1	**(i)**	Eg: Only students who use canteen The five will probably be friends	B1 B1 [2]	or any reason that some are excluded B1 each sensible reason must be in context
	(ii)	2–digits ignore > 82 (anything too big) Ignore repeats	B1 B1 B1 [3]	
			[Total 5]	
2	**(i)**	H_0: P(correct) = $\frac{1}{8}$ H_1: P(correct) > $\frac{1}{8}$	 B1 [1]	Or H_0 p = 1/8 H_1p > 1/8
	(ii)	$1-\left(\left(\frac{1}{8}\right)^{10}+10\left(\frac{1}{8}\right)^{9}\left(\frac{7}{8}\right)+{}^{10}C_2\left(\frac{1}{8}\right)^{8}\left(\frac{7}{8}\right)^{2}\right)$ = 0.120 (3 sf) or 0.119	M1 A1 A1 [3]	M1 for attempt at correct expression accept 1 error only, e.g. 1 term extra, omitted or wrong, or omit "1–" or incorrect p/q Correct expression Note Use of Poisson in (ii) could score M1 only for expression 1 –P(0,1,2) λ =1.25
	(iii)	12%	B1f [1]	ft their (ii) Must be a probability
			Total 5	
3	**(i)**	$\text{Var}(p_s) = \frac{0.22\times(1-0.22)}{100}$ $\left(=\frac{429}{250\,000}\text{ or }0.001716\right)$ $0.22 \pm z\sqrt{'\frac{429}{250\,000}'}$ z = 2.17 or 2.168/9 or 2.171 0.13(0) to 0.31(0) (2 sf)	M1 M1 B1 A1 [4]	pq/100 Expression of correct form with their variance Any z (must be a z value) accept one side only Seen Must be an interval
	(ii)	'2' × (1 – 0.97) × 0.97 = 0.0582	M1 A1 [2]	
			Total 6	

4	**(i)**	$\left(\frac{1508}{50}\right) = 30.16\ (30.2)$	B1	Allow any form
		$\frac{50}{49}\left(\frac{51\,825}{50} - (\text{'}30.16\text{'}^2)\right)$	M1	(129.46367)
		= 129 (3 sf) Or 130	A1 [3]	
	(ii)	(1.5 × '30.16' + 10) = 55.24	B1ft	ft their 30.16
		(1.5^2 × '129….')	M1	1.5^2 × their(129) with nothing added at any stage
		= 291 (3 sf)	A1ft [3]	Allow 290
			Total 6	
5	**(i)**	Cables broken or not all cables can be accessed oe or Too many cables oe or too time consuming oe	B1 [1]	e.g. previous days' stocks may have gone
	(ii)	H_0: Pop mean brk str (or μ) = 5 H_1: Pop mean brk str (or μ) < 5	B1	Not just "mean"
		$(\pm)\frac{4.95-5}{\frac{0.15}{\sqrt{60}}}$	M1	Allow 60 instead of √60
		(= ±2.582)	A1	
		comp ±2.326 There is evidence that mean breaking strength is less than it should be Or reject H_0 (H_0 correctly defined)	B1 ft [4]	Ft their –2.582 (No ft 2 tailed test) Correct comparison shown, no errors seen. Accept area comparison 0.0049 with 0.01 [CR method $(x - 5)/(0.15/\sqrt{60})$ = –2.326 M1 A1 leading to x = 4.955 compared to 4.95and correct conclusion B1ft OR $((x - 4.95)/0.15/\sqrt{60})$ leading to 4.995 M1 A1 compared to 5and correct conclusion B1ft]
	(iii)	Population not necessarily normal so yes	B1 B1dep [2]	SR B1 For "it" is not necc normal (no mention of population) AND Yes
			Total 7	

6	**(i)**	$e^{-3.5} \times \frac{3.5^3}{3!}$	M1	P($X = 3$) any λ
		= 0.216 (3 sf)	A1 [2]	
	(ii)	N(42, 42) stated or implied	B1	
		$\frac{29.5 - 42}{\sqrt{42}}$ (= –1.929)	M1	Allow with wrong or no cc OR without √
		P($z >$ '–1.929') = Φ('1.929')	M1	For correct area consistent with their working
		= 0.973 (3 sf)	A1 [4]	
	(iii)	(λ) = 2.4	B1	
		$1 - e^{-2.4}\left(1 + 2.4 + \frac{2.4^2}{2} + \frac{2.4^3}{3!}\right)$	M1	for 1 – P($X \leqslant 3$), any λ allow one end error
			M1	Correct expression any λ
		= 0.221 (3 sf)	A1 4	NB For combination method B1 attempting 10 combinations with λ=1, λ=1.4 M1 6 expressions M1 10 expressions 0.221 A1
			Total 10	
7	**(i)**	$\frac{3}{4}\int_0^c (cx - x^2)dx = 1$	M1	Attempt integ f(x) and = 1. Ignore limits
		$\frac{3}{4}\left[\frac{cx^2}{2} - \frac{x^3}{3}\right]_0^c = 1$	A1	Correct integration and limits (condone c = 2
		$\frac{3}{4}\left(\frac{c^3}{2} - \frac{c^3}{3}\right) = 1$ or $\frac{3}{4} \times \frac{c^3}{6} = 1$ or $\frac{c^3}{8} = 1$	A1 [3]	No errors seen
		($c = 2$ **AG**)		
	(ii)	Inverted parabola	B1	
		Through (0, 0) and (2, 0) and zero elsewhere	B1	Must not extend beyond [0,2]
		Median = 1	B1 [3]	
	(iii)	$\frac{3}{4}\int_0^{1.5} (2x - x^2)dx$	M1	Attempt integ f(x) ignore limits
		$= \frac{3}{4}\left[x^2 - \frac{x^3}{3}\right]_0^{1.5}$	A1	Correct integration ignore limits
		$\frac{3}{4}\left(1.5^2 - \frac{1.5^3}{3}\right)$	B1	Use of correct limits [0,1.5] or 1–[1.5,2]
		$= \frac{27}{32}$ or 0.844 (3 sf)	A1 [4]	

(iv)	$\left(\frac{27}{32} - \frac{1}{2} \text{ or } 0.844 - 0.5\right)$ $= \frac{11}{32}$ or 0.344 (3 sf)	B1f [1]	ft their (iii) For use of symmetry Note If do not use "hence" and start again B1 for cwo
		Total 11	

Total for paper 50