1. (a)	$g(3) = -265, \quad g(4) = 3104$	M1
	States change of sign, continuous and hence root in $[3, 4]$	A1
		(2)
(b)	$x_2 = \sqrt[6]{1000 - 2\times 3} \quad = 3.1591$	M1 A1
	$(\alpha =) 3.1589$	A1
		(3)
		(5 marks)

Question Number	Scheme	Marks
9(a)	$4\sin\theta\cos\theta = 2\sin 2\theta$	B1
	e.g. $\Rightarrow 6\sin^2\theta\cot 2\theta + 2\sin 2\theta = (3 - 3\cos 2\theta)\dfrac{\cos 2\theta}{\sin 2\theta} + 2\sin 2\theta$	M1A1
		(3)
(b)	$3\cot 2\theta - 14 = 6\sin^2\theta\cot 2\theta + 4\sin\theta\cos\theta$	
	e.g. $\Rightarrow 3\cot 2\theta\sin 2\theta - 14\sin 2\theta = (3 - 3\cos 2\theta)\cos 2\theta + 2\sin^2 2\theta$	M1
	$\Rightarrow -14\sin 2\theta = -3(1 - \sin^2 2\theta) + 2\sin^2 2\theta$	M1
	$5\sin^2 2\theta + 14\sin 2\theta - 3 = 0$ *	A1*
		(3)
(c)	$(\sin 2x =)\dfrac{1}{5} \Rightarrow x = ...$	M1
	$x = \text{awrt } 5.8°, \text{ awrt } 84.2°$	A1A1
		(3)
		(9 marks)

Question Number	Scheme	Marks
6 (a)	$y=(4x-7)^{\frac{1}{2}} \Rightarrow \left(\frac{dy}{dx}=\right) 2(4x-7)^{-\frac{1}{2}}$ (see notes)	M1 A1
	At $(8,5)$ gradient of tangent is $2(4\times8-7)^{-\frac{1}{2}}\left(=\frac{2}{5}\right)$	dM1
	Equation for l is $y-5=-\frac{5}{2}(x-8)$	ddM1
	$2y-10=-5x+40 \Rightarrow 5x+2y-50=0$ *	A1*
		(5)
(b)	$\int (4x-7)^{\frac{1}{2}}\,dx=\left[\frac{(4x-7)^{\frac{3}{2}}}{6}\right]$ (see notes)	M1, A1
	Complete area $=\int_{\frac{7}{4}}^{8}(4x-7)^{\frac{1}{2}}\,dx=\left[\frac{(4x-7)^{\frac{3}{2}}}{6}\right]_{\frac{7}{4}}^{8}+5$	dM1
	$=\frac{155}{6}$	A1
		(4)
		(9 marks)

Question Number	Scheme	Marks
1(a)	$(-2,-3)$	B1
		(1)
(b)	$(-3,-9)$	B1B1
		(2)
(c)	$(-4,3)$	B1
		(1)
		(4 marks)

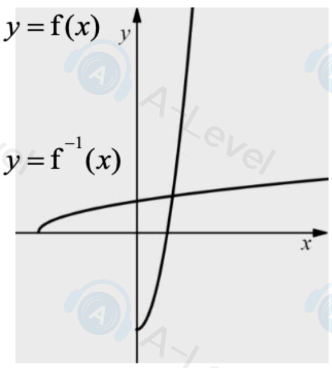
9(a)	$\frac{\cos 2x}{\sin x}+\frac{\sin 2x}{\cos x}=\frac{\cos 2x}{\sin x}+\frac{2\sin x\cos x}{\cos x}$ (One Correct identity)	B1
	$=\frac{1-2\sin^2 x}{\sin x}+\frac{2\sin x\cancel{\cos x}}{\cancel{\cos x}}$	M1
	$=\frac{1}{\sin x}-\frac{2\sin^{\cancel{2}} x}{\cancel{\sin x}}+2\sin x=\frac{1}{\sin x}=\text{cosec}\,x$ *	A1*
		(3)
(b)	E.g. Equation is $\text{cosec}^2\theta=6\cot\theta-4\Rightarrow 1+\cot^2\theta=6\cot\theta-4$	M1
	E.g. $\cot^2\theta-6\cot\theta+5=0$	A1
	E.g. $\tan\theta=\frac{1}{5},1$	dM1
	$\theta=0.197,\frac{\pi}{4}$	A1, A1
		(5)
(c)	$\int_{\frac{\pi}{6}}^{\frac{\pi}{4}}\text{cosec}x\cot x\,dx=\left[-\text{cosec}x\right]_{\frac{\pi}{6}}^{\frac{\pi}{4}}$	M1
	$=2-\sqrt{2}$	A1
		(2)
		10 marks

8	$h = 1.5x - 0.5x\mathrm{e}^{0.02x}$	
(a)	$0 = 1.5d - 0.5d\,\mathrm{e}^{0.02d} \Rightarrow \mathrm{e}^{0.02d} = 3$	M1
	$\Rightarrow 0.02d = \ln 3 \Rightarrow d = 54.93$	dM1 A1
		(3)
(b)	$\left(\frac{\mathrm{d}h}{\mathrm{d}x} = \right) 1.5 - \left(0.5\mathrm{e}^{0.02x} + 0.5x \times 0.02\mathrm{e}^{0.02x}\right)$	M1A1
	Sets $0 = 1.5 - 0.5\mathrm{e}^{0.02x} - 0.5x \times 0.02\mathrm{e}^{0.02x} \Rightarrow \mathrm{e}^{0.02x}(0.5 + 0.5x \times 0.02) = 1.5$	
	$\Rightarrow \mathrm{e}^{0.02x} = \frac{1.5}{(0.5 + 0.5x \times 0.02)}$	dM1
	$\Rightarrow \mathrm{e}^{0.02x} = \frac{1.5}{(0.5 + 0.5x \times 0.02)} = \frac{150}{50 + x} \Rightarrow x = 50\ln\left(\frac{150}{50 + x}\right)$ *	A1*
		(4)
(c)	(i) awrt 31.43	M1 A1
	(ii) awrt 30.88 metres **(including units)**	A1
		(3)
		(10 marks)

Question Number	Scheme	Marks
8(a)	$25 = a + -(5 \times -2 + b)\ (\Rightarrow 25 = a + 10 - b) \Rightarrow a = 15 + b$ *	M1A1*
		(2)
(b)	$9 = a + 10 + b \Rightarrow a = \ldots$ or $b = \ldots.$	M1
	$a = 7,\ b = -8$	A1A1
		(3)
(c)	$\left(\frac{8}{5}, 7\right)$	B1ftB1
		(2)
(d)	$15 - 5x = -2x^3 + 5x^2 + 4x - 3 \Rightarrow 2x^3 - 5x^2 - 9x + 18 = 0$	M1
	$2x^3 - 5x^2 - 9x + 18 = (x + 2)(2x^2 - 9x + 9)$	dM1A1
	$2x^2 - 9x + 9 = 0 \Rightarrow x = \frac{3}{2}$ (ignore $x = 3$)	ddM1
	$\left(\frac{3}{2}, \frac{15}{2}\right)$	M1A1
		(6)
		(13 marks)

	$f(x) = 2\sec x + 6x - 3$	
1. (a)	$f(0.1) = -0.39 \qquad f(0.2) = 0.24$	M1
	States change of sign, continuous and hence root	A1
		(2)
(b)	Sets $f(x) = 0$, uses $\sec x = \dfrac{1}{\cos x}$ and makes x of $6x$ the subject	
	$\Rightarrow 6x = 3 - \dfrac{2}{\cos x} \Rightarrow x = \dfrac{1}{2} - \dfrac{1}{3\cos x}$ *	B1*
		(1)
(c)	(i) $x_2 = \dfrac{1}{2} - \dfrac{1}{3\cos 0.15} = 0.16..$	M1
	$x_2 =$ awrt 0.1629	A1
	(ii) $\alpha = 0.1622$	A1
		(3)
		(6 marks)

2(a)	$R = 25$	B1
	$\tan\alpha = \dfrac{24}{7} \Rightarrow \alpha = ...$	M1
	$\alpha = 1.287$	A1
		(3)
(b)(i)	$\text{Min} = \dfrac{5}{90 - 3\times"25"\times(-1)}$	M1
	$= \dfrac{1}{33}$	A1
(b)(ii)	$(2x + "1.287") = \pi, ... \Rightarrow x = ...$	M1
	$\Rightarrow x = \dfrac{\pi - "1.287"}{2} = 0.927$	A1
		(4)
		Total 7

4.(a)	$f \geqslant -5$	B1
		(1)
(b)	 Curve starting on negative x-axis and passing through positive y-axis, in quadrants 1 and 2 only.	M1
	Shape and position correct.	A1
		(2)
(c)	$2x^2 - 5 = x$ or $2x^2 - 5 = \sqrt{\dfrac{x+5}{2}}$ or $x = \sqrt{\dfrac{x+5}{2}}$ or $2(2x^2-5)^2 - 5 = x$	B1
	Full attempt to solve $2x^2 - x - 5 = 0 \Rightarrow x = ...$ exact	M1
	$x = \dfrac{1+\sqrt{41}}{4}$	A1
		(3)
		6 marks

9 (a)	$(k=)\ 4\sin^2\left(\dfrac{\pi}{3}\right)-1=2$ *	B1*
		(1)
(b)	(i) $x=4\sin^2 y-1 \Rightarrow \dfrac{dx}{dy}=8\sin y\cos y$ o.e.	M1 A1
	(ii) Attempts either $\sin^2 y=\dfrac{\pm x\pm 1}{4}$ or $\cos^2 y=\pm 1\pm\dfrac{x+1}{4}$ (both for dM1)	M1 dM1
	$\dfrac{dy}{dx}=\dfrac{1}{8\sin y\cos y}=\dfrac{1}{8\times\sqrt{\dfrac{x+1}{4}}\times\sqrt{\pm1\pm\dfrac{x+1}{4}}}=\dfrac{1}{2\sqrt{x+1}\sqrt{3-x}}$ *	ddM1 A1*
		(6)
(c)	At $x=2$, gradient of curve $=\dfrac{1}{2\sqrt{3}} \Rightarrow$ gradient of normal is $-2\sqrt{3}$	M1
	Point N (base length of triangle) is solution of $\cancel{y}-\dfrac{\pi}{3}=-2\sqrt{3}(x-2)\Rightarrow x=2+\dfrac{\pi}{6\sqrt{3}}$ (= 2.3...)	dM1
	Area $=\dfrac{1}{2}\times\left(2+\dfrac{\pi}{6\sqrt{3}}\right)\times\dfrac{\pi}{3}=\dfrac{\pi}{3}+\dfrac{\pi^2}{36\sqrt{3}}$	A1
		(3)
		(10 marks)