M1: Uses at least one x value of the form $p\sqrt{a}, a>0$ and uses a non calculator method to find a value for $y=q\sqrt{a}$ Must use x correctly, not x^2 in place of x. It is not a dependent mark so if $x=\sqrt{10}$ followed by a correct non calculator method you may award the mark. Some calculations must be seen, not just a written down answer. So $x=\sqrt{10}\Rightarrow y=\left(\sqrt{10}\right)^3-6\sqrt{10}=4\sqrt{10}$ is acceptable

A1: At least one correct pair of solutions. Need not be fully simplified but should be single terms, so accept e.g. $\left(\sqrt{10},\frac{40}{\sqrt{10}}\right)$ if they use the other equation to find y.

So a mark of 00110 is possible for candidates who show evidence for y but not for x.

A1: CSO. All previous marks must have been awarded in part (b). Both pairs of solutions correct and simplified with no incorrect extra answers given. Must be clearly paired so do not accept $x=\pm\sqrt{10}, y=\pm4\sqrt{10}$ unless clear pairings have been given elsewhere.

Question	Scheme	Marks
7(a)	$f'(x)=2x^{-\frac{1}{2}}+Ax^{-2}+3\Rightarrow f''(x)=...x^{-\frac{1}{2}-1}+-...x^{-2-1}$	**M1**
	$\Rightarrow f''(x)=2\times-\frac{1}{2}x^{-\frac{3}{2}}+-2Ax^{-3}=-x^{-\frac{3}{2}}-2Ax^{-3}$	**A1**
	$f''(4)=0\Rightarrow-4^{-\frac{3}{2}}-2A\times4^{-3}=0\Rightarrow A=...$	**dM1**
	$-\frac{1}{8}-\frac{2A}{64}=0\Rightarrow A=-4$	**A1**
		(4)
(b)	$f(x)=\int2x^{-\frac{1}{2}}+Ax^{-2}+3\,dx=\frac{2x^{-\frac{1}{2}+1}}{-\frac{1}{2}+1}+\frac{Ax^{-2+1}}{-2+1}+3x(+c)$	**M1**
	$=4x^{\frac{1}{2}}-\frac{A}{x}+3x(+c)$	**A1ft**
	$f(12)=8\sqrt{3}\Rightarrow4\sqrt{12}-\frac{A}{12}+36+c=8\sqrt{3}\Rightarrow c=...$	**dM1**
	$c=8\sqrt{3}-4\sqrt{12}-36-\frac{4}{12}=-\frac{109}{3}$ or follow through $c=\frac{A}{12}-36$	**A1ft**
	So $\left(f(x)\right)=4x^{\frac{1}{2}}+\frac{4}{x}+3x-\frac{109}{3}$ oe	**A1**
		(5)
		(9 marks)
Notes: Mark parts (a) and (b) together		

(a)

M1: Correct method of differentiation, at least one **correct** power reduced by 1.

The indices or coefficients do not have to be processed/simplified.

A1: Correct differentiation, need not be simplified, but the indices and coefficients must be processed correctly.

dM1: Sets $f''(4) = 0$ and proceeds to find a value for *A*. It is dependent upon the previous M1

Don't be overly concerned with the mechanics of the solution here

A1: $A = -4$

(b)

M1: Attempts to integrate f'(*x*). Look for a **correct** power increased by 1 on at least one term. The indices and coefficients do not have to be processed/simplified. Constant of integration is not needed for this mark.

A1ft: Correct integration, either with *A* or follow through their value of *A*. The indices and coefficients must be processed correctly. Constant of integration is not needed for this mark.

dM1: Sets f(12) = $8\sqrt{3}$ and proceeds to find a value for a constant of integration " c" using their value of *A*. It is dependent upon the previous M1

A1ft: Correct value for *c* found. Follow through their value of *A* , so $c = \frac{A}{12} - 36$.

Accept awrt 1 dp

A1: Correct answer, $4x^{\frac{1}{2}} + \frac{4}{x} + 3x - \frac{109}{3}$, not follow through.

If they go on to multiply by 3 etc it is A0

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