Question Number	Scheme	Marks
8(i)	$5\sin\left(3x+0.1\right)+2=0$ $\Rightarrow 5\sin\left(3x+0.1\right)=-2$ $\Rightarrow \sin\left(3x+0.1\right)=-\frac{2}{5}$	M1
	$\sin\left(3x+0.1\right)=-\frac{2}{5}$ $\Rightarrow 3x+0.1=\sin^{-1}\left(-\frac{2}{5}\right)$ $\Rightarrow x=\frac{\sin^{-1}\left(-\frac{2}{5}\right)-0.1}{3}$	dM1
	$x=-0.94,\ -0.17,\ 1.15,\ 1.92$	A1A1
		(4)
(ii)	$2\tan\theta\sin\theta=\cos\theta+5$ $\Rightarrow 2\sin^2\theta=\cos^2\theta+5\cos\theta$	M1
	$\Rightarrow 2\left(1-\cos^2\theta\right)=\cos^2\theta+5\cos\theta$	M1
	$\Rightarrow 3\cos^2\theta+5\cos\theta-2=0$	A1
	$\cos\theta=\frac{1}{3}\left(,-2\right)$ $\Rightarrow \theta=\cos^{-1}\left(\frac{1}{3}\right)=...$	M1
	$\left(\theta=\right)\ 70.5°,\ 289.5°$	A1
		(5)
		Total 9

Answers with no working score 0 marks

(i)

M1 For ±2 and then dividing by 5 to reach $\sin(3x+0.1)=\pm\frac{2}{5}$ oe

May be implied by $3x+0.1=\pm0.411...$ or allow a different variable to be used such that $y=3x+0.1\ \Rightarrow\sin(y)=\pm\frac{2}{5}$.

Condone $3x+0.1=\pm23.57...$ if they have incorrectly worked in degrees for this mark only.

dM1 Correct strategy for finding x. Allow $x = \dfrac{\pm 2\pi n + \sin^{-1}\left(\pm\dfrac{2}{5}\right) \pm 0.1}{3}$ or

e.g. $x = \dfrac{\pi - \sin^{-1}\left(\pm\dfrac{2}{5}\right) \pm 0.1}{3}$ May be implied by a correct angle, but they must have proceeded as far as $\sin(3x + 0.1) = -\dfrac{2}{5}$ before achieving an angle.

Must be working in radians OR entirely in degrees (if the 0.1 radians is converted first)
It is dependent on the first method mark.

A1 Two of awrt $-0.94, -0.17, 1.15, 1.92$. Must be in radians.

A1 All of awrt $-0.94, -0.17, 1.15, 1.92$ and no extras in range

Beware of $5\sin(3x + 0.1) = -2 \Rightarrow 15\sin x + 0.5 = -2 \Rightarrow x = -0.17$ **which scores 0 marks**

Note: There are other credit worthy methods such as squaring $5\sin(3x + 0.1) = -2$ and using $\pm\sin^2\theta = \pm 1 \pm \cos^2\theta$, then solving a quadratic in cos θ. For the first M1 they would have to proceed as far $3x + 0.1 = ...$ but allow the mark if slips in rearranging are made.

(ii)

M1 For using $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ and attempting to multiply by cos θ (may even be $\cos^2\theta$ or higher which is acceptable). Look for the denominator being removed from $\dfrac{\sin^2\theta}{\cos\theta}$ and multiplying at least one other term by cos θ (or $\cos^2\theta$ etc).

M1 Attempts to use $\pm\sin^2\theta = \pm 1 \pm \cos^2\theta$ and proceeds to an equation in $\cos\theta$ only or $\sin\theta$ only

A1 $3\cos^2\theta + 5\cos\theta - 2\ (= 0)$. Not all need to be on the same side of the equation and condone the omission of = 0 if all on one side. Condone poor notation for $\cos^2\theta$ eg $\cos\theta^2$

M1 Solves their 3TQ in cos θ and takes inverse cos of one of their roots to obtain at least one value for θ. As a minimum, expect to see the root(s) to their 3TQ before proceeding to an angle which may need to be checked. Condone their angle to be in radians eg typically awrt 1.23 or awrt 5.05

A1 awrt 70.5, awrt 289.5 and no others in the range. Must be in degrees not radians.

Question Number	Scheme	Marks
9(a)	$(0, 5)$	B1
		(1)
(b)	$x^2-4x+5=2 \Rightarrow x^2-4x+3=0$ $\Rightarrow x=...$	M1
	$x(E)=1,\ x(F)=3$	A1
		(2)
(c)	Area $R_1 = \int_0^1 \left(x^2-4x+5-2\right)\mathrm{d}x = \left[\frac{x^3}{3}-2x^2+3x\right]_0^1 = \frac{1}{3}-2+3-0=\frac{4}{3}$	M1A1
	Area $R_2 = \frac{1}{2}\times 3\times 3-"\frac{4}{3}" = \frac{19}{6}$ or $\int_0^1 \left(5-x-\left(x^2-4x+5\right)\right)\mathrm{d}x+\frac{1}{2}\times 2\times 2 = \left[\frac{3x^2}{2}-\frac{x^3}{3}\right]_0^1+2=\frac{3}{2}-\frac{1}{3}+2=\frac{7}{6}+2=\frac{19}{6}$ or $\frac{1}{2}\times 3\times 3-\int_0^1 \left(x^2-4x+5-2\right)\mathrm{d}x = \frac{9}{2}-\left[\frac{x^3}{3}-2x^2+3x\right]_0^1 = \frac{9}{2}-\left(\left(\frac{1}{3}-2+3\right)-0\right)=\frac{19}{6}$	M1A1
	$\frac{\text{area of } R_1}{\text{area of } R_2} = \frac{\frac{4}{3}}{\frac{19}{6}} = \frac{8}{19}$	A1
		(5)
		Total 8

Diagram for reference:

