Question	Scheme	Marks	AOs
13(a)	$\dfrac{1}{x(100-x)} \equiv \dfrac{P}{x} + \dfrac{Q}{100-x} \Rightarrow P = \ldots,\ Q = \ldots$	M1	1.1b
	$\dfrac{1}{x(100-x)} \equiv \dfrac{1}{100x} + \dfrac{1}{100(100-x)}$	A1	1.1b
		(2)	
(b)	$500\dfrac{\mathrm{d}x}{\mathrm{d}t} = x(100-x) \Rightarrow \displaystyle\int \frac{500}{x(100-x)}\mathrm{d}x = \int \mathrm{d}t$ or $\displaystyle\int \frac{1}{x(100-x)}\mathrm{d}x = \int \frac{1}{500}\mathrm{d}t$ $\Rightarrow 5\displaystyle\int\left(\frac{1}{x}+\frac{1}{100-x}\right)\mathrm{d}x = \int \mathrm{d}t$ or e.g. $\displaystyle\int\left(\frac{1}{x}+\frac{1}{100-x}\right)\mathrm{d}x = \int \frac{1}{5}\mathrm{d}t$	M1	2.1
	$5\ln x - 5\ln(100-x) = t + c$	M1 A1ft	3.1a 1.1b
	$x = 5,\ t = 0 \Rightarrow 5\ln\dfrac{1}{19} = c$	M1	3.4
	$5\ln x - 5\ln(100-x) = t + 5\ln\dfrac{1}{19} \Rightarrow 5\ln\dfrac{x}{100-x} = t + 5\ln\dfrac{1}{19}$ $\Rightarrow \ln\dfrac{x}{100-x} = \dfrac{t}{5} + \ln\dfrac{1}{19} \Rightarrow \dfrac{x}{100-x} = \dfrac{1}{19}\mathrm{e}^{\frac{t}{5}} \Rightarrow x = \ldots$	M1	2.1
	$x = \dfrac{100}{1+19\mathrm{e}^{-\frac{1}{5}t}}$	A1	1.1b
		(6)	
(c)	$x = \dfrac{100}{1+19\mathrm{e}^{-\frac{1}{5}\times 10}} = \ldots$	M1	3.4
	$x = 28\ (\mathrm{m}^2)$	A1	1.1b
		(2)	
			(10 marks)

Notes

(a)

M1: Correct method of partial fractions to find values for P and Q. May be implied by correct values or correct fractions.

A1: Correct partial fractions

(b)

M1: Separates the variables and uses the result from part (a)

M1: Correct attempt at the integration.

Look for $\alpha\ln x + \beta\ln(100-x) = t$ or equivalent

A1ft: Correct integration for their PFs of the form $\dfrac{A}{x} + \dfrac{B}{100-x}$ (condone omission of $+c$)

M1: Uses the conditions in the model of $x = 5$, $t = 0$ to find their constant of integration

M1: Uses correct processing to make x the subject to reach an expression of the required form

A1: Correct expression

(c)

M1: Uses their equation with $t = 10$ to find a value for x

A1: $x = 28.00045\ldots$ awrt 28