

Q	Marking instructions	AO	Marks	Typical solution
15	Forms a single equation eliminating x or y	3.1a	M1	$6 - e^{\frac{x}{2}} = e^x$
	Obtains a correct rearranged quadratic equation. Either $e^x + e^{\frac{x}{2}} - 6 = 0$ or $(e^{\frac{x}{2}} + 3)(e^{\frac{x}{2}} - 2) = 0$ or $e^x + e^{\frac{x}{2}} + \frac{1}{4} = \frac{25}{4}$ OE	1.1b	A1	$e^x + e^{\frac{x}{2}} - 6 = 0$ $(e^{\frac{x}{2}} + 3)(e^{\frac{x}{2}} - 2) = 0$ $e^{\frac{x}{2}} = -3$ or 2
	Solves 'their' quadratic Must be a quadratic in $e^{\frac{x}{2}}$ or If squaring is used then it must be a quadratic in e^x or Obtains $x = 1.386$	1.1a	M1	$e^{\frac{x}{2}} > 0$ so -3 is not a valid solution $\frac{x}{2} = \ln 2$ $x = 2 \ln 2 = \ln 4$
	Explains that $e^{\frac{x}{2}} = -3$ is not valid as $e^{\frac{x}{2}} > 0$ or If squaring is used they must clearly check both solutions by substituting and conclude that $\ln 9$ is not valid OE	2.4	E1F	$\int_0^{\ln 4} (6 - e^{\frac{x}{2}} - e^x) dx$ $= [6x - 2e^{\frac{x}{2}} - e^x]_0^{\ln 4}$ $= (6 \ln 4 - 2e^{\frac{\ln 4}{2}} - e^{\ln 4}) - (-2 - 1)$
	Obtains $x = 2 \ln 2$ or $x = \ln 4$	1.1b	A1	
	Forms any definite integral which would contribute to finding the required area This could be $\int_0^{\ln 4} (6 - e^{\frac{x}{2}} - e^x) dx$ or $\int_0^{\ln 4} (6 - e^{\frac{x}{2}}) dx$ or $\int_0^{\ln 4} e^x dx$ or $\int_0^{\ln 4} (e^x + e^{\frac{x}{2}} - 6) dx$ Follow through 'their' value of x for the upper limit	1.1a	M1	$= 6 \ln 4 - 4 - 4 + 3$ $= 6 \ln 4 - 5$
Forms a fully correct definite integral (or integrals) which would lead to evaluating the correct area Follow through 'their' incorrect upper limit	3.1a	A1F		

<p>Integrates '<i>their</i>' expressions involving exponentials fully correctly Follow through their exponential expressions – but must have integrated both e^x and $e^{\frac{x}{2}}$ terms Condone missing/incorrect limits</p>	1.1b	B1F	
<p>Substitutes 0 and '<i>their</i>' upper limits into '<i>their</i>' integrated expression Must correctly use $F(\text{their upper limit}) - F(0)$ for each integral</p>	1.1a	M1	
<p>Completes rigorous argument by showing explicit evaluation of exponential terms before obtaining final answer AG This mark can be achieved without achieving the E1 mark</p>	2.1	R1	
Total		10	