Question Number	Scheme	Marks
5(i)	$4\tan\theta+5\sin\theta=0$	
	States or uses $\tan\theta=\dfrac{\sin\theta}{\cos\theta}\rightarrow 4\dfrac{\sin\theta}{\cos\theta}+5\sin\theta=0$	M1
	$\sin\theta\left(4+5\cos\theta\right)=0$	
	$\cos\theta=-\dfrac{4}{5}$	dM1
	$\cos\theta=-\dfrac{4}{5}\Rightarrow\theta=$ awrt $143°$ or awrt $217°$	A1
	$\cos\theta=-\dfrac{4}{5}\Rightarrow\theta=$ awrt $143.1°$ and awrt $216.9°$	A1
	$\sin\theta=0\Rightarrow\theta=180°,360°$	B1
		(5)
(ii)	$\dfrac{\sin x}{\cos x}+\dfrac{\cos x}{\sin x}=\dfrac{5}{\cos x}\overset{\times\sin x\cos x}{\Rightarrow}\sin^2 x+\cos^2 x=5\sin x$	
	$5\sin x=1$	M1, A1
	$x=$ awrt $0.201, 2.94$	dM1, A1
		(4)
		(9 marks)

(i) Condone a lack of a degrees symbol throughout. Condone solutions that drop θ's in their working

M1: States $\tan\theta=\dfrac{\sin\theta}{\cos\theta}$ or attempts to use $\tan\theta=\dfrac{\sin\theta}{\cos\theta}$ in the given equation.

Condone slips in coefficients but writing $4\tan\theta$ as $\dfrac{4\sin\theta}{4\cos\theta}$ is M0.

dM1: Attempts all of the following

- uses $\tan\theta=\dfrac{\sin\theta}{\cos\theta}$ condoning slips in the coefficients
- multiplies by $\cos\theta$ and proceeds to a linear equation in $\cos\theta$ via factorising or cancelling out the term in $\sin\theta$
- achieves $\cos\theta=k$ where $|k|<1$

A1: Achieves $\cos\theta=-\dfrac{4}{5}$ and finds one correct value for θ to the nearest degree or in radians to one dp. So, allow for example, awrt 2.5(0) following $\cos\theta=-\dfrac{4}{5}$

A1: Achieves $\cos\theta=-\dfrac{4}{5}$ and finds both θ values in degrees correct to one dp.

awrt $143.1°$ and awrt $216.9°$

Any extra values in the range (for $\cos\theta = -\frac{4}{5}$) is A0

B1: Correctly achieves $\sin\theta = 0$ for their equation followed by $\theta = 180°, 360°$

Condone 0 appearing as a solution

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Alternative approaches exist and can be marked in a similar way:

If you see an approach that deserves credit and you don't know how to score it, please send to review.

Alt I, II and III are examples of alternative approaches.

Alt I Using $\sin\theta = \tan\theta\cos\theta$

$4\tan\theta + 5\sin\theta = 0 \Rightarrow 4\tan\theta + 5\tan\theta\cos\theta = 0 \Rightarrow \tan\theta\left(4 + 5\cos\theta\right) = 0$

then solve $\cos\theta = -\frac{4}{5}$ and $\tan\theta = 0$

M1: Writing $\sin\theta$ as $\cos\theta\tan\theta$

dM1: Factorises out $\tan\theta$ and proceeds to $\cos\theta = k$ where $|k| < 1$

Alt II Squaring approach

$4\sin\theta + 5\sin\theta\cos\theta = 0 \Rightarrow 4\sin\theta = -5\sin\theta\cos\theta \Rightarrow 16\sin^2\theta = 25\sin^2\theta\cos^2\theta$

This will produce $\sin\theta = \pm\frac{3}{5}$ and $\sin\theta = 0$

M1: As main method

dM1: Squaring each term including the coefficients, factorising and cancelling leading to $\sin\theta = k$ where $|k| < 1$ Note that an approach $a + b = 0 \Rightarrow a^2 + b^2 = 0$ would score

dM0. It must be $a + b = 0 \Rightarrow a^2 - b^2 = 0$

B1: Allow this to be scored even from an approach where dM1has not been awarded

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Alt III using Pythagoras' theorem

$$4\frac{\sin\theta}{\cos\theta} + 5\sin\theta = 0 \Rightarrow 4\frac{\sin^2\theta}{\cos\theta} + 5\sin^2\theta = 0 \Rightarrow 4\frac{\left(1-\cos^2\theta\right)}{\cos\theta} + 5\left(1-\cos^2\theta\right) = 0 \Rightarrow 5\cos^3\theta + 4\cos^2\theta - 5\cos\theta - 4 = 0$$

Then solve by any means to find values for $\cos\theta$

$\Rightarrow \cos\theta = \pm 1, -\frac{4}{5} \Rightarrow \theta = 180°, 360°,$ awrt $143.1°$ and awrt $216.9°$

M1: As main method. dM1: Correct method of producing a 4 term cubic in $\cos\theta$ followed by a valid attempt to solve to produce value(s) for $\cos\theta$

(ii) Condone solutions that drop *x*'s in parts of the working and notational errors e.g. $\sin x^2 \leftrightarrow \sin^2 x$ as long as the candidate proceeds in a manner equivalent to the scheme

M1: Attempts to multiply by $\sin x \cos x$, seen on the two terms on the lhs of the equation and then uses $\sin^2 x + \cos^2 x = 1$. Condone slips when rearranging this identity as long as the equation leads to $\sin x = k, |k| < 1$ o.e

Alternatively uses a common denominator approach and simplifies $\frac{\sin x}{\cos x} + \frac{\cos x}{\sin x}$ to $\frac{1}{\sin x \cos x}$

A1: Proceeds to $5\sin x = 1$ or exact equivalent

dM1: Correct attempt to solve $5\sin x = 1$, implied by one correct solution to 2 sf in radians or 1 dp in degrees within the given range. 0 to So

$5\sin x = 1 \Rightarrow \sin x = \frac{1}{5} \Rightarrow x = 0.2$ only is dM0 but *x* = 0.20 or 2.9 is dM1.

Note that the degree answer is 11.5.

Also, solutions such as 0.064π (radians) are acceptable

Allow a miscopy on the 5. So, for example, if they had written $\frac{\sin x}{\cos x} + \frac{\cos x}{\sin x} = \frac{3}{\cos x}$ it would be for a solution of $3\sin x = 1$.

A1: $x =$ awrt $0.201, 2.94$ and no extras within the given domain (condoning the appearance of $\frac{\pi}{2}$ which occurs from a solution of $\cos x = 0$). Award as soon as you see the two correct solutions, so long as there are no additional solutions inside the range.

Also allow multiples of π so accept $x = 0.064\pi, 0.936\pi$ with the decimal aspect being accurate to at least 3dp

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 $(x-6)^2 + (y-12)^2 = 10$