Question	Scheme	Marks	AOs
9(a)	E.g. midpoint $PQ = \left(\dfrac{-9+15}{2}, \dfrac{8-10}{2}\right)$	M1	1.1b
	$= (3, -1)$, which is the centre point A, so PQ is the diameter of the circle.	A1	2.1
		(2)	
(a) Alt 1	$m_{PQ} = \dfrac{-10-8}{15--9} = -\dfrac{3}{4} \Rightarrow PQ:\ y-8 = -\dfrac{3}{4}(x--9)$	M1	1.1b
	$PQ: y = -\dfrac{3}{4}x + \dfrac{5}{4}$. So $x = 3 \Rightarrow y = -\dfrac{3}{4}(3) + \dfrac{5}{4} = -1$ so PQ is the diameter of the circle.	A1	2.1
		(2)	
(a) Alt 2	$PQ = \sqrt{(-9-15)^2 + (8--10)^2}\ \left\{= \sqrt{900} = 30\right\}$ **and either** • $AP = \sqrt{(3--9)^2 + (-1-8)^2}\ \left\{= \sqrt{225} = 15\right\}$ • $AQ = \sqrt{(3-15)^2 + (-1--10)^2}\ \left\{= \sqrt{225} = 15\right\}$	M1	1.1b
	e.g. as $PQ = 2AP$, then PQ is the diameter of the circle.	A1	2.1
		(2)	
(b)	Uses Pythagoras in a correct method to find either the radius or diameter of the circle.	M1	1.1b
	$(x-3)^2 + (y+1)^2 = 225\ \left(\text{or } (15)^2\right)$	M1	1.1b
		A1	1.1b
		(3)	
(c)	Distance $= \sqrt{(\text{"15"})^2 - (10)^2}$ or $= \dfrac{1}{2}\sqrt{(2(\text{"15"}))^2 - (2(10))^2}$	M1	3.1a
	$\left\{= \sqrt{125}\right\} = 5\sqrt{5}$	A1	1.1b
		(2)	
(d)	$\sin(A\hat{R}Q) = \dfrac{20}{2(\text{"15"})}$ or $A\hat{R}Q = 90 - \cos^{-1}\left(\dfrac{10}{\text{"15"}}\right)$	M1	3.1a
	$A\hat{R}Q = 41.8103... = 41.8°$ (to 0.1 of a degree)	A1	1.1b
		(2)	
		(9 marks)	

Question 9 Notes:	
(a)	
M1:	Uses a correct method to find the midpoint of the line segment PQ
A1:	Completes proof by obtaining $(3, -1)$ and gives a correct conclusion.
(a)	
Alt 1	
M1:	Full attempt to find the equation of the line PQ
A1:	Completes proof by showing that $(3, -1)$ lies on PQ and gives a correct conclusion.
(a)	
Alt 2	
M1:	Attempts to find distance PQ and either one of distance AP or distance AQ
A1:	Correctly shows either • $PQ = 2AP$, supported by $PQ = 30,\ AP = 15$ and gives a correct conclusion • $PQ = 2AQ$, supported by $PQ = 30,\ AQ = 15$ and gives a correct conclusion
(b)	
M1:	**Either** • uses Pythagoras correctly in order to find the **radius**. Must clearly be identified as the **radius**. E.g. $r^2 = (-9-3)^2 + (8+1)^2$ or $r = \sqrt{(-9-3)^2 + (8+1)^2}$ or $r^2 = (15-3)^2 + (-10+1)^2$ or $r = \sqrt{(15-3)^2 + (-10+1)^2}$ **or** • uses Pythagoras correctly in order to find the **diameter**. Must clearly be identified as the **diameter**. E.g. $d^2 = (15+9)^2 + (-10-8)^2$ or $d = \sqrt{(15+9)^2 + (-10-8)^2}$ **Note:** This mark can be implied by just 30 clearly seen as the **diameter** or 15 clearly seen as the **radius** (may be seen or implied in their circle equation)
M1:	Writes down a circle equation in the form $(x \pm \text{"3"})^2 + (y \pm \text{"}-1\text{"})^2 = (\text{their } r)^2$
A1:	$(x-3)^2 + (y+1)^2 = 225$ or $(x-3)^2 + (y+1)^2 = 15^2$ or $x^2 - 6x + y^2 + 2y - 215 = 0$
(c)	
M1:	Attempts to solve the problem by using the circle property "the perpendicular from the centre to a chord bisects the chord" and so applies Pythagoras to write down an expression of the form $\sqrt{(\text{their "15"})^2 - (10)^2}$.
A1:	$5\sqrt{5}$ by correct solution only
(d)	
M1:	Attempts to solve the problem by e.g. using the circle property "the angle in a semi-circle is a right angle" and writes down either $\sin(A\hat{R}Q) = \dfrac{20}{2(\text{their "15"})}$ or $A\hat{R}Q = 90 - \cos^{-1}\left(\dfrac{10}{\text{their "15"}}\right)$ **Note:** Also allow $\cos(A\hat{R}Q) = \dfrac{15^2 + \left(2\left(5\sqrt{5}\right)\right)^2 - 15^2}{2(15)\left(2\left(5\sqrt{5}\right)\right)}$ $\left\{= \dfrac{\sqrt{5}}{3}\right\}$
A1:	41.8 by correct solution only