Question	Answer	Marks	Guidance
1(i)	Mean = 115	**B1**	
	SD = 40	**B1**	
		2	
1(ii)	Mean = 15 × '115' = 1725	**B1ft**	
	15 × '40'^{2} (= 24000)	**M1**	or SD = √15 × '40'. ft their **(i)**
	SD = √24000 SD = 155 (cents) (3 sf)	**A1**	Accept √24000 SC: Allow correct answers in dollars
		3	

Question	Answer	Marks	Guidance
2(i)	Assume sd still 4.8 or is unchanged	**B1**	or Assume the 150 times can be treated as a random sample / are independent
	H_0: Pop mean = 26.5 H_1: Pop mean > 26.5	**B1**	Allow 'μ' but not just 'mean'
	$\frac{27.5-26.5}{\frac{4.8}{\sqrt{150}}}$	**M1**	Standardise, with √ Accept CV method
	= 2.552	**A1**	
	Comp with z-value '2.552' > 2.326	**M1**	or comp 1 – Φ('2.552') with 0.01 1 – 0.9946 = 0.0054 < 0.01
	There is evidence time has increased	**A1ft**	oe No contradictions (2 tail test scores max. B1 B0 M1 A1 M1 (for comparison with 2.576) A0 no ft)
		6	

Question	Answer	Marks	Guidance
2(ii)	No because pop is normal so distr of $\bar{X}$ is normal	**B1**	Condone just 'No because pop is normal'
		1	

Question	Answer	Marks	Guidance
3(i)	H_0: P(6) = $\frac{1}{6}$ H_1: P(6) < $\frac{1}{6}$	**B1**	
	$(\frac{5}{6})^{30} + 30(\frac{1}{6}) \times (\frac{5}{6})^{29} + {}^{30}C_2(\frac{1}{6})^2 \times (\frac{5}{6})^{28}$	**M1**	Allow one term incorrect, omitted or extra
	= 0.103	**A1**	
	'0.103' > 0.05	**M1**	
	No evidence (at 5% level) that die biased	**A1ft**	oe No contradictions
		5	
3(ii)	$(\frac{5}{6})^{30} + 30(\frac{1}{6}) \times (\frac{5}{6})^{29}$	**M1**	
	P(Type I) = 0.0295	**A1**	
		2	

Question	Answer	Marks	Guidance
4(a)(i)	$0.5 \times 1/a = (\frac{0.5}{a})$	**M1**	Or attempt to integrate f(x) (=1/a) between 0 and 0.5
	$= \frac{1}{2a}$ oe	**A1**	Accept 0.5/a for A1
		2	
4(a)(ii)	$\frac{a}{2}$	**B1**	
		1	
4(a)(iii)	$\int_0^a \frac{x^2}{a} dx - (\text{`}\frac{a}{2}\text{'})^2$	**M1**	Integ their x^2f(x) from 0 to a and sub their mean^2
	$\text{Var}(X) = \frac{a^2}{3} - \frac{a^2}{4}$ (Var(X) = $\frac{a^2}{12}$ **AG**)	**A1**	Must see this line oe
		2	
4(b)	$\int_2^b \frac{3}{2(t-1)^2} dt$	**M1**	Attempt integ g(t) ignore limits
	$\left[-\frac{3}{2(t-1)}\right]_2^b$	**A1**	Correct integral
	$-\frac{3}{2}(\frac{1}{(b-1)} - 1) = \frac{3}{4}$ $(1 - \frac{1}{(b-1)} = \frac{1}{2})$	**M1**	Attempt subst correct limits in their integ and = $\frac{3}{4}$
	$b = 3$	**A1**	
		4	

Question	Answer	Marks	Guidance
5(a)(i)	$e^{-2.3}(\frac{2.3^2}{2}+\frac{2.3^3}{3!}+\frac{2.3^4}{4!}$	**M1**	Allow one end error
	= 0.585	**A1**	
		2	
5(a)(ii)	$(\lambda) = 4.6$	**B1**	
	$1 - e^{-4.6}(1 + 4.6 + \frac{4.6^2}{2})$	**M1**	any λ, Allow one end error
	= 0.837 (3 sf)	**A1**	
		3	
5(a)(iii)	$S \sim N(115, 115)$	**B1**	May be implied
	$\frac{110.5-115}{\sqrt{115}}$ (= –0.420)	**M1**	Allow with wrong or no cc OR no √
	$1 - \Phi(\text{`0.420'})$ (= 1 – 0.663)	**M1**	
	= 0.337	**A1**	Accept alternative method using N(2.3, 2.3) no mixed methods.
		4	
5(b)	$e^{-\lambda} \times \frac{\lambda^3}{3!} = e^{-\lambda} \times \frac{\lambda^5}{5!}$	**M1**	
	$\lambda^3 = \frac{\lambda^5}{4\times5}$ or $\lambda^2 = 20$ oe	**A1**	any correct simplification without $e^{-\lambda}$ or !
	$\lambda = \sqrt{20}$ or $2\sqrt{5}$ or 4.47 (3 sf)	**A1**	
		3	

Question	Answer	Marks	Guidance
6(i)	Biased towards people who like tennis Excludes people who don't like tennis	**B1**	or other sensible
		1	
6(ii)	Obtain a list of all people in the town	**B1**	
	Use random numbers	**B1**	or, e.g. pick numbers from a hat or other sensible
		2	
6(iii)	$\text{Var}(p) = \frac{\frac{47}{350}(1-\frac{47}{350})}{350}$ (= 0.000332152)	**M1**	
	$z = 1.645$	**B1**	
	$\frac{47}{350} \pm z\sqrt{\frac{\frac{47}{350}(1-\frac{47}{350})}{350}}$	**M1**	Must be a z value
	0.104 to 0.164 (3 sf)	**A1**	Must be an interval
		4	
6(iv)	1.25×1.645 (= 2.056)	**M1**	or 1.25 × their width ÷ 2 ÷ their $\sqrt{\frac{\frac{47}{350}(1-\frac{47}{350})}{350}}$ (Complete method)
	Φ('2.056') (= 0.980)	**M1**	Attempt Φ(their z)
	$x = 96$ (2 sf)	**A1**	Allow 0.96 (2 sf) CWO
		3	