1	**(i)** Mean = 2.6	B1		
	Var = 4 × 1.3	M1		M1 for either 4 ×, or for Var(X) = 1.3 implied
	= 5.2	A1	[3]	
	(ii) Var ≠ mean or 2X does not take all integer values	B1	[1]	X and X are not independent oe
2	H_0: P(correct) = $^1/_5$ H_1: P(correct) > $^1/_5$ B(100, $^1/_5$) ≈ N(20, 16)	B1		Accept p Accept H_o: $\mu = 20$ H_1: $\mu > 20$
	$\frac{26.5 - 20}{4} = 1.625$	M1 A1		Allow wrong or no cc or denom = 16 For ± 1.625
		A1		
	comp z = 1.645	M1		Valid comparison of z or areas (0.0521 > 0.05)
	Claim not justified	A1ft	[5]	In context. No contradictions. Ft their z.
3	Var(Tot) = $0.02^2 + 0.03^2 + 0.01^2 = 0.0014$	B1		
	Mean(Tot) = 0.37 Tot ~ N(0.37, 0.0014)	B1		
	$\frac{0.30 - 0.37}{\sqrt{'0.0014'}}$ (= –1.871)	M1		Allow without √. No cc
	Φ("–1.871") = 1 – Φ("1.871")	M1		
	= 0.0306 or 0.0307	A1	[5]	Correct area
4	**(i)** Est(μ) = 331(.125)	B1		
	$\text{Est}(\sigma^2) = \frac{8}{7}\left(\frac{"877179"}{8} - "331.125"^2\right)$	M1		Allow their Σx^2
	= 4.125 or 4.13	A1	[3]	
	(ii) z = 2.326	B1		
	$331 \pm z \times \sqrt{\frac{4.2}{50}}$	M1		Allow incorrect z (≠ 1, 0), not a prob
	= 330 to 332 (3 sfs)	A1	[3]	Ignore brackets, if given. CWO
	(iii) No, because 333 is not within CI	B1ft	[1]	

5	**(i)**	±1.645 used	B1	
		$\dfrac{\bar{x}-22}{\frac{3.5}{\sqrt{12}}} > 1.645$	M1	
		$\bar{x} > 23.66(20)$ $\bar{x} > 23.7$ **AG**	A1 [3]	Accept '=' (standardising using 23.7 scores M1A0) or $\bar{x} = 23.66(20)$
	(ii)	$P(\bar{x} < 23.7 \mid \mu = 25.8)$	M1	For attempt type II error and standardising
		$\dfrac{23.662-25.8}{\frac{3.5}{\sqrt{12}}} = -2.116$	A1	$\dfrac{23.7-25.8}{\frac{3.5}{\sqrt{12}}} = -2.078$
		$\Phi(\text{'}-2.116\text{'}) = 1 - \Phi(\text{'}2.116\text{'})$ $(= 1 - 0.9828)$	M1	$\Phi(\text{"}-2.078\text{"}) = 1 - \Phi(2.078)$ $(= 1 - 0.9812)$
		= 0.0172 (3 sfs)	A1 [4]	= 0.0188
6	**(i)**	Customers arrive independently or randomly	B1 [1]	In context. Allow "singly"
	(ii)	$e^{-6} \times \dfrac{6^5}{5!}$	M1	Poisson P(5), allow any mean
		= 0.161 (3 sfs)	A1 [2]	
	(iii)	$\lambda = 2.4$	B1	
		$e^{-2}\left(1 + 2.4 + \dfrac{2.4^2}{2!}\right)$	M1	Poisson P(0, 1, 2), allow their mean allow one end error
		= 0.570 (3 sfs)	A1 [3]	
	(iv)	N(24, 24)	B1	Stated or implied
		$\dfrac{295-24}{\sqrt{24}}$ (= 1.123)	M1	Allow with wrong or no cc and/or no √ Correct area
		Φ("1.123")	M1	
		= 0.869 (3 sfs)	A1 [4]	

7 **(i)** **(a)** X or 5	B1 [1]	
(b) V or 3	B1	Should mention values or prob Not just graph or spread eg not "More spread"
Higher and lower values more likely or there are more higher and lower values or more prob at both extremes	B1dep [2]	
(ii) $\frac{2+1}{2}\times 0.5$ or $\int_0^{0.5}(2-2x)\mathrm{d}x$	M1	('or' method requires linear function and correct limits)
$= 0.75$	A1 [2]	CWO
(iii) **(a)** $\int_0^1 ax^n\mathrm{d}x = 1$	M1	Attempt integ of correct form = 1 (ignore limits)
$\left[\frac{ax^{n+1}}{n+1}\right]_0^1 = 1$	A1	Correct integrand & limits
$\frac{a}{n+1} = 1$	A1	No errors seen
($a = n + 1$ **AG**)	[3]	
(b) $\int_0^1 ax^{n+1}\mathrm{d}x = \frac{5}{6}$ oe	M1*	Integral of form $\int xf(x)\mathrm{d}x = \frac{5}{6}$, ignore limits
$\left[\frac{ax^{n+2}}{n+2}\right]_0^1 = \frac{5}{6}$ oe	A1	Correct integrand & limits
$\frac{a}{n+2} = \frac{5}{6}$ ($6a = 5n + 10$)	M1dep	Attempt to use $a = n + 1$ within 2nd equ to get an equ in n (or a)
$a = 5$, $n = 4$	A1 [4]	