Question Number	Scheme	Marks
3.(a)	Attempts $\left(\frac{dy}{dx}=\right) 2x+3$ at $x=3$	M1
	At $x=3$ gradient of tangent = 9	A1 **(2)**
(b)	$\left(y_Q=\right) (3+h)^2+3(3+h)-2$	B1
	Gradient $PQ=\frac{(3+h)^2+3(3+h)-2-16}{3+h-3}=\frac{9h+h^2}{h}=9+h$	M1 A1 **(3)**
(c)	States as $h\to 0$ Gradient $PQ\to 9$ = Gradient of tangent	B1 **(1)**
		(6 marks)

(a)

M1 Attempts to find the value of $\left(\frac{dy}{dx}=\right) ax+3,\quad a>0$ at $x=3$. Look for 3 to be substituted into the expression and proceeding to a value.

A1 9 (Answer only scores both marks)

(b)

B1 $\left(y_Q=\right) (3+h)^2+3(3+h)-2$ (seen or implied)

M1 Attempts $\pm\frac{y_Q-16}{x_Q-3}$ condoning slips, but must be a genuine attempt at y_Q. Condone lack of brackets if implied by later working.

A1 $9+h$ with no errors seen and not originating from methods in calculus. This expression may immediately follow a correct simplified expression of $y_Q=h^2+9h+16$

(c)

B1 States as $h\to 0$ Gradient $PQ\to 9$ = Gradient of tangent (oe)

They must have achieved $9+h$ in (b) and 9 in (a)

There should be reference to "limit" or "as *h* tends to 0" (words or symbols) and linked to part (a) (so same gradient, or showing the answers agree). But be generous with the explanation beyond these contraints.

Question Number	Scheme	Marks
4 (a)	States or uses $\cos AOD = \frac{4}{12} \Rightarrow$ angle $AOD = 1.231$ *	M1 A1* **(2)**
(b)	Attempts $\frac{1}{2}r^2\theta$ with $r = 12$ and $\theta = \pi \pm 1.231$ or 1.231	M1
	Attempts area $AOD = \frac{1}{2}\times"4"\times\sqrt{12^2-"4"^2}$ oe (22.627...)	M1
	Attempts sector $-$ triangle $= \frac{1}{2}\times12^2\times(\pi+1.231)-\frac{1}{2}\times"4"\times\sqrt{12^2-"4"^2}$ (314.8….) – (22.627…)	ddM1
	or Attempts circle-sector-triangle $\pi\times12^2-\frac{1}{2}\times12^2\times(\pi-1.231)-\frac{1}{2}\times"4"\times\sqrt{12^2-"4"^2}$ 452.38… – 137.562…. – 22.627…… = awrt 292.2 (m^2)	A1 **(4)**
(c)	Attempts $s = r\theta$ with $r = 12$ and $\theta = \pi \pm 1.231$ or 1.231	M1
	Attempts $P = 16+\sqrt{12^2-4^2}+12(\pi+1.231)$ oe	dM1
	= awrt 79.8 (m)	A1 **(3)** **(9 marks)**
Alt(a)	$AD = \sqrt{12^2-4^2} = 8\sqrt{2}$ $\cos AOD = \frac{12^2+4^2-(8\sqrt{2})^2}{2\times12\times4} \Rightarrow$ angle $AOD = \cos^{-1}\left(\frac{1}{3}\right) = 1.231$	M1A1*

(a)

M1 Attempts $\cos AOD = \frac{4}{12} \Rightarrow$ angle $AOD = ...$ via a correct method.

Alternatively attempts to find AD using Pythagoras' theorem correctly **and** uses the appropriate sine or tangent. They may attempt to use the cosine rule with all three side (see alt(a)).
Other candidates are finding angle *OAD* and using angles in a triangle to find angle *AOD*.

Do not award this mark for candidates who attempt to use 1.231 and compare with $\frac{4}{12}$

A1* Achieves angle $AOD = 1.231$ following a valid method and at least one step of working shown.

Minimum acceptable $\cos^{-1}\left(\frac{4}{12}\right) = 1.231$ or $\cos AOD = \frac{4}{12} \Rightarrow$ angle $AOD = 1.231$

Only withhold this mark if

- awrt 1.231 radians is not achieved following a correct method. FYI sight of 1.23095… is likely to imply both marks)
- they work in degrees but fail to achieve awrt 70.5° **before** proceeding to 1.231 radians

We are going to condone on this occasion any rounding that may be written as part of their intermediate steps as long as they achieve awrt 1.231. Ignore any omission of brackets.