Question	Scheme	Marks
2(a)	$b = 2$	B1
	$...\pm...(x\pm3)^2$	M1
	$\left(\mathrm{f}(x)=\right)\ 21-2(x-3)^2$	A1
		(3)
(b)	R is $(0,-4)$ or "h" $= 4$	B1
	$\mathrm{f}(x)-7=14-2(x-3)^2 \Rightarrow x=...$ or $\mathrm{f}(x)-7=-4+12x-2x^2 \Rightarrow x=...$ $\left(\text{NB } x=3\pm\sqrt{7}\right)$	M1
	$\text{Area}=\frac{1}{2}\times\left("3+\sqrt{7}"-\left("3-\sqrt{7}"\right)\right)\times"4"$	dM1
	$=4\sqrt{7}$	A1
		(4)
		(7 marks)

Notes

(a)

B1 $b = 2$ implied from their expression or stated. Eg look for $-2(x\pm...)^2$
Beware of expressions such as $21+2(x-3)^2$ which would be B0

M1 Sight of $(x\pm3)^2$

A1 $21-2(x-3)^2$. Condone $21-2(x+-3)^2$ or they may state the values for *a,b* and *c*. If there is a contradiction between what appears to be their final expression and values for *a*, *b* or *c* which are incorrectly stated afterwards then treat this as isw.

(b)

B1 R is $(0,-4)$ or "h" $= 4$ (The coordinate may be seen on a diagram as a point of their triangle or quadratic so allow just -4 rather than the full coordinate to be indicted on the *y*-axis). It may also be implied by their working.

M1 Attempts to solve $\mathrm{f}(x)-7=0$
Score for an attempt to solve a 3TQ of the form:
$-2x^2+12x+C=0$ where $C\neq3$ or $A-2(x-3)^2=0$ where $A\neq21$
or if they use their part (a) $"a"-"b"(x+"c")^2=0\Rightarrow d-"b"(x+"c")^2=0$ where $d\neq a$

(It must have a different y intercept to the given $f(x)$ or their $f(x)$ from part (a) but the coefficients of x and x^2 must remain the same.)
Condone slips in their working. They should be solving their quadratic using either the formula or completing the square. (usual rules for solving). Allow to be solved directly from a calculator. If only the roots are written, then these will need to be checked.

dM1 Fully correct method for the area of their triangle. It is dependent on the previous method mark.
Score for values embedded in $\frac{1}{2}\times(\beta-\alpha)\times"y-\text{intercept}"$ where α,β are the roots of their 3TQ.
This should be $\frac{1}{2}\times(2\times\sqrt{...})\times"y-\text{intercept}"$ oe

Alternatively, if their quadratic has a negative y-intercept they may find the area of a large right-angled triangle and subtract the area of the small right-angled triangle. Look for expressions of the form:

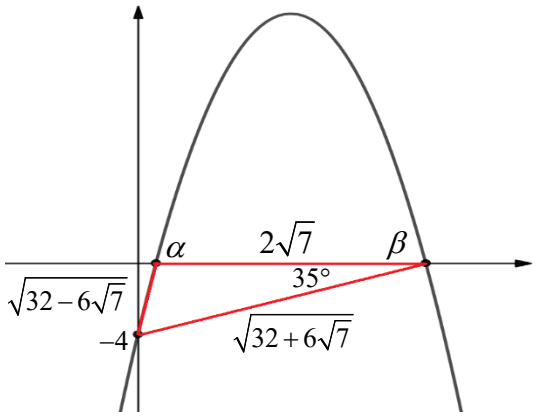
$$\frac{1}{2}\times\beta\times"y-\text{intercept}"-\frac{1}{2}\times\alpha\times"y-\text{intercept}"$$

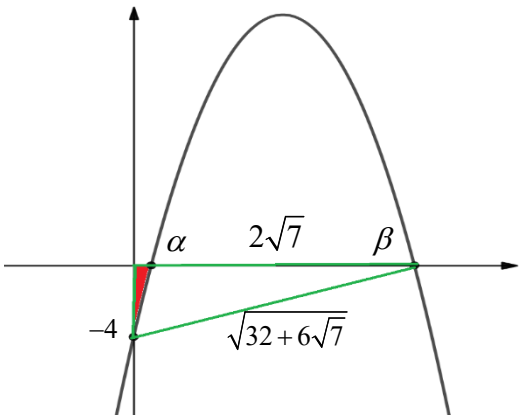
They may even attempt finding all the lengths of the triangle, applying the cosine rule to find an angle and then applying the area sine rule. (See diagrams below).
Alternatively, they may apply the shoelace method:
$\frac{1}{2}\left|\left((3+\sqrt{7})\times0+(3-\sqrt{7})\times(-4)+0\times0\right)-\left(0\times(3-\sqrt{7})+0\times0+(-4)\times(3+\sqrt{7})\right)\right|=4\sqrt{7}$ oe
You may see other credit worthy methods so if in doubt send to review.

A1 $4\sqrt{7}$ Cao (Allow e.g. $=2\sqrt{28}$, $\sqrt{112}$). They may work in decimals and state the correct exact answer of $4\sqrt{7}$ which can score full marks **if it follows from a correct method**.

Note

$f(x)+7=0\Rightarrow 28-2(x-3)^2$ or $10+12x-2x^2\Rightarrow x=3\pm\sqrt{14}\Rightarrow$ Area $=\frac{1}{2}\times\left(2\sqrt{14}\right)\times10=10\sqrt{14}$
would score B0M1M1A0





Large triangle $=6+2\sqrt{7}=11.29...$
Small triangle $=6-2\sqrt{7}=0.708...$

Question	Scheme	Marks
3(a)	$\frac{1}{2}\times 3^2\times\alpha = 7.2 \Rightarrow \alpha = ...$ or $\frac{1}{2}\times 3^2\times 1.6 = 7.2 \Rightarrow \alpha = 1.6$ $\alpha = 1.6$*	M1 A1*
		(2)
(b)(i)	Angle $COA = \frac{1}{2}(2\pi - 1.6)(= 2.34...)$ $(\approx 134°)$	M1
	Area $COA = \frac{1}{2}\times 5\times 3\sin("2.34")$ $(= 5.38...)$	M1
	Total Area $= 2\times\frac{1}{2}\times 5\times 3\sin("2.34") + 7.2$	dM1
	= 18 (cm^2) Awrt 18 (cm^2) (Ans = 17.96)	A1
(ii)	Arc $AB = 3\times 1.6(= 4.8)$	B1
	$(AC^2 =)\ 5^2 + 3^2 - 2\times 5\times 3\cos("2.34")$	M1
	Total perimeter $= 2\times\sqrt{5^2 + 3^2 - 2\times 5\times 3\cos("2.34")} + 3\times 1.6$	dM1
	= Awrt 19.6 (cm)	A1
		(8)
Alt (b)(i)	$AB = 2\times 3\sin 0.8$	M1
	$ON = 3\cos 0.8$	M1
	Total Area $= \frac{1}{2}(5 + ON)\times AB + 7.2 - \frac{1}{2}\times 3\cos 0.8\times 2\times 3\sin 0.8$	dM1
	= 18 (cm^2) Awrt 18 (cm^2) (Ans = 17.96)	A1
		(10 marks)

Notes

(a)

M1 Uses a correct sector area formula and 7.2 to find the value for α. They should show the values embedded in the equation and proceed to find a value for α.
Alternatively, substitutes in $\alpha = 1.6$ into the area of a sector formula and achieves 7.2.

A1* Correct proof starting with $\frac{1}{2}\times 3^2\times\alpha = 7.2$ and at least one intermediate line of working and no errors. Eg $\frac{1}{2}\times 3^2\times\alpha = 7.2 \Rightarrow \alpha = \frac{7.2}{4.5} = 1.6$ scores M1A1
Alternatively, they must conclude that $\alpha = 1.6$ or if there is a preamble then there should be some form of completion which could be a tick, QED etc.
If they use a different variable such as θ they must state/link somewhere that $\alpha = 1.6$