Qu	Scheme	Marks	AOs
2(a)	$\left[\mathrm{P}\left(L<7.902\right)=0.025\Rightarrow\right]\ \dfrac{7.902-8}{x}=-1.96$ oe	M1	3.4
	$\left[x=\right]0.05$ *	A1cso*	1.1b
	SC B1(mark as M0A1) for $\dfrac{7.902-8}{0.05}=-1.96\Rightarrow 0.024998$		
		(2)	
(b)	$\mathrm{P}\left(\ 7.94\leqslant L\leqslant 8.09\right)=0.8490\ldots$ **awrt 0.849**	B1	1.1b
		(1)	
(c)	$[\mathrm{P}\left(L<7.94\right)=]$ 0.115069...(awrt 0.115) **or** $[\mathrm{P}\left(L>8.09\right)=]$ 0.03593...(awrt 0.036)	B1	1.1b
	$[\mathrm{P}\left(L<7.94\right)=]$ 0.115069...(awrt 0.115) **&** $[\mathrm{P}\left(L>8.09\right)=]$ 0.03593...(awrt 0.036)	B1	1.1b
	Expected income per 500 rods = $\sum\left(\text{Income}\times\text{probability}\times 500\right)$ $\left(500\times\text{"0.849"}\times 0.5\right)+\left(500\times\text{"0.1150..."}\times 0.05\right)+\left(500\times\text{"0.03593..."}\times 0.4\right)$ **or** Expected profit per rod = $\sum\left(\text{Profit}\times\text{probability}\right)$ $0.30\times\text{"0.849"}+-0.15\times\text{"0.1150..."}+0.20\times\text{"0.03593..."}$ **[**= 0.2446..]	M1	3.4
	Expected profit per 500 rods $500\times\sum\left(\text{Profit}\times\text{probability}\right)$ **or** $\sum\left(\text{Income}\times\text{probability}\times 500\right)-500\times 0.2$ $=500\times\text{"0.2446..."}$ **or** $=\ \text{"222.3"}-500\times 0.2$	M1d	3.1b
	= [£]122.3… **awrt [£]122**	A1	1.1b
		(5)	
(d)	Let $X\sim \mathrm{B}(200,0.015)$	M1	3.3
	$\mathrm{P}(X\leqslant 5)=$ $\quad$ $\mathrm{P}\left(X\geqslant 6\right)=$	M1	1.1b
	0.9176… $\quad$ 0.0824	A1	1.1b
	Manufacturer is unlikely to achieve their aim since $\underline{0.9176<0.95}$ $\quad$ Manufacturer is unlikely to achieve their aim since $\underline{0.0824>0.05}$	A1ft	2.4
		(4)	

Notes: **(12 marks)**

(a)	**M1**	Using the normal distribution to set up equation. Allow σ for x and awrt ± 1.96
	A1*	cso For a correct expression for x followed by 0.05 or 0.05000… No incorrect working seen
(b)	**B1**	awrt 0.849
(c)	**B1**	awrt 0.115 (Implied by awrt 57.5 for number of rods) **or** awrt 0.036 (Implied by awrt 18 for number of rods)
	B1	awrt 0.115 (Implied by awrt 57.5 for number of rods) **and** awrt 0.036 (Implied by awrt 18 for number of rods)
	M1	Correct method to find the total income of 500 rods. Attempt at all 3 with at least two correct and no extras **or** Correct method to find sum of all three profits with at least two of 30, −15 or 20 correct. May work in pence but need to be consistent. Allow awrt 24.5 or 0.245
	M1d	Dep on previous method for finding profit for 500 rods. May work in pence but need to be consistent. Allow $\text{"0.2446..."}\times 500$ or "their income" for 500 rods -500×0.2 (accept 499 or 501)
	A1	All previous marks must be awarded for awrt 122 awrt 12200p **NB** if uses any integer values for numbers of rods then it is A0 other than for 18 for $L>8.09$
(d)	**M1**	Selecting the appropriate model. May be seen or used. Allow B(200,0.985) or Po(3) Condone B(0.015, 200) or B(0.985, 200).
	M1	Writing or using $\mathrm{P}\left(X\leqslant 5\right)$ Do not accept $\mathrm{P}\left(X<6\right)$ unless found $\mathrm{P}\left(X\leqslant 5\right)$ $\quad$ Writing or using $\mathrm{P}\left(X\geqslant 6\right)$ Do not accept $\mathrm{P}\left(X>5\right)$ unless found $\mathrm{P}\left(X\geqslant 6\right)$
	A1	0.92 (Poisson 0.916…) $\quad$ 0.08 or better
	A1ft	Need at least one of the method marks to be awarded. Correct conclusion with the comparison (may be in words). Ft "their $p=0.9176\ldots$" as long as $p>0.9$ If "their 0.9176…"< 0.95 must … be unlikely… If "their 0.9176…"> 0.95 they must say … be likely... To ft the alternative then $p<0.1$