Question	Answer	Marks	Guidance
1	$\frac{40.5-31}{\sqrt{31}}$ (= 1.706)	**M1**	standn correct but allow with no or incorrect cc
	1 – ϕ("1.706")	**M1**	indep correct area consistent with working
	= 0.0441 (3 sf) or 0.0440	**A1**	not 0.044
		3	

Question	Answer	Marks	Guidance
2	Poisson	**B1**	seen or implied
	$\lambda = 4.03$	**B1**	seen or implied
	$e^{-4.03}(1 + 4.03 + \frac{4.03^2}{2!})$	**M1**	any λ; e.g. allow $\lambda = 4$ no extra or missing terms
	= 0.234 (3 sf)	**A1**	
		4	

Question	Answer	Marks	Guidance
3	$\frac{153}{200} + z \times \sqrt{\frac{\frac{153}{200} \times \frac{200-153}{200}}{200}} = 0.835$ (Var(P_s) = 0.000898875) (s.d. 0.02998)	**M1**	
	$z = 2.335$	**A1**	allow 2.33 or 2.34
	$2\Phi(z) - 1$	**M1**	or equivalent method indep
	$\alpha = 98$	**A1**	allow 98.0 but not e.g. 98.04
		4	

Question	Answer	Marks	Guidance
4(i)	$300.1 \pm z \times \frac{0.9}{\sqrt{75}}$	**M1**	allow any value of z
	$z = 2.576$	**B1**	allow 2.574 to 2.579
	299.83 to 300.37 (2 dps)	**A1**	answer must be seen to 2 dps need an interval
		3	
4(ii)	CI includes 300 so claim supported or justified or probably true	**B1 FT**	or equivalent FT from CI in **(i)**
		1	

Question	Answer	Marks	Guidance
5(i)	$\frac{1}{4}\int_0^2 (x^2 + x)\,dx \qquad (= \frac{1}{4}\left[\frac{x^3}{3} + \frac{x^2}{2}\right]_0^2)$	**M1**	Attempt integ $xf(x)$, ignore limits
	$= \frac{1}{4}(\frac{8}{3} + 2) \quad (- 0)$	**A1**	Subst correct limits in correct integration
	$= \frac{7}{6}$ OE or 1.17 (3 sf)	**A1**	
		3	
5(ii)	$\frac{1}{4}\int_0^m (x+1)\,dx = 0.5 \quad (= \frac{1}{4}\left[\frac{x^2}{2} + x\right]_0^m = 0.5)$	**M1**	attempt integ f(x), limits 0 to unknown (or unknown to 2) and = 0.5
	$\frac{1}{4}(\frac{m^2}{2} + m) = 0.5$ $m^2 + 2m - 4 = 0$ $m = \frac{-2 \pm \sqrt{4+16}}{2}$ OE	**A1**	a correct equation in m (any form) or $\sqrt{5} - 1$
	$m = 1.24$	**A1**	must reject the negative value if there
		3	

Question	Answer	Marks	Guidance
6(i)	Mean = $3.2 \times 90 = 288$	**B1**	
	Variance = $0.4^2 \times 90^2$	**M1**	
	$= 1296$	**A1**	
		3	
6(ii)	Mean = '288' + $4.3 \times 95 = 696.5$	**B1 FT**	
	Variance = '1296' + $0.6^2 \times 95^2 = 4545$	**B1 FT**	FT their **(i)**
	$\frac{670-696.5}{\sqrt{4545}}$ (= -0.393)	**M1**	FT Var provided both given Vars used standardising (ignore cc) no sd / Var mix
	$1 - \phi(\text{'}-0.393\text{'}) = \phi(\text{'}0.393)$	**M1**	correct area consistent with their working (i.e. their mean)
	= 0.653 (3 sf)	**A1**	
		5	

Question	Answer	Marks	Guidance
7(i)	H_0: mean no. sales = 3.5	**B1**	or " ... = 0.7 (per day)"
	H_1: mean no. sales > 3.5	**M1**	allow 'λ' or 'μ' but not just 'mean'
	$P(X \geqslant 5) = 1 - e^{-3.5}(1 + 3.5 + \frac{3.5^2}{2!} + \frac{3.5^3}{3!} + \frac{3.5^4}{4!})$	**M1**	
	= 0.275	**A1**	allow 0.274
	Comp with 0.10	**M1**	valid comparison using Poisson
	No evidence (at 10%) to believe that sales per day have increased	**A1 FT**	correct conclusion FT no contradictions
		6	

Question	Answer	Marks	Guidance
7(ii)	$\lambda = 3.9$	**B1**	
	$e^{-3.9} \times \frac{3.9^2}{2!}$	**M1**	any λ ($\neq 0.7$ or 0.6), single term
	= 0.154 (3 sf)	**A1**	
		3	

Question	Answer	Marks	Guidance
8(i)	$\bar{x} = 27/150$ (= 0.18)	**B1**	
	$s = \sqrt{\frac{150}{149}} \times \sqrt{\frac{5.01}{150} - 0.18^2}$ or variance (= 0.031729) (var = 3/2980 = 0.0010067)	**M1**	or var = $1/149(5.01 - 27.0^2/150)$
	H_0: Pop mean = 0.185 H_1: Pop mean < 0.185	**B1**	allow just 'μ'
	$\frac{0.18 - 0.185}{\frac{'0.031729'}{\sqrt{150}}}$	**M1**	standardising, need $\sqrt{150}$
	= (–) 1.930 (3 sfs) or 1.93	**A1**	
	Comp with z = (–) 2.326	**M1**	consistent signs or using probs 0.0268 > 0.01 or 0.9732 < 0.99 or using x_{crit} 0.18 > 0.17897
	There is no evidence (at 1% level) that concentration with drug is less than without drug	**A1 FT**	conclusion FT no contradictions
		7	

Question	Answer	Marks	Guidance
8(ii)	$\frac{cv - 0.185}{\frac{'0.031729'}{\sqrt{150}}}$ (= – 2.326)	**M1**	must use 0.185 and $\sqrt{150}$
	= 0.17897 or 0.179	**A1**	acceptance region (for H_0) is > 0.179
	$\frac{"0.17897" - 0.175}{\frac{'0.031729'}{\sqrt{150}}}$ (=1.534)	**M1**	must use 0.175 and $\sqrt{150}$
	1 – ϕ(“1.534”)	**M1**	indep mark
	= 0.0625 (3 sf)	**A1**	Accept 0.0610 to 0.0628
		5	