6(b)	$\frac{4k}{x-2k}=6-2x \Rightarrow 4k=6x-12k-2x^2+4kx$ o.e.	M1 A1
	$2x^2-(4k+6)x+16k=0 \Rightarrow b^2-4ac=(4k+6)^2-4\times 2\times 16k$	**d**M1
	$4k^2-20k+9=0 \Rightarrow (2k-1)(2k-9)=0 \Rightarrow k=\frac{1}{2},\frac{9}{2}$ so $0<k\leq\frac{1}{2}, k\geq\frac{9}{2}$	**dd**M1 A1
		(5)
		(9 marks)

(b) Notes

M1: Equates curve with given line and attempts to form a quadratic equation.
The terms do not need to be collected.
Look for $\frac{4k}{x-2k}=6-2x$ cross multiplies (condoning slips) and proceeds to a quadratic equation.

A1: Correct quadratic equation with brackets expanded which may be unsimplified e.g.
$\frac{4k}{x-2k}=6-2x \Rightarrow 4k=6x-12k-2x^2+4kx$

dM1: Correct attempt to find the discriminant b^2-4ac for their $ax^2+bx+c=0$ with both *b* and *c* expressions in terms of *k*. May be seen embedded in an attempt at the quadratic formula.
It is dependent upon the previous Method mark.

ddM1: Solves their 3 term quadratic equation/inequality in *k* resulting from $b^2-4ac...0$ **and** chooses the **outside region** for their critical values.
Allow calculator solutions for solving their 3TQ and condone factors that are inconsistent with their equation so just look for the correct or correct ft roots with an attempt at the outside regions e.g. condone $4k^2-20k+9=0 \Rightarrow \left(k-\frac{1}{2}\right)\left(k-\frac{9}{2}\right)=0 \Rightarrow k=\frac{1}{2},\frac{9}{2} \Rightarrow k<\frac{1}{2}, k>\frac{9}{2}$

The roots may be embedded so allow e.g. $4k^2-20k+9=0 \Rightarrow k\leq\frac{1}{2}, k\geq\frac{9}{2}$ to imply this mark.

Condone the boundaries not being included in the inequality and condone the omission of $k>0$
Condone the use of *x* rather than *k*.
It is dependent upon both previous Method marks.

A1: CSO $0<k\leq\frac{1}{2}, k\geq\frac{9}{2}$ o.e. Must be in terms of *k*.

The following are acceptable:

$0 < k \leq \frac{1}{2}, k \geq \frac{9}{2}$	$0 < k \leq \frac{1}{2}$ and $k \geq \frac{9}{2}$	$0 < k \leq \frac{1}{2}$ or $k \geq \frac{9}{2}$	$0 < k \leq \frac{1}{2} \cup k \geq \frac{9}{2}$
$\left(0, \frac{1}{2}\right], \left[\frac{9}{2}, \infty\right)$	$\left\{k : 0 < k \leq \frac{1}{2}, k \geq \frac{9}{2}\right\}$		

But do **not** allow $0 < k \leq \frac{1}{2} \cap k \geq \frac{9}{2}$.

Do not isw and mark their final answer.

Question Number	Scheme	Marks
7(a)	$\frac{1}{2}r^2\times1.65=30\Rightarrow r^2=\ldots$ or $r=\ldots$	M1
	$r=6.03$	A1
	$\left(OQ=\right)6.03+2.8=8.83\,(\text{m})$*	A1*
		(3)
	(a) Alternative	
	$\frac{1}{2}(OQ-2.8)^2\times1.65=30\Rightarrow(OQ-2.8)^2=\ldots$ or $(OQ-2.8)=\ldots$	M1
	$(OQ-2.8)=6.030\ldots$	A1
	$\left(OQ=\right)6.03+2.8=8.83\,(\text{m})$*	A1*

Notes

(a)

M1: Uses $\frac{1}{2}r^2\times1.65=30$ in an attempt to find a value for r^2 or r (where r is OP)

A1: $"r"=6.03\ldots$ or exact $\sqrt{\frac{400}{11}}$ or $\frac{20}{\sqrt{11}}$ or $\frac{20\sqrt{11}}{11}$ or $\sqrt{36.36\ldots}$

A1*: $\left(OQ=\right)6.03\left(\text{or e.g.}\frac{20\sqrt{11}}{11}\text{ or }\sqrt{36.36\ldots}\right)+2.8=8.83\,(\text{m})$

Must be 8.83 not awrt 8.83

The "$OQ=$" is not required.

There must be some indication that they are adding $6.03\left(\text{or e.g.}\frac{20\sqrt{11}}{11}\right)$ to 2.8

There is no requirement for units but if any are given they must be correct.

Allow equivalent **correct** work in degrees e.g. $1.65\,\text{rads}=1.65\times\frac{180}{\pi}°$ etc.

Alternative:

M1: Uses $\frac{1}{2}(OQ-2.8)^2\times1.65=30$ in an attempt to find a value for $(OQ-2.8)^2$ or $(OQ-2.8)$

A1: $(OQ-2.8)=6.03\ldots$ or exact $\sqrt{\frac{400}{11}}$ or $\frac{20}{\sqrt{11}}$ or $\frac{20\sqrt{11}}{11}$ or $\sqrt{36.36\ldots}$

A1*: $OQ=6.03\left(\text{or e.g.}\frac{20\sqrt{11}}{11}\right)+2.8=8.83\,(\text{m})$

Must be 8.83 not awrt 8.83

No requirement for units but if any are given they must be correct.

Note that any attempts to verify the result in (a) would need a complete argument e.g. attempts to find the area for 2 suitable values of OQ such as 8.835 and 8.825 for M1, A1 for both areas evaluated correctly and A1 for fully reasoning that OQ is 8.83 to 2dp.

(b)	Attempts $\frac{1}{2}\times 8.83^2\times(2\pi-1.65)=(180.__)$	M1
	Total area = $\frac{1}{2}\times 8.83^2\times(2\pi-1.65)+30=...$	dM1
	awrt 210 (m^2) or 211 (m^2)	A1
		(3)
(c)	"6.03"$\times 1.65=(9.95)$ **or** $8.83\times(2\pi-1.65)=(40.91)$	M1
	Full method for perimeter = "6.03"$\times 1.65+8.83\times(2\pi-1.65)+2.8\times 2$	dM1
	= awrt 56 (m)	A1
		(3)
		(9 marks)

Notes

Allow equivalent correct work in degrees.

(b)

M1: Attempts $\frac{1}{2}\times 8.83^2\times(2\pi-1.65)$ or equivalent e.g. $\pi\times 8.83^2-\frac{1}{2}\times 8.83^2\times 1.65$

May be implied by awrt 180 or awrt 181 provided no incorrect working is seen.

dM1: Attempts $\frac{1}{2}\times 8.83^2\times(2\pi-1.65)+30=...$

Adds 30 to a correct attempt at the area of the major sector of the larger circle.

A1: awrt 210 (m^2) or awrt 211 (m^2)

No requirement for units but if any are given they must be correct.

Correct answer only scores no marks.

(c)

M1: Attempts "6.03"$\times 1.65$ which may be implied by awrt 9.95 or 3sf accuracy for their 6.03 provided no incorrect working is seen.

OR

Attempts $8.83\times(2\pi-1.65)$ which may be implied by awrt 40.9 provided no incorrect working is seen.

dM1: Full method for perimeter = "6.03"$\times 1.65+8.83\times(2\pi-1.65)+2.8\times 2$

A1: awrt 56 (m) . No requirement for units but if any are given they must be correct.

Correct answer only scores no marks.

