Question	Answer	Marks	Guidance
1	573, 43 (or 043), 289	**B1B1B1**	Ignore incorrect numbers. But allow other correct use of table (i.e. 573, 650, 431)
	Total:	**3**	
2(i)	$z = 1.751$	**B1**	
	$\frac{103}{200} \pm z\sqrt{\frac{\frac{103}{200}\times(1-\frac{103}{200})}{200}}$ oe	**M1**	all correct except for recognisable value of z, allow for one side only
	= 0.453 to 0.577 (3 sf) as final answer	**A1**	must be an interval
	Total:	**3**	
2(ii)	0.08 oe 8%, 8/100	**B1**	
3	10×0.46^2 (= 2.116) or $\frac{0.46}{\sqrt{10}}$	**B1**	SOI
	Total mass of ore ~ N(70, 2.116) or $\sim N\left(7, \left(\frac{0.46}{\sqrt{10}}\right)^2\right)$	**B1**	
	$\pm\frac{71-"70"}{\sqrt{"2.116"}}$ or $\pm\frac{7.1-"7.0"}{0.46/\sqrt{10}}$ (= 0.687)	**M1**	correct, using their sd or √(their var) e.g. allow $\frac{71-"70"}{4.6}$ for **M1**
	$1 - \phi("0.687")$	**M1**	for correct area consistent with their working
	= 0.246 (3 sf)	**A1**	
	Total:	**5**	

Question	Answer	Marks	Guidance
4(i)	$\bar{x} = 6.7/200$ (= 67/2000 = 0.0335)	**B1**	
	$s^2 = \frac{200}{199} \times \left(\frac{0.2312}{200} - \text{"}0.0335\text{"}^2\right)$	**M1**	$s^2 = \frac{0.2312}{200} - 0.0335^2$ **M0**
	= 0.0000339(2) = 27/796000	**A1**	= 0.00003375 **A0**
	Total:	**3**	
4(ii)	H_0: Pop mean level = 0.034 H_1: Pop mean level ≠ 0.034	**B1**	not just "mean", but allow just "μ"
	$\dfrac{\text{"}030335\text{"} - 0.034}{\frac{\sqrt{\text{"}0.00003392\text{"}}}{\sqrt{200}}}$	**M1**	must have $\sqrt{200}$ $\dfrac{0.0335 - 0.034}{\frac{\sqrt{\text{"}0.00003375\text{"}}}{\sqrt{200}}}$ **M1**
	= –1.21(4) (3 sfs) (–1.22 ↔ –1.21)	**A1**	= –1.217 (3 sfs) **A1**
	Comp with $z = -1.645$ (or 0.1124>0.05)	**M1**	0.112 > 0.05 valid comparison z or areas
	No evidence that (mean) pollutant level has changed, accept H_0 (if correctly defined)	**A1FT**	correct conclusion no contradictions SR: One tail test: **B0**, **M1A1** as normal, **M1** (comparison with 1.282 consistent signs) **A0**
	Total:	**5**	

Question	Answer	Marks	Guidance
5(i)(a)	$X \sim \mathrm{N}(42, 42)$	**B1**	stated or implied
	$\dfrac{39.5-\text{"}42\text{"}}{\sqrt{\text{"}42\text{"}}}$ $(=-0.386)$	**M1**	allow with wrong or no cc
	$1-\phi(\text{"}-0.386\text{"}) = \phi(\text{"}0.386\text{"})$	**M1**	correct area consistent with their working
	$= 0.65(0)$ (3 sf)	**A1**	
	Total:	**4**	
5(i)(b)	$42 >$ (e.g. 15) or mean is large	**B1**	$\lambda > 15$ or higher, $\lambda =$ large ignore subsequent work if not undermining what already written
	Total:	**1**	
5(ii)(a)	$Y \sim \mathrm{Po}(1.2)$	**B1**	stated or implied
	$1-\mathrm{e}^{-1.2}(1+1.2+\frac{1.2^2}{2})$	**M1**	allow any λ allow one end error
	$= 0.121$ (3 sf)	**A1**	Using binomial: 0.119 SR **B1**
	Total:	**3**	
5(ii)(b)	$60 \times 0.02 = 1.2 < 5$ or mean is small	**B1FT**	or large n small p FT Poisson only
	Total:	**1**	

Question	Answer	Marks	Guidance
6(i)	$k\int_0^1 (x - x^2)\,dx = 1$	**M1**	Attempt integ f(x) and "= 1", ignore limits
	$= k\left[\frac{x^2}{2} - \frac{x^3}{3}\right]_0^1 = 1$	**A1**	correct integration, limits 0 and 1
	$= k\left[\frac{1}{2} - \frac{1}{3}\right] = 1$ or $\frac{k}{6} = 1$	**A1**	correctly obtained, no errors seen
	Total:	**3**	
6(ii)	E(X) = 0.5	**B1**	
	$6\int_0^1 (x^3 - x^4)\,dx$	**M1**	Attempt integ x^2f(x), limits 0 to 1
	$(= 6\left[\frac{1}{4} - \frac{1}{5}\right] = 0.3)$ "0.3" – "0.5"^{2}	**M1**	their int x^2f(x) – their (E(X))^2 dep +ve result
	= 0.05(= 1/20)	**A1**	
	Total:	**4**	
6(iii)	$6\int_{0.4}^{1} (x - x^2)\,dx$	**M1**	ignore limits, eg **M1** for $6\int_{0.4}^{2} (x - x^2)\,dx$
	$= 6\{\frac{1}{2} - \frac{1}{3} - (\frac{0.4^2}{2} - \frac{0.4^3}{3})\}$	**A1FT**	subst correct limits into correct integration
	= 0.648(= 81/125)	**A1**	condone incorrect "k" for **A1**
	Total:	**3**	

Question	Answer	Marks	Guidance
7(i)	H_0: Pop mean no. accidents = 5.64 H_1: Pop mean no. accidents < 5.64	**B1**	or "= 0.47 (per month)" not just "mean", but allow just "λ" or "μ"
	Use of $\lambda = 5.64$	**B1**	used in a Poisson calculation
	$= e^{-5.64}(1 + 5.64 + \frac{5.64^2}{2})$	**M1**	Allow incorrect λ in otherwise correct
	= 0.08(0)	**A1**	
	Comp with 0.05	**M1**	Valid comparison (Poisson only), no contradictions.
	No evidence to believe mean no. of accidents has decreased; accept H_0 (if correctly defined)	**A1FT**	Normal distribution: **M0M0**
	Total:	**6**	
7(ii)	Mean < 0.47 but conclude that this is not so	**B1**	(Mean) no. of accidents **reduced**, but conclude not reduced. Must be in context.
	Total:	**1**	
7(iii)	(Need greatest x such that $P(X \leqslant x) < 0.05$) $P(X \leqslant 1) = e^{-5.64}(1 + 5.64) = 0.024$ $P(X \leqslant 2) = 0.08$	**B1**	Both, could be seen in (i)
	Hence rejection region is $X \leqslant 1$	**B1**	Can be implied
	With $\lambda = 12 \times 0.05 = 0.6$, $1 - P(X \leqslant 1) = 1 - e^{-0.6}(1 + 0.6)$	**M1**	λ=0.6 and $1 - P(X \leqslant 1)$
	= 0.122 (3 sf)	**A1**	Normal scores 0
	Total:	**4**	