

A1 : Awrt 0.473 m² or 4730 cm²

Variations are possible, e.g. 3 × area of blades (inc. circle) + area circle – area of blades within the circle, but these can be marked according to the scheme.

Question	Scheme		Marks
9(a)	(i) $2p$		**B1**
	(ii) $-p$		**B1**
	(iii) $3-p$		**B1**
			(3)
(b)		Correct shape, same height starting at *O*, scaling may be incorrect. Two repeats of the sin*x* graph each side	**M1** **A1**
			(2)
(c)	For $x = \frac{\alpha}{2}$		**B1**
	Attempt at second root E.g. $x = \frac{180° - \alpha}{2}$		**M1**
	$x = 90° - \frac{\alpha}{2}$		**A1**
			(3)
			(8 marks)
Notes:			

(a)

(i) B1: For $2p$. Condone $p + p$. Award when $2p$ is the y coordinate of a coordinate pair. E.g $(180-\alpha, 2p)$

(ii) B1: For $-p$. Award when $-p$ is the y coordinate of a coordinate pair. E.g $(\alpha - 180, -p)$