1	State non-modulus equation $(0.4x-0.8)^2=4$ or equivalent or corresponding pair of linear equations	**B1**		SR One solution only – B1
	Solve 3-term quadratic equation or pair of linear equations	**M1**		Must see some evidence of attempt to solve the quadratic for M1 for at least one value of x For a pair of linear equations, there must be a sign difference
	Obtain -3 and 7	**A1**	[3]	If extra solutions are given then A0
2 (i)	Use $4^y=2^{2y}$	**B1**		
	Attempt solution of quadratic equation in 2^y	**M1**		
	Obtain finally $2^y=7$ only	**A1**	[3]	
(ii)	Apply logarithms to solve equation of form $2^y=k$ where $k>0$	**M1**		Must be using their positive answer for (i)
	Obtain 2.81	**A1**	[2]	
3 (i)	Obtain integral of form $k_1e^{\frac{1}{2}x}+k_2x$	**M1**		Allow $k_1=4$
	Obtain correct $8e^{\frac{1}{2}x}+3x$ oe	**A1**		
	Use limits correctly to confirm $8e-2$	**A1**	[3]	
(ii)	Draw increasing curve in first quadrant	**M1**		If incorrect y intercept used then M1 A0
	Draw more or less accurate sketch with correct curvature, gradient at $x=0$ must be >0	**A1**	[2]	Allow if no intercept stated
(iii)	State more and refer to top(s) of trapezium(s) above curve	**B1**	[1]	Can be shown using a diagram. Reference to a trapezium must be made

4	(i)	Substitute $x=-1$ and simplify	M1		Allow attempt at long division , must get down to a remainder Allow M1 if at least 2 numerical values of a are used May equate to $(x+1)\left(Ax^2+Bx+C\right)+R$ - allow M1 if they get as far as finding R
		Obtain $-4+a-a+4=0$ and conclude appropriately	A1	[2]	Must have a conclusion - allow 'hence shown', or made a statement of intent at the start of the question
	(ii)	Substitute $x=2$ and equate to -42 and attempt to solve	M1		May equate to $(x-2)\left(Ax^2+Bx+C\right)$, must have a complete method to get as far as $a=$ ... to obtain M1
		Obtain $a=-13$	A1	[2]	
	(iii)	Divide $\mathrm{p}(x)$ with their a at least as far as $4x^2+kx$	M1		
		Obtain $4x^2-17x+4$	A1		
		Obtain $(x+1)(4x-1)(x-4)$ or equivalent if x^2 already involved	A1		If $(x+1)(4x-1)(x-4)$ seen with no evidence of long division then allow the marks
		Obtain $(x^2+1)(2x-1)(2x+1)(x-2)(x+2)$	A1	[4]	
5	(i)	Use quotient rule (or product rule) to find first derivative	M1		Quotient: Must have a difference in the numerator and $(x^2+1)^2$ in the denominator
		Obtain $\dfrac{\frac{4}{x}(x^2+1)-8x\ln x}{(x^2+1)^2}$ or equivalent	A1		Product: Must see an application of the chain rule.
		State $\frac{4}{x}(x^2+1)-8x\ln x=0$ or equivalent	A1		Condone missing brackets if correct use is implied by correct work later
		Carry out correct process to produce equation without ln, without any incorrect working	M1		
		Confirm $m=\mathrm{e}^{0.5(1+m^{-2})}$ or $x=\mathrm{e}^{0.5(1+x^{-2})}$	A1	[5]	

(ii)	Use iterative formula correctly at least once	M1		Should not be attempting to use $x_0 = 0$, but if used and 'recovered' then SC M1 A1- usually see $m_1 = 1.6487$
	Obtain final answer 1.895	A1		
	Show sufficient iterations to 6 sf to justify answer or show sign change in interval $(1.8945, 1.8955)$	A1	[3]	
6 (i)	Use $\cos 2\theta = 2\cos^2\theta - 1$ appropriately twice	B1		Alternative method $\frac{1-2\sin^2\theta}{2\cos^2\theta} = \frac{1}{2}\sec^2\theta - \tan^2\theta$ or $\frac{1}{2\cos^2\theta} - \tan^2\theta$ B1
	Simplify to confirm $1 - \frac{1}{2}\sec^2\theta$	B1	[2]	then as for 2nd B1
(ii)	Use $\sec^2\alpha = 1 + \tan^2\alpha$	B1		
	Obtain equation $\tan^2\alpha + 10\tan\alpha + 25 = 0$ or equivalent	B1		
	Attempt solution of 3-term quadratic equation for $\tan\alpha$ and use correct process for finding value of α from negative value of $\tan\alpha$	M1		If quadratic is incorrect, need to see evidence of attempt to solve as required to obtain M1
	Obtain 1.77	A1	[4]	Allow better or in terms of π $\left(\frac{1013\pi}{1800}\right)$
(iii)	State or imply integrand $1 - \frac{1}{2}\sec^2\frac{1}{2}x$	B1		
	Obtain integral of form $k_1x - k_2\tan\frac{1}{2}x$	M1		
	Obtain correct $x - \tan\frac{1}{2}x$	A1		
	Apply limits correctly to obtain $\pi - 2$	A1	[4]	

7	**(i)**	Use correct addition formula for either $\cos(\theta+\frac{1}{6}\pi)$ or, after diffn, $\sin(\theta+\frac{1}{6}\pi)$	**B1**		Condone 'missing brackets'
		Differentiate to obtain $\frac{dy}{d\theta}$ of form $k_1\sin\theta+k_2\cos\theta$ or $k\sin(\theta+\frac{1}{6}\pi)$	**M1**		
		Divide attempt at $\frac{dy}{d\theta}$ by attempt at $\frac{dx}{d\theta}$	**M1**		
		Obtain $\dfrac{-\frac{3\sqrt{3}}{2}\sin\theta-\frac{3}{2}\cos\theta}{4\cos\theta}$ or equivalent	**A1**		
		Simplify to obtain $-\frac{3}{8}(1+\sqrt{3}\tan\theta)$	**A1**	[5]	
	(ii)	Identify $\theta=0$	**B1**		soi
		Substitute 0 into formula for $\frac{dy}{dx}$ and take negative reciprocal	**M1**		be implied by $y=1+\dfrac{3\sqrt{3}}{2}$ or 3.6 Must be from correct **(i)**
		Obtain gradient of normal $\frac{8}{3}$	**A1**		
		Form equation of normal through point $(0, 1+\frac{3\sqrt{3}}{2})$	**M1**		
		Obtain $y=\frac{8}{3}x+1+\frac{3\sqrt{3}}{2}$ or equivalent	**A1**	[5]	