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	Cambridge International A Level – October/November 2014	9709	73	
1	(i) “Different” being investigated	B1	[1]	Oe (“changed”, “not equal to”)
	(ii) H_0 : Pop mean (or μ) in region same as elsewhere			Must be “pop mean”, not just “mean” Can be awarded in (i)
	H_1 : Pop mean (or μ) in region diff from elsewhere	B1		oe
	$1.91 < 2.054$ (or 2.055) or $-1.91 > -2.054$	M1		or $P(z > 1.91) = 0.0281 > 0.02$ or $0.0562 > 0.04$ or $0.972 < 0.98$ Accept 2.05 if nothing better seen.
	No evidence that mean is different	A1	[3]	inequality sign incorrect M1A0 no contradictions “accept H_0 ” provided H_0 reasonably well defined
Total			[4]	
2	(i) $\frac{1}{2}c^2 = 1$	M1		Area of triangle = 1 or integral of kx with limits 0 and c and equated to 1
	$c = \sqrt{2}$ or 1.41 (3 sf)	A1	[2]	
	(ii) $f(x) = x$ or $y = x$	B1		Seen or implied, e.g. by next line. Can be awarded anywhere in the question. Implied by $(a + 1)$ in area of trapezium.
	$\int_a^1 x dx = 0.1$	M1		Ignore limits. Must be integral of kx and equated to 0.1. Or trapezium area.
	$\left[\frac{x^2}{2}\right]_a^1 = 0.1$	A1 ^{ft}		Correct limits, ft incorrect kx .
	$1 - a^2 = 0.2$	A1	[4]	$\sqrt{\left(\frac{4}{5}\right)}$ oe
	$a = 0.894$ (3 sf)			
(iii)	$\int_0^{\sqrt{2}} x^2 dx$	M1		Ignore limits; ft their $f(x)$ but not $\int x dx$
	$\left[\frac{x^3}{3}\right]_0^{\sqrt{2}}$			
	$= \frac{2}{3}\sqrt{2}$ or 0.943 or $\sqrt{\left(\frac{8}{3}\right)}$	A1 ^{ft}	[2]	ft their c , dep $0 < \text{ans} < \text{their } c$. Not ft their $f(x)$
Total			[8]	

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3	(i)	$\text{Est}(\mu) = \frac{7220}{80} \text{ or } 90.25$ $\text{Est}(\sigma^2) = \frac{80}{79} \left(\frac{656060}{80} - \left(\frac{7220}{80} \right)^2 \right)$ $= 56.3924 \text{ or } \frac{4455}{79}$ $z = 2.17$ $\frac{7220}{80} \pm z \times \sqrt{\frac{56.3924}{80}}$ $= 88.4 \text{ to } 92.1 \text{ (3 sf)}$	B1	Accept 90.3
			M1	$\frac{1}{79} \left(656060 - \frac{7220^2}{80} \right)$
			A1	Accept 56.4
	(ii)	Pop normal No	B1 B1dep	Accept 56.4 Expression of correct form Must be an interval (N.B. biased var gives 88.4 to 92.1 scores possible B1M0A0B1M1A1)
	Total			[6] [2] [8]
4	(i)	$4 \times 125 + 6 \times 130 (= 1280)$ $4 \times 30^2 + 6 \times 32^2 (= 9744)$ $\left(\pm \right) \frac{1500 - 1280}{\sqrt{9744}} (= 2.229)$ $\Phi("2.229")$ $= 0.987 \text{ (3 sf)}$	B1 B1	Give at early stage. Could be implied by 220. (If B0B0 then 1.28 and 0.009744 can score B1B1).
			M1	Standardising. Accept sd/var mix. Must be from combination attempt.
			M1	Use of tables and correct area consistent with their working
	(ii)	$125 - 0.9(130) (= 8) \text{ (or } -8)$ $30^2 + 0.9^2(32^2) (= 1729.44)$ $\left(\pm \right) \frac{0 - '8'}{\sqrt{1729.44}} (= -0.192)$ $\Phi('0.192')$ $= 0.576 \text{ (3 sf)}$	A1 B1 B1	Use of tables and correct area consistent with their working cwo
			M1	Give at early stage. (If B0B0 scored then accept 0.008 and 0.0017944 for B1B1)
			M1	Accept sd/var mix. Must come from a linear combination.
			M1	Use of tables and correct area consistent with their working (unclear M0)
	Total			[5] [5] [10]

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5	(i)	H_0 : population proportion = 0.1 oe H_1 : population proportion > 0.1 oe $P(X \geq 4) = 1 - P(X \leq 3) =$ $1 - \left(0.9^{18} + 18 \times 0.9^{17} \times 0.1 + \right.$ $\left. {}^{18}C_2 \times 0.9^{16} \times 0.1^2 + {}^{18}C_3 \times 0.9^{15} \times 0.1^3 \right)$ = 0.0982 (3 sf) Comp 0.08 No evidence that more reach 1m	B1		Allow “ $p = 0.1$ ” and “ $p > 0.1$ ”
			M1		Allow 1 – (one term omitted or extra or wrong)
			A1		(note CR method 0.0982 and $CR \geq 5$ for A1)
			M1		Valid comparison (0.9018 < 0.92 also recovered previous A1). Or 4 is not in CR
			A1 ✓ ^h	[5]	Dep M1M1 no contradictions “Accept H_0 ” provided H_0 defined
	(ii)	Not rejected H_0 Type II	B1 ✓ ^h B1dep ✓ ^h	[2]	Ft their (i) If (i) “reject H_0 ” then ft gives Type I error
	(iii)	$P(X \geq 5)$ (= 0.0282) 0.0282 < 0.08 P(Type I error) = 0.0282 (3 sf)	M1 B1 ✓ ^h		Attempt $P(X \geq 5)$ e.g. ‘0.0982’ – ${}^{18}C_4 \times 0.9^{14} \times 0.1^4$ oe. Valid comp of their ≥ 5 (if CR method used, could be awarded in (i))
	Total			[10]	
6	(i)	$e^{-3.84} \times \frac{3.84^4}{4!}$ = 0.195 (3 sf)	M1		Poisson $P(X = 4)$, any λ
			A1	[2]	
	(ii)	1.44 $1 - e^{-1.44} \left(1 + 1.44 + \frac{1.44^2}{2} \right)$ = 0.176	B1		Seen
			M1		Any λ , allow one end error, need “1 – ...”
			A1	[3]	
	(iii)	$X \sim N(41, 41)$ $\frac{40.5 - 41}{\sqrt{41}} (= -0.078) \quad \frac{59.5 - 41}{\sqrt{41}} (= 2.889)$ $\Phi(‘2.889’) - \Phi(‘-0.078’)$ = $\Phi(‘2.889’) - (1 - \Phi(‘0.078’))$ = 0.9981 – (1 – 0.5311) = 0.529 (3sf)	B1		Seen or implied
			M1M1		M1M0 if no cc or incorrect cc OR no $\sqrt{\quad}$ in both
			M1		Use of tables and correct area consistent with their working.
			A1	[5]	cwo
	Total			[10]	