Question Number	Scheme	Marks
6 (a)	Centre of circle is midpoint of $(-2,18)$ and $(14,6) = (6,12)$	B1
	Attempts radius^2 or diameter^2. E.g. $D^2 = (14--2)^2 + (6-18)^2 = 400$	M1
	Radius^2 = 100	A1
	$(x-6)^2 + (y-12)^2 = 100$	M1, A1
		(5)
(b)	Recognises equation of C_2 is $x^2 + y^2 = k^2$	B1
	Attempts to find one value of k or k^2 Look for $\sqrt{"6"^2 + "12"^2} \pm \sqrt{"100"}$	M1
	$x^2 + y^2 = \left(6\sqrt{5}+10\right)^2$ or $x^2 + y^2 = \left(6\sqrt{5}-10\right)^2$ o.e.	A1
	$x^2 + y^2 = \left(6\sqrt{5}+10\right)^2$ and $x^2 + y^2 = \left(6\sqrt{5}-10\right)^2$ o.e.	A1
		(4)
		(9 marks)

(a) **The demand here is that the method must be made clear**

B1: Correctly finds the midpoint of the two given points to find the centre of the circle.
It can be implied within the circle formula $(x-6)^2 + (y-12)^2 = r^2$

M1: Attempts to find the radius, radius^2 , diameter or diameter^2.
It does not need to be correctly assigned to either the radius or the diameter
So $(14--2)^2 + (6-18)^2$, $16^2 + 12^2$, $\sqrt{8^2 + 6^2}$ or radius = 10 are acceptable attempts that score M1

A1: Correctly calculates the radius^2 = 100 o.e. or the radius = 10
Alternatively states that the diameter = 20 or diameter^2 = 400
It must be simplified and correctly assigned (radius or diameter) but may be implied from within a circle formula $(x \pm "6")^2 + (y \pm "12")^2 = 100$

M1: Attempts correct form for circle using $(x-a)^2 + (y-b)^2 = r^2$
where (a, b) is their m.p. of *AB* and r is the value of what they think is the radius of the circle.
If there is no statement i.e, radius(*r*) = … or diameter (*d*) = … , the value used must be the equivalent of the distance between the mid-point of *AB* and either point *A* or point *B*.
Look for $(x-"6")^2 + (y-"12")^2 = "100"$ or $(x-"6")^2 + (y-"12")^2 = \frac{"400"}{4}$
So if they clearly state something that is incorrect, e.g. $r^2 = 10$, thus losing the previous A mark, they can score this method mark for $(x-6)^2 + (y-12)^2 = 10$

A1: $(x-6)^2+(y-12)^2=100$, $(x-6)^2+(y-12)^2=10^2$ but not $(x-6)^2+(y-12)^2=\left(\sqrt{100}\right)^2$

ISW after a correct answer.

The method used must have been made clear for A1 to be scored. So, look for all of the following

- a correct calculation of the mid-point of *AB* or alternatively words such as 'centre of circle is $(6,12)$'
- a correct calculation for radius (radius^2) or diameter (diameter^2) or alternatively words such as 'radius of circle is 10'
- a correct equation

(b)

B1: Recognises equation of C_2 is $x^2+y^2=k^2$. Allow for any $x^2+y^2=p, \quad p>0$

Accept $(x\pm 0)^2+(y\pm 0)^2=p, \quad p>0$ Allow 'letters' here so long as the rhs is positive, so k^2 is fine but *p* isn't unless *p* is defined to be positive.

M1: Attempts to find at least one value for the radius of C_2.

For example, score for a radius of $\sqrt{a^2+b^2}\pm r$ for their $(x-a)^2+(y-b)^2=r^2$

A1: $x^2+y^2=\left(6\sqrt{5}+10\right)^2$ or $x^2+y^2=\left(6\sqrt{5}-10\right)^2$ or exact equivalents including versions such as $(x\pm 0)^2+(y\pm 0)^2=\left(6\sqrt{5}+10\right)^2$. ISW after sight of a correct answer.

Expanded equivalents are $x^2+y^2=280+120\sqrt{5}$ or $x^2+y^2=280-120\sqrt{5}$ but isw after a correct answer

A1: $x^2+y^2=\left(6\sqrt{5}+10\right)^2$ and $x^2+y^2=\left(6\sqrt{5}-10\right)^2$ o.e. including versions such as $(x\pm 0)^2+(y\pm 0)^2=\left(6\sqrt{5}+10\right)^2$. ISW after sight of correct answers.

Expanded equivalents are $x^2+y^2=280+120\sqrt{5}$ and $x^2+y^2=280-120\sqrt{5}$ but isw after a correct answer

(b) Longer alternative

Substitutes $y=2x$ into $(x-6)^2+(y-12)^2=100$ and solves

E.g. $(x-6)^2+(2x-12)^2=100\Rightarrow 5(x-6)^2=100\Rightarrow (x-6)^2=20\Rightarrow x=6\pm 2\sqrt{5}$

Hence points of intersection are $\left(6-2\sqrt{5},12-4\sqrt{5}\right)$ and $\left(6+2\sqrt{5},12+4\sqrt{5}\right)$

Radius for smaller circle is found via $r^2 = \left(6-2\sqrt{5}\right)^2 + \left(12-4\sqrt{5}\right)^2 = 280-120\sqrt{5}$

Radius for larger circle is found via $r^2 = \left(6+2\sqrt{5}\right)^2 + \left(12+4\sqrt{5}\right)^2 = 280+120\sqrt{5}$

The same scoring traits can be applied

B1: Recognises equation of C_2 is $x^2+y^2=k^2$. Allow for any $(x\pm 0)^2+(y\pm 0)^2 = p, \quad p>0$

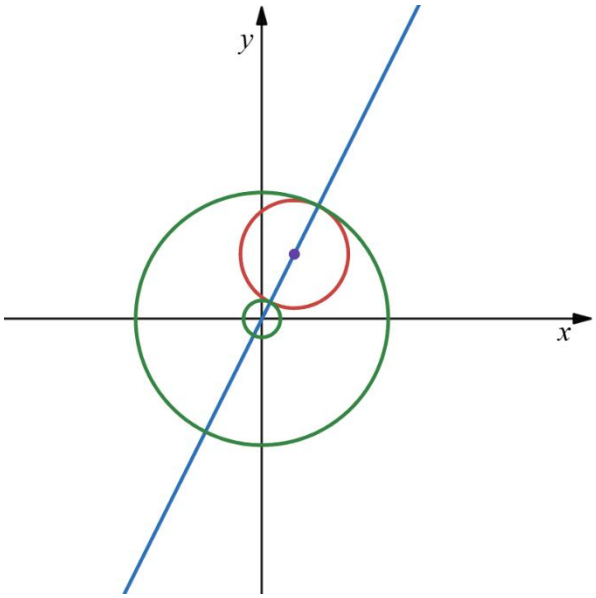
M1: Attempts to find at least a value of r or a value of r^2 for C_2.

For example,

- find at least one intersection point of the line through (0, 0) and their (6, 12) and the circle
- find the distance from the origin to one of the points of intersection

A1: $x^2+y^2 = 280-120\sqrt{5}$ or $x^2+y^2 = 280+120\sqrt{5}$ or exact equivalents

A1: $x^2+y^2 = 280-120\sqrt{5}$ and $x^2+y^2 = 280+120\sqrt{5}$ or exact equivalents



Question Number	Scheme	Marks
7.(a)	$y = x^3 - 4x^{\frac{5}{2}} - kx^{\frac{1}{2}} + 28x - 44$ $y = x^3 - 4x^{\frac{5}{2}} - kx^{\frac{1}{2}} + 28x - 44 \Rightarrow \left(\frac{dy}{dx}\right) = 3x^2 - 10x^{\frac{3}{2}} - \frac{k}{2}x^{-\frac{1}{2}} + 28$	M1, A1 **(2)**
(b)	Subs $x = 9$ into $\frac{dy}{dx}$ and sets = 0 $\Rightarrow 3\times 81 - 10\times 27 - \frac{k}{6} + 28 = 0$ $243 - 270 - \frac{k}{6} + 28 = 0 \Rightarrow \frac{k}{6} = 1 \Rightarrow k = 6$ *	M1 A1* **(2)**
(c)	$\int x^3 - 4x^{\frac{5}{2}} - 6x^{\frac{1}{2}} + 28x - 44\,dx = \frac{1}{4}x^4 - \frac{8}{7}x^{\frac{7}{2}} - 4x^{\frac{3}{2}} + 14x^2 - 44x$ Correct value of $y = -53$ at T Shaded area = $"53"\times 9 + \left[\frac{1}{4}x^4 - \frac{8}{7}x^{\frac{7}{2}} - 4x^{\frac{3}{2}} + 14x^2 - 44x\right]_0^9$ = 248	M1, A1, A1 B1 dM1 A1 **(6)** **(10 marks)**

(a)

M1: Attempts to differentiate. Look for **two** correct terms, one of which could be $-44 \to 0$.
Allow the coefficients to be un-simplified but the indices must be processed

A1: $\left(\frac{dy}{dx}\right) = 3x^2 - 10x^{\frac{3}{2}} - \frac{k}{2}x^{-\frac{1}{2}} + 28$ or other simplified equivalent. ISW after a correct answer

(b)

M1: Substitutes $x = 9$ into their $\frac{dy}{dx}$ and sets = 0. Look for embedded values, or 4 simplified terms set = 0

For the M1 only, allow a substitution of $x = 9$ into their $\frac{dy}{dx}$ which develops into an equation that implies $\frac{dy}{dx}$ = 0. E.g. $\frac{dy}{dx} = 3\times 9^2 - 10\times 9^{\frac{3}{2}} - \frac{k}{2}\times 9^{-\frac{1}{2}} + 28 = \frac{k}{6} - 1$ So $\frac{k}{6} = 1$

Alternatively substitutes $x = 9$ and $k = 6$ into their $\frac{dy}{dx}$ and finds the value of $\frac{dy}{dx}$ with conditions as above.