Question Number	Scheme	Marks
6 (a)	$\frac{\sin CAO}{17} = \frac{\sin 0.6}{15} \Rightarrow CAO = 0.6944...$	M1
	Angle $COA = \pi - 0.6 - "0.6944" = 1.847$ *	dM1, A1*
		(3)
(b)	Attempts $\frac{1}{2}r^2\theta = \frac{1}{2}\times 15^2 \times \theta$ where $\theta = \left(2\pi - 1.847\right)$ or just 1.847 OR attempts $\frac{1}{2}ab\sin C = \frac{1}{2}\times 15\times 17\sin\left(1.847\right)$	M1
	Attempts $\frac{1}{2}r^2\theta = \frac{1}{2}\times 15^2 \times \left(2\pi - 1.847\right)\left(\approx 499\right)$ AND $\frac{1}{2}ab\sin C = \frac{1}{2}\times 15\times 17\sin\left(1.847\right)\left(\approx 122.7\right)$ AND adds	dM1
	(awrt) 622 m^2	A1
		(3)
(c)	$r\theta = 15\times\theta$ where $\theta = \left(2\pi - 1.847\right)$ or just 1.847 OR $\left(AC^2 =\right) 15^2 + 17^2 - 2\times 15\times 17\cos\left(1.847\right)\left(\approx 653\right)$	M1
	Attempts $r\theta = 15\times\left(2\pi - 1.847\right)\left(= 66.54\right)$ AND $\left\{AC =\right\}\sqrt{15^2 + 17^2 - 2\times 15\times 17\cos\left(1.847\right)}$	dM1
	92.1 + 2 = (awrt) 94.1 m	A1
		(3)
		(9 marks)

Note: Work must be completed in the appropriate parts to gain credit, but if no labelling is given, apply benefit of doubt that area work is for (b) and perimeter work is for (c).

(a)

M1: Writes down a correct sine rule and attempts to find angle *CAO*. Alternatively, writes down a correct cosine rule and attempts to find *AC* :

$$15^2 = 17^2 + AC^2 - 2\times 17\times AC\cos 0.6 \Rightarrow AC = \frac{34\cos 0.6 \pm \sqrt{(34\cos 0.6)^2 - 4\times 64}}{2} = ...$$

Allow if degrees mode is used. Here angle *CAO* = 0.680

Watch for cases where the inverse sine is not taken, which give 0.6399. These will score M0dM0A0.

dM1: Full method to find angle *COA*. As scheme or in the Alt they may proceed to use the sine rule with their *AC* (note they should get 1.293… from this method).

A1*: Complete and correct proof. In the Alt the selection of the positive root must be justified (from diagram angle *COA* is obtuse so…) and justification of the correct angle seen (ie $\pi - 1.293...$ before the 1.847…). Allow as long as all values are to at least 3dp throughout (if seen).

There may be attempts via verification. Allow

M1: For a correct attempt at the sine (or cosine) rule as a part of their check.

dM1: For a full process to check the angle, e.g.

$$\text{angle } CAO = \pi - 0.6 - 1.847 = 0.69459... \Rightarrow \angle ACO = \arcsin\left(\frac{15\sin 0.69459...}{17}\right) = 0.600 \ \checkmark$$

A1*: If all is correct with a minimal conclusion.

Note: for (b) and (c) if they use their 1.847 rather than the given value in the question, allow the M's for correct method with their value.

(b)

M1: Correct attempt at one relevant area, allowing the minor sector as relevant. See scheme.

dM1: Complete method to find both areas and adds.

A1: Awrt 622 m^2 including the units

(c)

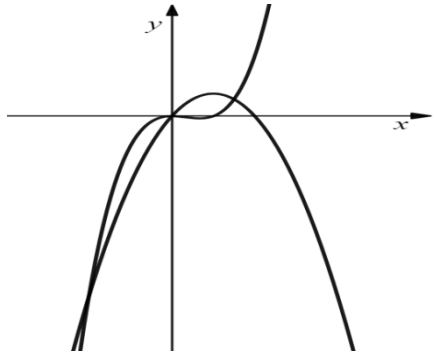
M1: Attempts major or minor arc length *AB* OR length *AC* or its square, e.g. $r\theta = 15\times\theta$ where $\theta = \left(2\pi - 1.847\right)$ or just 1.847 OR attempts $15^2 + 17^2 - 2\times 15\times 17\cos(1.847)$ condoning if it is called *AC*.

There may be alternative approaches to these (e.g. sine rule $AC = \frac{15\sin 1.847}{\sin 0.6}$).

For each approach allow if correct formula is quoted but they subsequently forget to apply the cosine or sine to the angle.

dM1: Attempts both major arc length and length *AC* ie $r\theta = 15\times\left(2\pi - 1.847\right)$ AND $AC = \sqrt{15^2 + 17^2 - 2\times 15\times 17\cos(1.847)}$ or equivalent approaches. Must correctly apply the trig ratios for this mark.

A1: Awrt 94.1 m. Should include units unless the A mark in (b) was penalised only for lack of units (ie penalise only the first instance of incorrect or missing units).

Question Number	Scheme	Marks
7 (a)	States or implies that $f(x)=\lambda x^2(x-4)$	M1
	Attempts to find λ. E.g. $120=\lambda 10^2(10-4)\Rightarrow\lambda=...$	dM1
	$\{f(x)=\}\ 0.2x^2(x-4)$	A1
		(3)
(b)	 "Upside down" parabola	M1
	Passing through *O* and +ve *x* axis > 4	A1
		(2)
(c)	Sets $1.2x(8-x)=$ their $0.2x^2(x-4)$	B1ft
	$1.2x(8-x)=0.2x^2(x-4)\Rightarrow x\left(x^2+2x-48\right)=0$ or $\Rightarrow x^3+2x^2-48x=0$	M1
	$\Rightarrow x=...,...(,0)$	dM1
	For $x=$ $-8,0,6$ OR one of $(-8,-153.6),(6,14.4)$	A1
	All of $(-8,-153.6),(6,14.4),(0,0)$ $\left\{\left(-8,-\frac{768}{5}\right),\left(6,\frac{72}{5}\right),(0,0)\right\}$	A1
		(5)
		(10 marks)

(a)

M1: States or implies that $f(x)=\lambda x^2(x-4)$. Allow with λ = 1 (or any other constant). Credited when first seen, but must use this expression to access the dM mark.

dM1: Attempts to find λ. E.g. $120=\lambda 10^2(10-4)\Rightarrow\lambda=...$

A1: $\{f(x)=\}\ 0.2x^2(x-4)$ o.e. Allow with $(x-0)^2$

Alt: May see attempts at using $f(x)=ax^3+bx^2+cx+d$

M1: States or implies $f(x)=ax^3+bx^2+cx+d$ AND uses (0,0) on curve to deduce $d = 0$

dM1: Full method to find the remaining constants, so $f'(0)=0\Rightarrow c=0$ and $f(4)=0\Rightarrow 64a+16b=0\Rightarrow b=-4a$ then $f(10)=120\Rightarrow 1000a+100b=120\Rightarrow 50a+5b=6\Rightarrow a=..,b=...$

They must set up sufficient equations to be able to solve for all the constants.

A1: For $f(x)=0.2x^3-0.8x^2$ o.e.

Note, do not be concerned if the f(*x*) = … is missing, mark the expression.