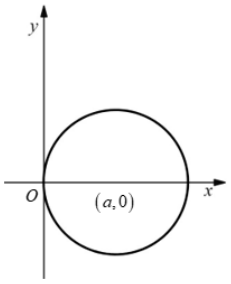
Question Number	Scheme	Marks
9(a)		B1 **(1)**
(b)	$(x \pm a)^2 + y^2 = ...$	M1
	$(x \pm a)^2 + y^2 = a^2$	A1
	Uses $(5, 6)$ in $(x \pm a)^2 + y^2 = a^2$ to form and solve an equation in a	dM1
	E.g. $(5-a)^2 + 36 = a^2 \Rightarrow 10a = 61 \Rightarrow a = 6.1$	
	$(x-6.1)^2 + y^2 = 6.1^2$	A1
		(4) **(5 marks)**

(a)

B1: A circle lying in quadrants 1 and 4 only which

- passes through (0, 0)
- is symmetrical about the *x*-axis

Condone slips of the pen. Mark this positively.
Ignore any reference to the point $(5,6)$
Ignore any reference to the coordinates of the centre

(b) Way One: Candidates start from an appropriate equation involving x^2 and y^2 then use (5, 6)

The following equations are mostly written with a constant *a*. Any suitable constant may be used.
The sign of the constant is also not important so accept $(x+a)^2 + y^2 = ...$ or $(x-a)^2 + y^2 = ...$ as well as $(a-x)^2 + y^2 = ...$

M1: Allowable left-hand side for the equation of *C* For example $(x \pm a)^2 + y^2 = ...$ or $(a-x)^2 + y^2 = ...$
This must involve a constant and not be $(x-5)^2 + y^2 = ...$ for example

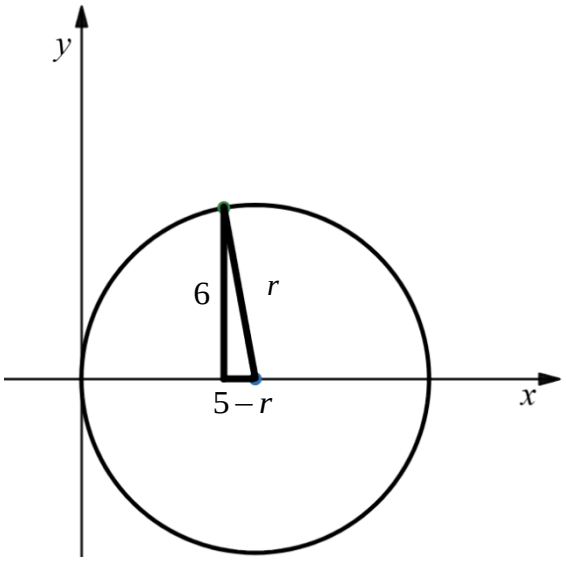
A1: Correct form for the equation involving a **single** constant.
Examples of correct equations are $(x-a)^2 + y^2 = a^2$, $(x+k)^2 + y^2 = k^2$ and $x^2 + y^2 = \pm 2px$
If they write $(x-a)^2 + y^2 = r^2$ and $r^2 = a^2$ this can be implied

dM1: Uses $(5, 6)$ in $(x \pm a)^2 + y^2 = a^2$ o.e. to form and solve an equation in *a*.
E.g. $(5-a)^2 + 36 = a^2 \Rightarrow \pm 10a = 61 \Rightarrow a = ...$
$5^2 + 6^2 = \pm 10p \Rightarrow p = ...$

A1: $(x-6.1)^2 + y^2 = 6.1^2$ o.e. such as $x^2 + y^2 = 12.2x$

……

Way Two: Candidates use Pythagoras' theorem to set up an equation in single variable



M1: Applies Pythagoras's theorem leading to the equation $(r-5)^2+36=r^2$ or $(5-r)^2+36=r^2$
This may be awarded for any variable

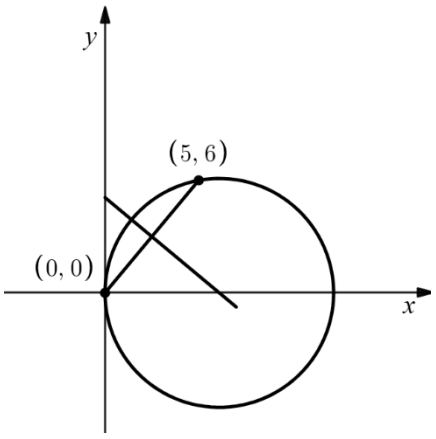
A1: Solves the above equation to find correct value $r=6.1$

dM1: Uses a correct equation of circle $(x-'6.1')^2+y^2='6.1'^{\,2}$ following through on their 6.1.
This is dependent on the 6.1 being a solution of a correct equation (previous M1)

A1: $(x-6.1)^2+y^2=6.1^2$ o.e.

Way Three: Bisector of chord method

M1: Attempts to find where the perpendicular bisector cuts the *x*-axis
Look for a good attempt using mid points and perpendicular gradient work.



A1: Achieves equation of perpendicular bisector as $y=-\frac{5}{6}x+\frac{61}{12}$
and point of intersection with the *x*-axis to be $\frac{61}{10}$ o.e

dM1: Correct form of equation with $(x-'6.1')^2+y^2='6.1'^{\,2}$

A1: $(x-6.1)^2+y^2=6.1^2$ o.e.

Question Number	Scheme	Marks
10 (a)	$y = 2x + \frac{64}{x^2} - 3$ $\frac{dy}{dx} = 2 - \frac{128}{x^3}$	M1, A1
	Attempts to solve $\frac{dy}{dx} \Rightarrow x^3 = 64 \Rightarrow x = 4$ *	dM1, A1*
		(4)
(b)	$\int 2x + \frac{64}{x^2} - 3\,dx = x^2 - \frac{64}{x} - 3x \quad (+c)$	M1, A1
	Finds the y values at both $x = 2$ and $x = 4$. $M = (0, 17)$ and $N = (0, 9)$	B1
	Full attempt at area = $\left[x^2 - \frac{64}{x} - 3x\right]_2^4 - 9 \times 2 + 2 \times (17 - 9) = 22 - 18 + 16 = 20$	dM1, A1
		(5) **(9 marks)**

(a)

M1: Attempts $\frac{dy}{dx}$ with one correct aspect. Allow for $2x \to 2$ or $x^{-2} \to x^{-3}$ but not $3 \to 0$

A1: $\frac{dy}{dx} = 2 - \frac{128}{x^3}$ o.e which may be left un simplified. The lhs is not required

dM1: Sets their $\frac{dy}{dx} = p \pm qx^{-3} = 0$ and proceeds to $\alpha x^{\pm 3} = \beta$

Also allow candidates to substitute 4 into their $\frac{dy}{dx}$ which must be of the form $\frac{dy}{dx} = p \pm qx^{-3}$ and find its value.

A1*: Shows that the x coordinate of P is 4. This is a given answer so there must be sufficient evidence

For a direct proof you should see all of $2 - \frac{128}{x^3} = 0$, $x^3 = 64$ (condone $2x^3 = 128$) and $x = 4$

or $2 - \frac{128}{x^3} = 0$, $x^{-3} = \frac{1}{64}$ (condone $x^{-3} = \frac{2}{128}$) and $x = 4$

For a substitution method look for $\frac{dy}{dx} = 2 - \frac{128}{x^3}$ and at P, $\frac{dy}{dx} = 2 - \frac{128}{4^3} = 0$, hence proven (o.e.)