Q	Marking instructions	AO	Marks	Typical solution
10(a)(i)	Forms correct model Or applies repeated percentage increase 4 times PI by AWRT 75.9	3.3	B1	$x = 25 \times 1.32^t$
	Substitutes t = 5 into their model Or Applies repeated percentage increase 5 times	3.4	M1	$t = 5 \Rightarrow x = 25 \times 1.32^5 = 100.18...$
	Obtains 101 Condone 100 CAO	3.2a	A1	x = 101
	Subtotal		**3**	

Q	Marking instructions	AO	Marks	Typical solution
10(a)(ii)	Explains that the **model** grows **exponentially** Must refer to model and exponential	3.5b	E1	The value predicted by the exponential model will grow without limit.
	Refers to 900 plants. eg this can't be true as there are only 900 tomato plants Condone reference to "tomato(es)" or "plants" in place of "tomato plants"	3.5a	E1	This can't be true as there are only 900 tomato plants in the greenhouse.
	Subtotal		**2**	

Q	Marking instructions	AO	Marks	Typical solution
10(b)(i)	Rearranges to obtain one of the following: $\frac{P}{x(900-x)}\frac{\mathrm{d}x}{\mathrm{d}t}=\frac{1}{Q}$ $\frac{P}{x(900-x)}\mathrm{d}x=\frac{1}{Q}\mathrm{d}t$ $\frac{P}{x(900-x)}=\frac{1}{Q}\frac{\mathrm{d}t}{\mathrm{d}x}$ where $P\times Q=2700$ If their P=2700 no need to see explicit $\frac{1}{Q}$ with dt, or $\frac{\mathrm{d}t}{\mathrm{d}x}$ May include integral signs	3.1a	B1	$\frac{\mathrm{d}x}{\mathrm{d}t}=\frac{x(900-x)}{2700}$ $\frac{2700}{x(900-x)}\frac{\mathrm{d}x}{\mathrm{d}t}=1$ $\int\left(\frac{A}{x}+\frac{B}{900-x}\right)dx=\int dt$ $\frac{2700}{x(900-x)}\equiv\frac{A}{x}+\frac{B}{900-x}$ $2700\equiv A(900-x)+Bx$ $x=0\Rightarrow A=\frac{2700}{900}=3$ $x=900\Rightarrow B=3$ $\therefore$ $\int\left(\frac{3}{x}+\frac{3}{900-x}\right)dx=\int dt$
	Forms partial fraction equation with correct denominators and uses an appropriate method to find their numerators PI by correct A and B without incorrect working	3.1a	M1	
	Obtains correct A and B and concludes with $\int\left(\frac{3}{x}+\frac{3}{900-x}\right)dx=\int dt$ Accept $\int 1dt$ Condone missing brackets	2.1	R1	
	Subtotal		**3**	

Q	Marking instructions	AO	Marks	Typical solution
10(b)(ii)	Integrates to obtain $\ln x$ or $\pm\ln(900-x)$ Condone missing brackets for this mark	3.1a	M1	
	Integrates to obtain $\ln x$ and $\pm\ln(900-x)$ Condone missing brackets for this mark	1.1a	M1	
	Integrates to obtain $3(\ln x-\ln(900-x))+c=t$ OE Condone missing $+c$	1.1b	A1	$3(\ln x-\ln(900-x))+c=t$ $3(\ln 25-\ln(900-25))+c=0$ $c=10.67$
	Uses t = 0, x= 25, to obtain a value for c	3.4	M1	$t=3(\ln x-\ln(900-x))+10.67$
	Obtains correct equation for t in terms of x ACF If c given as a decimal accept AWRT 11 eg $t=3(\ln x-\ln(900-x))+3\ln 35$ $t=3\ln\left(\frac{35x}{900-x}\right)$	1.1b	A1	
	Subtotal		**5**	

Q	Marking instructions	AO	Marks	Typical solution
10(b)(iii)	Substitutes x = 450 into their model from part (b)(ii)	3.4	M1	$3(ln\,450 - ln(450)) + 10.67$ $= 10.67..$
	Obtains 11 CAO	3.2a	A1	It takes 11 days from when the damage is first noticed until half of the plants are damaged by insects
	Subtotal		**2**	

	Question 10 Total		**15**	