1	E(T) = 9.6 Var(wt of one bag) = 0.0016 Var(T) = 3 × 0.0016 sd of T = √(3 × 0.0016) = 0.0693	B1 M1 M1 A1 [4]	May be impl. by Var(T) = 0.0048 or 0.0144
		[Total: 4]	
2	$\overline{X}$ ~N(3, $\frac{\frac{9}{4}}{60}$) $\frac{2.8-3}{\sqrt{\frac{\frac{9}{4}}{60}}}$ (= –1.033) Φ("–1.033") = 1 – Φ("1.033") = 0.151	B2 M1 M1 A1 [5]	B1 for N & μ = 3; (oe) B1 for $^{9/4}/_{60}$ or $^{3}/_{80}$ or 0.0375 (oe) (oe working with totals or proportions) With or without c.c. With cc of $-^{1}/_{120}$, Φ(–1.076) = 1 – Φ(1.076) = 0.141
		[Total: 5]	
3 **(i)**	Constant average rate of goals scored Goals random Goals indep	B1 B1 [2]	Any two given in context (SR score B1 for any two not in context) Not Goals scored singly (because this is inherent in the context so it's not a condition)
(ii)	$e^{-1.8}(\frac{1.8^3}{3!}+\frac{1.8^4}{4!}+\frac{1.8^5}{5!})$ = 0.259	M1 A1 [2]	Poisson probs, λ = 1.8. Allow 2, 6 included
(iii)	$1-e^{-1.8}$ $(1-e^{-1.8})^{10}$ = 0.164	M1 M1 A1 [3]	Any λ. Allow end errors.
		[Total: 7]	
4 **(i)**	$\bar{x}$ = 8.4 $8.4 \pm z\frac{1.3}{\sqrt{15}}$ z = 2.576 [7.54, 9.26]	B1 M1 B1 A1 [4]	Accept 2.574 to 2.579 or equiv. Accept 7.53. Accept 9.27
(ii)	No because pop normal so $\overline{X}$ normally distr	B1 B1 [2]	SR If 'Yes' or no conclusion, but 2 correct statements score B1
(iii)	8 within CI Claim justified	B1√ B1√ [2]	ft **(i)**
		[Total: 8]	

5	**(i)**	Po(3.3) $e^{-3.3}(1 + 3.3 + \frac{3.3^2}{2})$ = 0.359	B1 M1 A1 [3]	seen or implied Poisson P(0) + P(1) + P(2). Allow + P(3) Allow wrong λ. Accept equiv method.
	(ii)	X~Po(36) X~N(36, 36) $\frac{48.5 - 36}{\sqrt{36}}$ = 2.08(3) comp with 1.96 Evidence to support claim	B1 B1 M1 A1 M1 A1√ [6]	 Allow with no or wrong cc or no √ 2.08(3) or 0.0186/0.0187 if area comparison Valid comparison Correct conclusion (ft their z)
			[Total: 9]	
6	**(i)**	H_0: P(6) = $\frac{1}{6}$ H_1: P(6) > $\frac{1}{6}$	B1 [1]	Condone undefined p
	(ii)	$\left(\frac{5}{6}\right)^{10} + 10 \times \left(\frac{5}{6}\right)^{9} \times \frac{1}{6} + \binom{10}{2} \times \left(\frac{5}{6}\right)^{8} \times \frac{1}{6}^{2} + \binom{10}{3} \times \left(\frac{5}{6}\right)^{7} \times \left(\frac{1}{6}\right)^{3}$ $1 - (\left(\frac{5}{6}\right)^{10} + 10 \times \left(\frac{5}{6}\right)^{9} \times \frac{1}{6} + \binom{10}{2} \times \left(\frac{5}{6}\right)^{8} \times \left(\frac{1}{6}\right)^{2}$ $+ \binom{10}{3} \times \left(\frac{5}{6}\right)^{7} \times \left(\frac{1}{6}\right)^{3})$ = 0.0697 (3 sfs)	M1 M1 A1 [3]	(1 –) P(0,1,2,3) o.e. using B(10,1/6) allow end errors Attempt at fully correct expression for 1 – P(0,1,2,3) o.e. Accept 0.0698
	(iii)	Die biased towards a six but result < 4 so no evidence of bias	B1 [1]	or equiv. Must be in context
	(iv)	P(0, 1, 2 or 3 sixes) $(\left(\frac{1}{2}\right)^{10} + 10 \times \left(\frac{1}{2}\right)^{9} \times \frac{1}{2} + \binom{10}{2} \times \left(\frac{1}{2}\right)^{8} \times \left(\frac{1}{2}\right)^{2} + \binom{10}{3} \times \left(\frac{1}{2}\right)^{7} \times \left(\frac{1}{2}\right)^{3})$ = 0.172 or 11/64	B1 M1 A1 [3]	Stated or attempted. Can be implied Attempt at P(0,1,2,3) with p = 1/2, allow end errors.
			[Total: 8]	

7 **(i)**	$\int_{-1}^{1} k(1-x)\mathrm{d}x = 1$ $(k[x - \frac{x^2}{2}]_{-1}^{1} = 1)$ $2k = 1$ $(k = \frac{1}{2}$ **AG)**	M1 A1 [2]	Attempt integ f(x) = 1 with correct limits
(ii)	$(\int_{0.5}^{1} \frac{1}{2}(1-x)\mathrm{d}x = \frac{1}{2}[x - \frac{x^2}{2}]_{0.5}^{1})$ $= \frac{1}{16}$ or 0.0625	 B1 [1]	
(iii)	$\int_{-1}^{1} \frac{1}{2}(x - x^2)\mathrm{d}x$ $= \frac{1}{2}[\frac{x^2}{2} - \frac{x^3}{3}]_{-1}^{1}$ $= -\frac{1}{3}$ or –0.333	M1 A1 A1 [3]	$\int xf(x)\mathrm{d}x$ ignore limits Correct integrand and limits
(iv)	$\int_{-1}^{a} \frac{1}{2}(1-x)\mathrm{d}x = 0.25$ $(\frac{1}{2}[x - \frac{x^2}{2}]_{-1}^{a} = 0.25)$ $(\frac{1}{2}(a - \frac{a^2}{2} - (-1 - \frac{1}{2}) = 0.25)$ $a^2 - 2a - 2 = 0$ $a = 1 - \sqrt{3}$ or –0.732	M1 A1 A1 [3]	Correct limits (or integral from a to 1 = 0.75) any correct QE with "= 0"(or in completed square form $(a-1)^2 = 3$) Not $a = 1 \pm \sqrt{3}$; Not –0.732 or 2.732
	[Total: 9]		