Question Number	Scheme	Marks
4 (a)	States or implies that $\left[\text{f}(x)=\right]kx(x-4)$	M1
	Attempts to find k. E.g. $-4.8=k\times2\times(2-4)\Rightarrow k=...$	dM1
	$\left[\text{f}(x)=\right]1.2x(x-4)$	A1
		(3)
(b)	States or implies that $\left[\text{g}(x)=\right]\lambda x(x-4)^2$	M1
	Attempts to find λ . E.g. $7.2=\lambda\times6\times(6-4)^2\Rightarrow\lambda=...$	dM1
	$\left[\text{g}(x)=\right]0.3x(x-4)^2$	A1
		(3)
(c)	Sets their $1.2x(x-4)=0.3x(x-4)^2$	B1ft
	Valid attempt to solve $1.2\cancel{x}\cancel{(x-4)}=0.3\cancel{x}(x-4)^{\cancel{2}}\Rightarrow x=4+\dfrac{1.2}{0.3}$	M1
	$x=8$	A1
	$\left(8,38.4\right)$	A1
		(4) **(10 marks)**

(a)

M1: States or implies that $\text{f}(x)=kx(x-4)$. Allow with k = 1. The f(x) need not be seen – assume they are working with f(x) in part (a)

Alternatives include $\text{f}(x)=k(x-2)^2-4.8$ Allow with k = 1 and $\text{f}(x)=ax^2+bx$ with at least one of $4a+b=0$ and/or $4a+2b=-4.8$

dM1: Attempts to find all the constants in their equation for $\text{f}(x)$ using $\left(2,-4.8\right)$. E.g. $-4.8=k\times2\times(2-4)\Rightarrow k=...$

A1: $\left[\text{f}(x)=\right]1.2x(x-4)$ o.e. such as $\left[\text{f}(x)=\right]1.2x^2-4.8x$ or $\left[\text{f}(x)=\right]1.2(x-2)^2-4.8$ and isw. Accept with (x − 0). The f(x) may be missing, it can be assumed (but use of g(x) is A0). Allow if the full expression is given in latter parts if all the work was correct in (a) to find the constants.

(b)

M1: States or implies that $\text{g}(x)=\lambda x(x-4)^2$ Allow with λ = 1. The g(x) need not be seen – assume they are working with g(x) in part (b).

Alternatives include $\text{g}(x)=ax^3+bx^2+cx$ with at least two of $64a+16b+4c=0$, $48a+8b+c=0$, and/or $216a+36b+6c=7.2$ (allow minor slips).

dM1: Attempts a full equation for $\text{g}(x)$ using $\left(6,7.2\right)$

E.g. $7.2=\lambda\times6\times(6-4)^2\Rightarrow\lambda=...$

A1: $\left[\text{g}(x)=\right]0.3x(x-4)^2$ o.e. such as $\left[\text{g}(x)=\right]0.3x^3-2.4x^2+4.8x$ and isw. Accept with (x − 0). The g(x) may be missing, it can be assumed (but use of f(x) is A0). Allow if the full expression in used in (c) if all the work was correct in (b) to find the constants.

(c)

B1ft: Sets their $1.2x(x-4)=0.3x(x-4)^2$. It is for a "correct" ft equation on their constants, but the form (quadratic = cubic) must be correct.

M1: Valid attempt to solve their equations to find at least one non-zero solution as long as they have a cubic and quadratic equated. E.g. $1.2\cancel{x}\cancel{(x-4)}=0.3\cancel{x}(x-4)^{\cancel{2}} \Rightarrow x=4+\dfrac{1.2}{0.3}$.

Alternatively, they may expand, factor out the x and solve the quadratic (allowing for slips), or even expand to a cubic (allowing slips) and solve via calculator (may need to check, and you may ignore "incorrect factorisation" if the answers are correct for their equation).

A1: $x = 8$ identified as the x coordinate of P. A0 if they give 0,4 and 8 and do not select the correct answer.

A1: $\left(8, 38.4\right)$ or exact equivalent for 38.4

Question Number	Scheme	Marks
5 (a)	Attempts $r\theta = 5\times1.2$ Perimeter =5 + 5 + 6 = 16 (km)	M1 A1 **(2)**
(b)	Attempts $\frac{1}{2}r^2\theta = \frac{1}{2}\times5^2\times1.2$	M1
	Area AOP = $\frac{1}{4}\times\left(\frac{1}{2}\times5^2\times1.2\right) = 3.75\text{ km}^2$ *	M1, A1* **(3)**
(c)	Sets $\frac{1}{2}\times5\times OP\times\sin1.2 = 3.75 \Rightarrow OP = ...$	M1
	$OP = 1.6...$	A1
	$AP^2 = 5^2 + "1.6.."^2 - 2\times5\times"1.6.."\times\cos1.2$	M1
	$AP = 4.7\text{km}$ or 4700m	A1cso **(4)** **(9 marks)**

(a)

M1: Attempts $r\theta = 5\times1.2$

A1: Achieves 16 (km)

(b)

M1: Attempts $\frac{1}{2}r^2\theta = \frac{1}{2}\times5^2\times1.2$ (or $\frac{1}{2}rl = \frac{1}{2}\times5\times6$) May be implied by Area of sector = 15 seen.

M1: Attempts $\frac{1}{4}\times\left(\frac{1}{2}\times5^2\times1.2\right)$ or $\frac{3}{4}\times\left(\frac{1}{2}\times5^2\times1.2\right)$ or other full method to find the area for one of the two regions.

A1*: Achieves given answer, including units, showing all steps with no errors and full accuracy kept throughout. Score A0 if rounded values were used during working.

Approaches by verification are acceptable. The first M1 will apply the same way, a clear attempt at the sector area formula will be needed to determine the area.
The second M may then be gained for attempting
Area Sector $AOB =$ Area R_1 + Area $R_2 = 3\times3.75 + 3.75 = \ldots$

Then for the A mark the calculations need to both be correct (giving 15), and a conclusion made: E.g. (so) Area R_2 = 3.75 km^2.

(c)

M1: Sets $\frac{1}{2}\times5\times OP\times\sin1.2 = 3.75 \Rightarrow OP = ...$ There are some longer methods to find OP, so this may be scored for any complete method. E.g finds area of triangle APB from difference of area triangle OAB $\left(=\frac{1}{2}5^2\sin1.2\right)$ and 3.75, the uses ratio OP:PB is same

as ratio of these areas to form and solve an equation for *OP*. Other method may be possible. Or $\frac{1}{2}OP.h = 3.75,\ h = 5\sin 1.2 \Rightarrow OP = ...$

A1: Achieves distance *OP* = awrt 1.6 (allow if called *AP*). May be implied by subsequent work.

M1: Attempts the cosine rule, or other full method, to find at least AP^2 using angle 1.2, *OA* = 5 and their *OP*. Condone if AP^2 is missing or labelled *AP*.

Again there are longer winded ways, e.g. using right angle triangle *OAX* where *X* is the base of perpendicular to *OB* through *A*, then $AX = 5\sin 1.2,\ PX = \frac{AX}{\tan 1.2} - OP$ and $AP^2 = AX^2 + PX^2$ can be used to find *AP*.

A1cso: $AP = 4.7\text{km}$ or 4700m (isw once seen if further rounding occurs). Must include the correct units and be given to nearest 100m.

Watch out for using of $\frac{1}{2} \times 5 \times OP \times 1.2 = 3.75 \Rightarrow OP = 1.25$ which also leads to 4.7km. This scores at most M0A0M1A0 despite giving the same answer.

SC If R_1 and R_2 are mixed up in part (c) then score as a misread if the work is otherwise correct – so M1 for attempting $\frac{1}{2} \times 5 \times OP \times \sin 1.2 = 11.25 \Rightarrow OP = ...$ and dM1 for a correct use of the cosine rule to find *AP*.

Some methods do not find *OP*, but a different intermediate length for a triangle containing *AP*. Such methods score the M1 for the attempt to find two other side lengths for a triangle with side *AP* and the A1 for a correct length, then second M for full method to find at least AP^2. For example

Question Number	Scheme	Marks
5(c) Alt	Let *X* be base of perpendicular to *OA* though *P*, then $\frac{1}{2} \times 5 \times XP = 3.75 \Rightarrow XP = 1.5 \Rightarrow OX = \frac{"1.5"}{\tan 1.2}$ so $AX = 5 - \frac{"1.5"}{\tan 1.2} = ...$ $AX = 4.416...$ $AP^2 = "4.416..."^2 + "1.5"^2 = ...$ $AP = 4.7\text{km}$ or 4700m	M1 A1 M1 A1 **(4)** **(9 marks)**