Question Number	Scheme		Marks
8. (a)	Let $y = 3-2e^{-x}$, then $2e^{-x} = 3-y$	*Or* $2e^{-y} = 3-x$	M1
	$-x = \ln\frac{3-y}{2}$ and $x =$	$-y = \ln\frac{3-x}{2}$ and $y =$	M1
	$x = -\ln\frac{3-y}{2}$	This mark earned with next for correct answer by this method	A1
	$\cancel{f^{-1}(x)} = \ln\frac{2}{3-x}$ or $-\ln\frac{3-x}{2}$ o.e.		A1
	Domain is $x < 3$		B1 (5)
(b)	$\ln\frac{2}{3-x} = \ln x \rightarrow 2 = (3-x)x$		M1
	$x^2 - 3x + 2 = 0$		A1
	$x = 2$ or $x = 1$		M1 A1 (4)
(c)	$3-2e^{-t} = ke^{t} \rightarrow ke^{2t} - 3e^{t} + 2 = 0$ or $\rightarrow ke^{2t} - 3e^{t} = -2$ o.e. (isw)		M1 A1
	Use "$b^2 - 4ac = 0$" or "$b^2 = 4ac$" or attempts $e^{t} = \frac{3 \pm \sqrt{9-8k}}{2k}$		dM1
	So $k = 1.125$ o.e. e.g. $\frac{9}{8}$ or $1\frac{1}{8}$		A1 (4) **[13]**

Notes

(a) **M1**: Puts $y = f(x)$ and makes e^{-x} term subject of formula so $2e^{-x} = 3-y$ or $e^{-x} = \frac{3-y}{2}$ or even $-2e^{-x} = y-3$ or $-e^{-x} = \frac{y-3}{2}$ - allow sign slips. Allow $f(x)$ instead of y in expression for both Ms

M1: Uses ln to get $x =$ (This mark is for knowing that ln$x$ is inverse of e^x so allow sign errors and weak log work. These errors will be penalised in the A mark.)
A1: completely correct log work giving a correct unsimplified answer for $x =$ (then isw for this mark)
A1: any correct answer - do not need to see LHS of equation but variable **must** be x not y

NB Possible answers include $\frac{\log\frac{2}{3-x}}{\log e}$, $-\ln(3-x)+\ln 2$, $-\ln\left(-\frac{1}{2}x+\frac{3}{2}\right)$, or $\ln\frac{-2}{x-3}$ etc

If x and y interchanged at start – see alternative in scheme. Note this method gives A1A1 or A0A0

B1: For $x < 3$ (independent mark); allow $(-\infty, 3)$, but $x \le 3$ is B0

(b) **M1**: Removes ln correctly on both sides and multiplies across
A1: expands bracket to give three term quadratic equation, allow $x^2 - 3x = -2$
M1: Solves quadratic (may be implied by answers)
A1: Need both these correct answers

(c) **M1**: Sets $3-2e^{-t} = ke^{t}$ and attempts to multiply all terms by e^{t} or by e^{-t} (allow use of x instead of t)
A1: three term quadratic – allow x or t so $ke^{2x} - 3e^{x} + 2 = 0$ or $ke^{2x} - 3e^{x} = -2$ or $k = 3e^{-t} - 2e^{-2t}$ etc
dM1: Uses condition for equal roots to give expression in k – may not be simplified- or attempts to solve their quadratic equation in e^{t} using formula or completion of the square **A1**: See scheme

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