1 $50 = a + b \times 54$	B1		
$100 = b^2 \times 144$ or $10 = b \times 12$	B1		
$b = \frac{5}{6}$ oe	M1		Solving two simultaneous equations
$a = 5$	A1	[4]	Both correct
2 $2 \times z \times \sqrt{\frac{0.35 \times 0.65}{n}} = 0.157$	M1 M1		For $\sqrt{(pq/n)}$ in equation For equation of the form $2 \times z \times \mathrm{f}(n) = 0.157$
$z = 2.326$	B1		
$n = 4 \times 2.326^2 \times 0.35 \times 0.65 \div 0.157^2$ (=199.738…)	M1		Rearrange to form $n = ...$ from a correct equation in n, but allow any z and/or factor of "2" errors
$n = 200$	A1	[5]	cao
3 **(i)** Number all members	B1		
Explain the selection of 3-digit random numbers	B1		
Omit repeats OR omit nos. over 750 (until have 8 nos.)	B1	[3]	
(ii) Est (μ) = 20	B1		
Est (σ^2) = $\frac{8}{7}\left(\frac{3636}{8} - 20^2\right)$	M1		$1/7 \times (3636 - 160^2/8)$
$= \frac{436}{7}$ or 62.3 (3 sfs)	A1	[3]	$(7.89...)^2$ M1A1, but 7.89... only M1A0
(iii) Amounts spent last week in café by all club members	B1	[1]	
4 **(i)** $\int_0^1 ke^{-x}\,\mathrm{d}x = 1$	M1		Int = 1, ignore limits
$\left[-ke^{-x}\right]_0^1 = 1$	A1		Correct integral & limits, & = 1
$(= -ke^{-1} - (-ke^0))$			
$= k \times \frac{e-1}{e} = 1$ or $k(e-1) = e$			
$k = \frac{e}{e-1}$ **AG**	A1	[3]	Correctly obtained, no errors seen

(ii) $\frac{e}{e-1}\int_0^1 xe^{-x}dx$	M1	Attempt $\int xf(x)dx$, ignore limits
$= \frac{e}{e-1}\left(\left[x(-e^{-x})\right]_0^1 - \int_0^1(-e^{-x})dx\right)$	M1*	Attempt integration by parts the correct way round, ignore limits
$= \frac{e}{e-1}\left(\left[-xe^{-x}\right]_0^1 - \left[e^{-x}\right]_0^1\right)$	M1dep*	Attempt second integral of the form $\pm\int e^{-x}dx$, ignore limits
$(= \frac{e}{e-1}(-e^{-1} - 0 - (e^{-1} - 1)))$		
$= \frac{e}{e-1}(1 - \frac{2}{e})$ or $\frac{e-2}{e-1}$ oe	A1 [4]	Accept k instead of $\frac{e}{e-1}$ throughout except ans
5 **(i)** Assume pop sd same (105)	B1	
H_0: Pop mean = 1150 H_1: Pop mean < 1150	B1	Allow "μ" but not just "mean"
$\dfrac{\frac{21800}{20} - 1150}{\frac{105}{\sqrt{20}}}$	M1	Allow $\div\frac{105}{20}$. (Accept "totals" method)
$= \pm 2.556$ or 2.56	A1	Or 0.0053 if prob/area comparison used
Compare with $z = \pm 2.326$ (for a clear 2 tail test compare with ± 2.576)	M1	Correct comparison of z or prob/area consistent with their test
Evidence that mean distance decreased	A1ft [6]	In context. Allow mean dist decreased ft their z and/or clear 2 tail test
(ii) 0.01	B1	
Concluding there has been a decrease when there has not.	B1 [2]	In context

6	**(i)**	E(Tot) = 2 × 36 + 55 (= 127)	B1		(Or ±13)
		Var(Tot) = $2 \times 3.5^2 + 5.2^2$ (= 51.54)	B1		
		$\frac{140-127}{\sqrt{"51.54"}}$ (= 1.811)	M1		For standardising with their mean and var. Allow without √ or with false cc, but their mean and variance must involve parameters from both given distributions
		Φ("1.811")			
		= 0.965 (3 sfs)	A1	[4]	
	(ii)	E(*RM*) = 36 + 1.5 × 55 (= 118.5)	B1		(Or ±18.5)
		Var(*RM*) = $3.5^2 + 1.5^2 \times 5.2^2$ (= 73.09)	B1		
		$\frac{100-1185}{\sqrt{73.09}}$ (= –2.164)	M1		For standardising with their mean and var. Allow without √ or with false cc, but their mean and variance must involve parameters from both given distributions
		1 – Φ("–2.164") = Φ ("2.164")			
		0.985 (3 sfs)	A1	[4]	
7	**(i)**	**(a)** $1-e^{-1.2}(1+1.2)$ (= 0.3374) $1-e^{-1.4}$ (= 0.7534)	M1 A1		M1 for Poisson either P(0 or 1) or P(0) with λ = 1.2 or 2.4 or 1.4 or 2.8, accept one end error Both expressions fully correct
		$(1-e^{-1.2}(1+1.2)) \times (1-e^{-1.4})$	M1		Their Poisson P(0 or 1) × P(0)
		= 0.254 (3 sfs)	A1	[4]	
	(i)	**(b)** $\lambda = 2.6$ seen	B1		
		$1-e^{-2.6}(1+2.6+2.6^2 \div 2)$	M1		Poisson 1 – P(0, 1, 2), allow 1 – P(0, 1, 2, 3), with attempt at combined λ for M and W. Accept combination method: at least 4 correct terms and "1 –" M1; all terms correct B1
		= 0.482 (3 sfs)	A1	[3]	

(ii) N(52, 52)	B1		Seen or implied
$\frac{60.5-52}{\sqrt{52}}$ (= 1.179)	M1		Standardising with N(λ, λ) with $\lambda = 10 \times 5.2$ or 10×2.6 Allow with wrong or no cc or no √
1 – Φ("1.179")	M1		Their correct area
(= 1 – 0.8808)			
= 0.119 (3 sfs)	A1	[4]	