9(a)	$x=0 \Rightarrow \frac{2}{3}\sin\left(3y+\frac{\pi}{4}\right)=0 \Rightarrow 3y+\frac{\pi}{4}=\pi,\ 2\pi,\ldots \Rightarrow y=\ldots$	M1
	$y=\frac{\pi}{4}$ or $y=\frac{7\pi}{12}$	A1
	$y=\frac{\pi}{4}$ and $y=\frac{7\pi}{12}$	A1
		(3)

(b)	$x=\frac{2}{3}\sin\left(3y+\frac{\pi}{4}\right) \Rightarrow \frac{dx}{dy}=\frac{2}{3}\times 3\cos\left(3y+\frac{\pi}{4}\right)\left(=2\cos\left(3y+\frac{\pi}{4}\right)\right)$	B1
	$\Rightarrow \frac{dy}{dx}=\frac{1}{2\cos\left(3y+\frac{\pi}{4}\right)} \Rightarrow \left(\frac{dy}{dx}\right)^2=\frac{1}{4\cos^2\left(3y+\frac{\pi}{4}\right)}=\frac{1}{4\left(1-\sin^2\left(3y+\frac{\pi}{4}\right)\right)}$	M1
	$=\frac{1}{4\left(1-\left(\frac{3x}{2}\right)^2\right)}$	**d**M1
	$=\frac{1}{4-9x^2}$	A1
		(4)

(c)	Identifies that one of the gradients is $\sqrt{"4"}$ or that one of the gradients is $\frac{1}{\sqrt{"4"}}$ **or** Identifies that one of the gradients is 2 or that one of the gradients is $\frac{1}{2}$	B1ft
	At A: $y-"\frac{\pi}{4}"="2"x$ **and** At B: $y-"\frac{7\pi}{12}"="\frac{1}{2}"x$	M1
	$"2"x+"\frac{\pi}{4}"="\frac{1}{2}"x+"\frac{7\pi}{12}" \Rightarrow x=\ldots$	**d**M1
	$x=\frac{2\pi}{9}$	A1
		(4)
		Total 11

9 (a)	$(k=)\ 4\sin^2\left(\frac{\pi}{3}\right)-1=2$ *	B1*
		(1)
(b)	(i) $x=4\sin^2 y-1 \Rightarrow \quad \frac{dx}{dy}=8\sin y\cos y$ o.e.	M1 A1
	(ii) Attempts either $\sin^2 y=\frac{\pm x\pm 1}{4}$ or $\cos^2 y=\pm 1\pm\frac{x+1}{4}$ (both for dM1)	M1 dM1
	$\frac{dy}{dx}=\frac{1}{8\sin y\cos y}=\frac{1}{8\times\sqrt{\frac{x+1}{4}}\times\sqrt{\pm 1\pm\frac{x+1}{4}}}=\frac{1}{2\sqrt{x+1}\sqrt{3-x}}$ *	ddM1 A1*
		(6)
(c)	At $x=2$, gradient of curve $=\frac{1}{2\sqrt{3}} \Rightarrow$ gradient of normal is $-2\sqrt{3}$	M1
	Point N (base length of triangle) is solution of $y-\frac{\pi}{3}=-2\sqrt{3}(x-2) \Rightarrow x=2+\frac{\pi}{6\sqrt{3}}$ $(=2.3...)$	dM1
	$\text{Area}=\frac{1}{2}\times\left(2+\frac{\pi}{6\sqrt{3}}\right)\times\frac{\pi}{3}=\frac{\pi}{3}+\frac{\pi^2}{36\sqrt{3}}$	A1
		(3)
		(10 marks)

5.(a)	$\frac{dy}{dx}=-10\sin 2x-24\cos 2x$	M1, A1
	$\left.\frac{dy}{dx}\right\|_{x=\frac{\pi}{3}}=-10\sin\left(\frac{2\pi}{3}\right)-24\cos\left(\frac{2\pi}{3}\right)=-5\sqrt{3}+12$	A1
		(3)
(b)	$R=13$	B1
	$\tan\alpha=\frac{12}{5}\Rightarrow\alpha=\text{awrt } 1.176$	M1A1
		(3)
(c)	Sets $-26\sin(2x+1.176)=6$	M1
	$\sin(2x+"1.176")=-\frac{3}{13}$	A1 ft
	$x=\frac{\arcsin\left(-\frac{3}{13}\right)-1.176}{2}=\text{awrt } 2.44$	dM1, A1
		(4)
		(10 marks)

Question Number	Scheme	Marks
7	$\left(\frac{dy}{dx}=\right) 2e^{x^2+(3k-2)x}+2xe^{x^2+(3k-2)x}\times(2x+(3k-2))$ $\Rightarrow 2x^2+(3k-2)x+1=0 \Rightarrow (3k-2)^2-4\times2\times1$ $9k^2-12k-4(>0)$ $9k^2-12k-4=0 \Rightarrow k=\frac{12\pm\sqrt{(-12)^2-4\times9\times(-4)}}{2\times9} \Rightarrow k=\ldots$ $k<\frac{2-2\sqrt{2}}{3}$ or $k>\frac{2+2\sqrt{2}}{3}$	M1A1A1 dM1A1 M1A1
		(7 marks)

4(a)	$\frac{49x}{x^2+x-12}+\frac{7x}{x+4}=\frac{49x+7x(x-3)}{(x+4)(x-3)}$ or e.g. $\frac{49x(x+4)}{(x^2+x-12)(x+4)}+\frac{7x(x^2+x-12)}{(x+4)(x^2+x-12)}=\frac{49x(x+4)+7x(x^2+x-12)}{(x+4)(x^2+x-12)}$	M1A1
	$\frac{49x+7x(x-3)}{(x+4)(x-3)}=\frac{49x+7x^2-21x}{(x+4)(x-3)}=\frac{7x^2+28x}{(x+4)(x-3)}$ $=\frac{7x\cancel{(x+4)}}{\cancel{(x+4)}(x-3)}=\frac{7x}{(x-3)}$*	A1*
		(3)

(b)	$f(x)=\frac{7x}{(x-3)} \Rightarrow f'(x)=\frac{(x-3)\times7-7x\times1}{(x-3)^2}$	M1
	$f(x)=\frac{7x}{(x-3)} \Rightarrow f'(x)=-\frac{21}{(x-3)^2}$	A1
		(2)
(b) ALT	$f(x)=\frac{7x}{(x-3)}=7+\frac{21}{x-3} \Rightarrow f'(x)=-\frac{21}{(x-3)^2}$	M1A1
		Total 5

10.(a)	$x = 3\cos 2y \Rightarrow \left(\frac{dx}{dy} =\right) -6\sin 2y$	M1 A1 **(2)**
(b)	E.g. $\frac{dx}{dy} = -6\sqrt{1-kx^2}$ or $\frac{dy}{dx} = \frac{1}{\text{their}\frac{dx}{dy}}$	M1
	$\frac{dy}{dx} = -\frac{1}{6\sqrt{1-\cos^2 2y}} = -\frac{1}{6\sqrt{1-\left(\frac{x}{3}\right)^2}} = -\frac{1}{2\sqrt{9-x^2}}$	dM1 A1 **(3)**
(c)	Sets $\frac{dy}{dx} = -\frac{1}{2\sqrt{9-x^2}} = -\frac{1}{4}$	
	$x^2 = 5 \Rightarrow a = \sqrt{5}$	M1 A1
	$\sqrt{5} = 3\cos 2y \Rightarrow b = \frac{1}{2}\arccos\left(\frac{\sqrt{5}}{3}\right)$	dM1 A1
Alt (c)	Sets $\frac{dy}{dx} = -\frac{1}{6\sin 2y} = -\frac{1}{4}$	
	$\Rightarrow \sin 2y = \frac{2}{3} \Rightarrow y = \frac{1}{2}\arcsin\left(\frac{2}{3}\right)$	M1A1
	$x = 3\cos 2y = 3\sqrt{1-\sin^2\left(\arcsin\frac{2}{3}\right)} = \sqrt{5}$	dM1 A1 **(4)** **(9 marks)**

3.	$\frac{dy}{dx} = \frac{4(x+3)^2 - 2(4x+1)(x+3)}{(x+3)^4}$	M1 A1
	Solves their $4(x+3)^2 - 2(4x+1)(x+3) = 0$ $\Rightarrow (x+3)(10-4x) = 0 \Rightarrow x = \ldots$	M1
	Critical value of $\frac{5}{2}$; Critical value of -3	A1; B1
	C increasing when $\frac{dy}{dx} > 0 \Rightarrow -3 < x < \frac{5}{2}$	A1 **(6 marks)**