1		$\frac{6.2}{\sqrt{50}}$ or $\frac{6.2^2}{50}$	**B1**	seen or implied
		$\frac{51-53}{6.2\div\sqrt{50}}$ (= –2.281)	**M1**	allow without $\div\sqrt{50}$
		P($z >$ '–2.281') = ϕ('2.281') = 0.989 (3 sf)	**M1** **A1** [4]	for finding correct area consistent with working as final answer
2	**(i)**	Conclude less than 90% satisfied when this is not true oe	**B11**	In context
	(ii)	$1 - (0.9^{15} + 15 \times 0.9^{14} \times 0.1$ $+ {}^{15}C_2 \times 0.9^{13} \times 0.1^2 + {}^{15}C_3 \times 0.9^{12} \times 0.1^3)$ = 0.0556 (3 sf) or 0.0555	**M1** **M1** **A1** [3]	Attempt (1–)P(X = 15,14,13,12) allow 1 end error Attempt fully correct expression
3	**(i)**	Pop too big or takes too long oe or testing destroys articles oe	**B1** [1]	or too expensive oe or pop inaccessible oe
	(ii) (a)	$z = 1.96$	**B1**	seen
		$65.7 \pm z \times \frac{\sqrt{15}}{10}$	**M1**	Expression of correct form (must be 'z' must be 65.7) Must be an interval
		= 64.9 to 66.5 (3 sf)	**A1** [3]	
	(b)	CI does not include 64.7 Probably has affected (or increased) mean bounce ht.	**B1**√ [1]	allow 64.7 not within CI both needed. ft their CI ft 65.7 / 64.7 mix
4		H_0: λ (or μ) = 42 H_1: λ (or μ) $\neq$ 42 Po(42) ~ N(42, 42) stated or implied	**B1** **B1**√	Or pop weekly mean = 2.1 etc. allow 'population mean' not just 'mean' ft their '42' (Accept alt method N(2.1,2.1 / 20)
		$\frac{53.5-42}{\sqrt{42}}$	**M1**	
		= 1.77(4) (or 0.038 for area comparison)	**A1**	allow with wrong or no cc. Accept alt method using N(2.1,2.1 / 20) with or without cc
		comp 1.96	**M1**	Valid comp z or 1 – ('1.774') with 0.025 seen
		No evidence that mean has changed	**A1**√ [6]	allow comp 1.645 if H_1: λ (or μ) > 42 No contradictions. No ft for H_1: λ (or μ) > 42 Note – accept other valid methods(e.g. cv method)

5	**(i)**	$T \sim N(520, 70)$ $\frac{530-520}{\sqrt{'70'}}$ (= 1.195) ('1.195') = 0.884 (3 sf)	**B1** **B1** **M1** **M1** **A1** [5]	for N(520,..) or N(500,..) if standardising with 510 for Var = 70 seen or implied ft their E and Var; allow without √ finding correct area consistent with working CWO
	(ii)	E(T) = –10 Var(T) = 50 + 4.1^2 × 20 (= 386.2) $\frac{0-(-10)}{\sqrt{'386.2'}}$ (= 0.509) 1 – ('0.509') = 0.305 (3 sf)	**B1** **B1** **M1** **M1** **A1** [5]	or +10 for T < 0 Seen or implied ft their E and Var; allow without √ finding correct area consistent with working CWO
6	**(i)**	$\lambda = 6.8$ $e^{-6.8} \times \frac{6.8^5}{5!}$ = 0.135 (3 sf)	**B1** **M1** **A1** [3]	any λ
	(ii) (a)	$e^{-3.4}(1 + 3.4 + \frac{3.4^2}{2} + \frac{3.4^3}{3!} + \frac{3.4^4}{4!})$ = 0.744 (3 sf)	**M1** **A1** [2]	any λ, allow one end-error
	(b)	'0.744' + $e^{-3.4} \times \frac{3.4^5}{5!}$ = 0.87(0) (3 sf) or 0.871	**M1** **A1** [2]	or complete method, any λ, allow one end-error
	(iii)	P($X \leqslant 6$) = '0.870' + $e^{-3.4} \times \frac{3.4^6}{6!}$ = 0.94 Need 6 hair driers	**M1** **A1** **A1** [3]	or complete method, any λ fully correct un-simplified expression or better dep M1A1 with numerical justification (0.94 or better)
7	**(a)**	0.3 or 1 – 0.6 or 0.4 or 0.2 seen 0.8	**M1** **A1** [2]	
	(b) (i)	$k\int_0^{1.5}(2.25 - x^2)dx = 1$ $k\left[2.25x - \frac{x^3}{3}\right]_0^{1.5} = 1$ $k \times [3.375 - 1.125] = 1$ or $k \times \frac{9}{4} = 1$ oe $k = \frac{4}{9}$ **AG**	**M1** **A1** **A1** [3]	attempt integ f(x) and '= 1'. Ignore limits correct integration and limits No errors seen

(ii)	$\frac{4}{9}\int_0^{1.5}(2.25x - x^3)\mathrm{d}x$	**M1**	attempt integ $xf(x)$, ignore limits, condone missing k
	$= \frac{4}{9}\left[2.25\frac{x^2}{2} - \frac{x^4}{4}\right]_0^{1.5}$	**A1**	correct integration and limits, condone missing k
	$= 0.5625$ or 0.563		
	Mean no. of hours = 56.25 or 56.3 56 hrs 15 mins	**A1**	
		A1√ [4]	ft their 0.5625
(iii)	Max x is 1.5, less than 2.9 or $150 < 290$	**B1** [1]	Needs numerical justification
(iv)	any a such that $2.9 \leqslant a \leqslant 5$	**B1** [1]	
	Total for paper	**50**	