Question	Answer	Marks	Guidance
1	$\frac{5-4.9}{\frac{2.21}{\sqrt{75}}}$ (= 0.392)	**M1**	Correct stand'n. Must have √75
	1 – Φ("0.392")	**M1**	Correct area consistent with working
	= 0.348 (3 sfs)	**A1**	
		3	

Question	Answer	Marks	Guidance
2	$\lambda = 98.4$	**B1**	
	N(98.4, 98.4) seen or implied	**B1**	
	$\frac{90.5-"98.4"}{\sqrt{"98.4"}}$ (= –0.796)	**M1**	allow with wrong or no cc. No sd/var mix.
	ϕ("0.796")	**M1**	Correct area consistent with working
	= 0.787 (3 sf)	**A1**	
		5	

Question	Answer	Marks	Guidance
3(i)	$E(H_A) = 6$	**B1**	
	$Var(H_A) = 5 \times 0.03^2$	**M1**	
	= 0.0045 or 9/2000	**A1**	
		3	
3(ii)	$E(H_A - 2H_B) = 0$	**B1**	From 6–6
	$Var(H_A - 2H_B) = "0.0045" + 4\times5\times0.02^2$	**M2**	Allow **M1** for $"0.0045" - 4\times5\times0.02^2$ *or* $"0.0045" + 2\times5\times0.02^2$ *or* $"0.0045" + 4\times0.02^2$ *or* $"0.0045" + 4\times5^2\times0.02^2$
	= 0.0125 (3 sf) or 1/80	**A1**	
		4	

Question	Answer	Marks	Guidance
4(i)	(Po)(2.4)	**B1**	seen or implied
	$e^{-2.4}(1 + 2.4 + \frac{2.4^2}{2} + \frac{2.4^3}{3!})$	**M1**	allow + P(4)/one end error. Allow wrong λ
	= 0.779 (3 sfs)	**A1**	Final answer (Note: accept combination method)
		3	
4(ii)	H_0: λ (or mean) = 3.6 (or 0.9) H_1: λ (or mean) < 3.6 (or 0.9)	**B1**	Accept μ for both
	$e^{-3.6}(1 + 3.6)$	**M1**	Allow any λ
	= 0.126	**A1**	
	0.126 > 0.1	**M1**	Valid comparison. (Comparison with 0.9 could recover previous **M1A1**)
	No evidence that fewer than usual sold	**A1FT**	Correct conclusion. No contradictions
		5	

Question	Answer	Marks	Guidance
5(i)	H_0: P(Orange) = 0.17 H_1: P(Orange) < 0.17	**B1**	or H_0: $p = 0.17$ H_1: $p < 0.17$
5(ii)	Wrongly concluding that % age is less than 17%	**B1**	OE in context allow "fewer than 3 orange in packet even though average 17% is correct"
		1	
5(iii)	B(30, 0.17) stated or implied	**M1**	eg by $0.17^p \times 0.83^q$ ($p + q = 30$) or ${}^{30}C_r$ ($r < 30$)
	$(1 - 0.17)^{30} + 30(1 - 0.17)^{29} \times 0.17 + {}^{30}C_2(1 - 0.17)^{28} \times 0.17^2$	**M1**	correct, but allow + ${}^{30}C_3(1–0.17)^{27} \times 0.17^3$
	= 0.0949 (3 sf)	**A1**	(SR: use of N(5.1,4.233) **M1** standardising (with or without cc) **M1** max 2/3)
		3	

Question	Answer	Marks	Guidance
5(iv)	P(⩾ 3 orange | $p = 0.05$)	**M1**	stated or attempted; can be implied
	$= 1 - [(0.95)^{30} + 30(0.95)^{29} \times 0.05 + {}^{30}C_2(0.95)^{28} \times 0.05^2]$	**M1**	allow $+ {}^{30}C_3(0.95)^{27} \times 0.05^3$ in bracket, or ans 0.0608
	= 0.188 (3 sfs)	**A1**	
		3	

Question	Answer	Marks	Guidance
6(i)	$1 - 6\int_{0.3}^{0.7}\left(x - x^2\right)\mathrm{d}x$	**M1**	or $2 \times 6\int_{0}^{0.3}\left(x - x^2\right)\mathrm{d}x$ or similar correct expression before integration
	$1 - \left[6\left(\frac{x^2}{2} - \frac{x^3}{3}\right)\right]_{0.3}^{0.7}$	**A1**	or similar correct expression after integration
	$1 - 6\left[\frac{0.7^2}{2} - \frac{0.7^3}{3} - \frac{0.3^2}{2} + \frac{0.3^3}{3}\right]$	**M1**	Attempt subst correct limits in this or other correct expression
	= 0.432 (or 54/125)	**A1**	(SR1 Omission of '1–' scores **B2** for 0.568 or 71/125) (SR2 Omission of '2x' scores **B2** for 0.216 or 27/125)
		4	
6(ii)	Correct shape between $x = 0$ and 1	**B1**	No curve outside this range.
	E(X) = 0.5	**B1**	
		2	
6(iii)	$6\int_0^1\left(x^3 - x^4\right)\mathrm{d}x$ $= \left[6\left(\frac{x^4}{4} - \frac{x^5}{5}\right)\right]_0^1$	**M1**	attempt int x^2f(x), ignore limits
	$6[\frac{1^4}{4} - \frac{1^5}{5}]$ (= 0.3)	**M1**	attempt subst correct limits in correct integ
	Var(X) = '0.3' – '0.5'^{2} = 0.05	**A1FT**	FT their mean, dep their Var(X) > 0
		3	

Question	Answer	Marks	Guidance
7(i)	$\bar{x} = 11.83$	**B1**	
	$11.83 \pm z \frac{0.1}{\sqrt{10}}$	**M1**	any z
	$z = 2.576$	**B1**	accept 2.574 to 2.579
	[11.75 to 11.91]	**A1**	or equiv. Accept 11.7 to 11.9
		4	
7(ii)	No because pop normal (so $\bar{X}$ normally distr)	**B1**	
		1	
7(iii)	11.7 not within CI	**B1FT**	
		1	
7(iv)	No because 95% CI is narrower than 99% CI	**B1**	OE
		1	
7(v)	Σx^2 (= 1399.67)	**M1**	attempted
	$\text{Est}(\sigma^2) = \frac{10}{9}\left(\frac{"1399.67"}{10} - \left(\frac{"118.3"}{10}\right)^2\right)$ OE	**M1**	correct sub of their Σs into correct formula
	= 0.0201 (3 sf) or 181/9000	**A1**	
		3	