Note: "(3 sfs)" means "answer which rounds to ... to 3 sfs". If correct ans seen to ≧ 3sfs, ISW for later rounding. Penalise < 3 sfs only once in paper.

1	$\frac{1}{2}a^2 = 1$	M1	or $\int_0^a x\mathrm{d}x = 1$
	$a = \sqrt{2}$	A1	Allow 1.41 or better
	$\int_0^{\sqrt{2}} x^2\mathrm{d}x$	M1	ignore limits
	$= \left[\frac{x^3}{3}\right]_0^{\sqrt{2}}$	A1f	correct integral and limits, but ft their a
	$= \frac{\left(\sqrt{2}\right)^3}{3} = \text{or } \frac{2^{1.5}}{3} \text{ or } \frac{2.83}{3} \text{ or } 0.9428$ (= 0.943 **AG**)	A1 [5]	must see this numerical expression, or equiv SR Equating $\int x\ \mathrm{f}(x)$ to 0.943 scores M1 Solving to find a = 1.41 scores A1
		[Total 5]	
2 (i)	H_0: $p = 0.2$ or $\mu = 10$ H_1: $p > 0.2$ or $\mu > 10$	B1 [1]	
(ii)	N(10, 8) seen or implied	B1	or $\mathrm{N}\left(0.2, \frac{0.2\times0.8}{50}\right)$
	$\frac{125-10}{\sqrt{8}}$ or $\frac{\frac{125}{50}-02}{\sqrt{\frac{0.2\times0.8}{50}}}$	M1	For standardising allow with no or wrong cc
	= 0.884	A1	
	comp 1.282	M1f	Allow area comparison with 0.188 or comp 1.645 if H_1 $p \neq 0.2$
	Claim not justified or No evidence to support claim	A1f [5]	Allow accept H_0 provided correctly defined. Follow through their test statistic ;dep 1–tail test No Contradictions SR; Use of B(50,0.2) scores B1 provided at least two probabilities calculated. M1 For finding $P(X \geqslant 13)$ allow one end error. A1 for 0.186
		[Total: 6]	

3	**(i)**	34 $2.2^2 + 1.3^2 + 2.6^2$ (=13.29)	B1 B1 [2]	Accept 13.3 or 3.65^2 Allow at early stage
	(ii)	$\frac{33-'34'}{\sqrt{\frac{'13.29'}{70}}}$ (= –2.295) $\frac{35-'34'}{\sqrt{\frac{'13.29'}{70}}}$ (= 2.295) Φ('2.295') – Φ('–2.295') = Φ('2.295') – (1 – Φ('2.295')) oe = 0.978 (3 sf)	M1 M1 M1 A1 [4]	correct standardisation method for either For attempt to use tables to find the probability between two z values ,may be implied by next line For a correct method to find the area between their two z values
			[Total: 6]	
4	**(i)**	H_0: pop mean (or μ) = 12.4 H_1: pop mean (or μ) > 12.4 $\frac{12.9-12.4}{2.1+\sqrt{50}}$ 1.684 comp cv z = 1.96 No evidence that pop mean time has increased	B1 M1 A1 B1f [4]	not just "mean" Allow with 50 instead of √50 or P($z > 1.684$) = 0.0461 $>$ 0.025 Allow accept H_0 if correctly defined. Ft their test statistic. No contradictions
	(ii)	Not reject (or accept) that mean time is unchanged (or is 12.4) oe although mean time has increased (or is more than 12.4) oe	B1 B1 [2]	
	(iii)	True (or new) mean	B1 [1]	
			[Total: 7]	

5	**(i)**	4200/80 (=52.5)	B1	
		$= \frac{80}{79}\left(\frac{229\,000}{80} - '52.5'^2\right)$ (= 107.595)	M1 A1 [3]	
		= 108 (3 sf)		
	(ii)	$'52.5' \pm z\sqrt{\frac{'107.595'}{80}}$	M1	Correct form – must be z-value – allow one side only
		$z = 2.326$	B1	Seen
		49.8 to 55.2	A1f [3]	ft their 52.5 and 107.595. Must be an interval
	(iii)	49	B1 [1]	
			[Total: 7]	
6	**(i)**	$e^{-\frac{10}{3}} \times \frac{\left(\frac{10}{3}\right)^2}{2}$	M1	P(2), allow any λ
		= 0.198 (3 sf)	A1 [2]	
	(ii)	$1 - e^{-2}\left(1 + 2 + \frac{2^2}{2}\right)$	M1 M1	M1 allow any λ and/or 1end error Correct expression , correct λ
		= 0.323 (3 sf)	A1 [3]	
	(iii)	$N\left(\frac{200}{3}, \frac{200}{3}\right)$	M1	seen or implied
		$\frac{49.5 - \frac{200}{3}}{\sqrt{\frac{200}{3}}}$ (= –2.102)	M1	For standardising allow either wrong or no cc No sd/var mix
		$\Phi('-2.102') = 1 - \Phi('2.102')$ = 0.0178 (3 sf)	M1 A1 [4]	For finding area consistent with their working
			[Total: 9]	

7	**(i)**	$7E(X) + 5E(Y) - 2$ $(= 7 \times 8 + 5 \times 3) - 2$ $= 69$	M1 A1 [2]	allow incorrect means
	(ii)	$Var(X) = 1.6$, $Var(Y) = 3$ $16Var(X) + 9Var(Y)$ $(= 16 \times 1.6 + 9 \times 3)$ $= 52.6$	B1 M1 M1 A1 [4]	both M1 for mult by 16 and 9; allow with '+ 3' M1 for add without '+ 3'; allow incorrect multipliers
	(iii)	$X = 10$, $Y = 2$ and $X = 9$, $Y = 0$ $0.8^{10} \times e^{-3} \times \frac{3^2}{2}$ or $10 \times 0.8^9 \times 0.2 \times e^{-3}$ $0.8^{10} \times e^{-3} \times \frac{3^2}{2} + 10 \times 0.8^9 \times 0.2 \times e^{-3}$ $= 0.0374/5$	B1 M1 M1 A1 [4]	both pairs seen or implied or 0.0241 or 0.0134 (3sf) one correct product all correct
			[Total: 10]	

[Total for paper 50]