Question	Answer	Marks	Guidance
1	Introduce logarithms to both sides and use power law	***M1**	
	Obtain $(3x-1)\log 5 = 4x\log 2$ or equivalent	**A1**	Allow **A1** for poor use of brackets if recovered later
	Solve linear equation for x	**DM1**	dep *M
	Obtain 0.783	**A1**	Allow 3 sf or better
		4	

Question	Answer	Marks	Guidance
2	Solve 3-term quadratic equation or a pair of linear equations	**M1**	For **M1**, must square both sides when attempting a quadratic equation
	Obtain $x=-5$ and $x=3$	**A1**	
	Substitute (at least) one value of x (less than 4) into $\lvert x+4\rvert - \lvert x-4\rvert$, showing correct evaluation of modulus and producing only one answer in each case	**M1**	
	Obtain –8 and 6 and no others	**A1**	
		4	

Question	Answer	Marks	Guidance
3	Differentiate to obtain form $k_1\sec^2\frac{1}{2}x + k_2\cos\frac{1}{2}x$	**M1**	If a factor of 0.5 is missed, can still get 5/6, penalise at first **A1**
	Obtain $\frac{1}{2}\sec^2\frac{1}{2}x + \frac{3}{2}\cos\frac{1}{2}x$	**A1**	
	Equate first derivative to zero and produce $\cos^3\frac{1}{2}x = k_3$	***M1**	
	Use correct process to find one value of x	**DM1**	Dep on *M, allow for obtaining 1.609….. , 92.2° or 268°
	Obtain $x=4.67$	**A1**	Allow $x=4.67$ or better for **A1**
	Obtain $y=1.12$	**A1**	Allow $y=1.12$ from $x=4.66$ but nothing else
		6	

Question	Answer	Marks	Guidance
4(i)	Substitute $x=-3$ into either $p(x)$ or $q(x)$ and equate to zero (may be implied)	**M1**	Allow long division, but the remainder needs to be independent of *x*
	Obtain $a=-11$	**A1**	
	Obtain $b=-8$	**A1**	
		3	
4(ii)	Divide $x+3$ into expression for $q(x)-p(x)$ (may be a four term cubic equation), or Obtain a 3 term cubic equation by subtraction	***M1**	Allow *M1 for their $x^3+3x+36$, but must have integer values for *a* and *b*
	Obtain $x^2-3x+12$ or x^2-2x-5 and $2x^2-5x+7$	**A1**	
	Apply discriminant to quadratic factor of $q(x)-p(x)$ or equivalent	**DM1**	dep on *M
	Obtain -39 or equivalent and conclude appropriately	**A1**	
		4	

Question	Answer	Marks	Guidance
5(i)	Obtain derivative of the form ke^{-2x}	***M1**	Condone $k=4$ for **M1**
	State or imply gradient of curve at *P* is –8	**A1**	
	Form equation of straight line through $(0, 9)$ with negative gradient	***DM1**	dep on *M
	Obtain $y=-8x+9$ or equivalent	**A1**	
	Equate equation of curve and equation of straight line	**DM1**	dep on both *M
	Rearrange to confirm $x=\frac{9}{8}-\frac{1}{2}e^{-2x}$	**A1**	
		6	

Question	Answer	Marks	Guidance
5(ii)	Use iterative process correctly at least once	**M1**	
	Obtain final answer 1.07	**A1**	
	Show sufficient iterations to 5 sf to justify answer or show sign change in interval $(1.065, 1.075)$	**A1**	
		6	

Question	Answer	Marks	Guidance
6(a)	Obtain $2-2\cos 2x$ as part of integrand	**B1**	
	Obtain $3\sin 2x$ as part of integrand	**B1**	Allow second **B1** for writing
	Integrate to obtain form $k_1x+k_2\sin 2x+k_3\cos 2x$	**M1**	$\int 6\sin x\cos x\ \mathrm{d}x = 6\left(\frac{1}{2}\sin^2 x\right)$, **M1** may then be implied by subsequent work
	Obtain $2x-\sin 2x-\frac{3}{2}\cos 2x$ or $2x-\sin 2x+3\sin^2 x$	**A1**	
	Apply limits to obtain $\frac{1}{2}\pi+\frac{1}{2}$	**A1**	
		5	
6(b)	Integrate to obtain $2\ln(3x+2)$	**B1**	Allow $\frac{6}{3}\ln(3x+2)$ for **B1**
	Use at least one relevant logarithm property	***M1**	
	Obtain $\frac{3a+2}{2}=7$ or $\frac{(3a+2)^2}{4}=49$ or equivalent without ln	**A1**	
	Solve relevant equation to find a	**DM1**	Dep on ***M1**, allow for $49=(3a+2)^2$ OE or correct working involving $(3a+2)$
	Obtain $a=4$ only	**A1**	
		5	

Question	Answer	Marks	Guidance
7(i)	Obtain $4y + 4x\frac{dy}{dx}$ as derivative of $4xy$	**B1**	
	Obtain $4y\frac{dy}{dx}$ as derivative of $2y^2$	**B1**	
	State $2x + 4y + 4x\frac{dy}{dx} + 4y\frac{dy}{dx} = 0$	**B1**	3rd **B1** may be implied by later work
	Substitute $x = -1$, $y = 3$ to find gradient of line	***M1**	dep at least one **B1**
	Form equation of tangent through $(-1, 3)$ with numerical gradient	**DM1**	dep *M
	Obtain $5x + 4y - 7 = 0$ or equivalent of required form	**A1**	Allow any 3 term integer form for **A1**
		6	
7(ii)	Substitute $\frac{dy}{dx} = \frac{1}{2}$ to find relation between x and y	***M1**	dep at least one **B1** in part **(i)**, must be linear
	Obtain $4x + 6y = 0$ or equivalent	**A1**	
	Substitute for x or y in equation of curve	**DM1**	dep on *M
	Obtain $-\frac{7}{4}y^2 = 7$ or $-\frac{7}{9}x^2 = 7$ or equivalent and conclude appropriately	**A1**	
		4	