Question Number	Scheme	Marks
1. (*a*)	Continuous uniform (Rectangular) U(–0.5, 0.5)	B1 B1 (2)
(*b*)	P(error within 0. 2 cm) = 2 × 0.2 = 0.4	M1 A1 (2)
(*c*)	P(both within 2 cm) = $0.4^2 = 0.16$	M1 A1 (2)
		(6 marks)
2. (*a*)	$X \sim \text{Po}(7)$	B1
	$P(X \le 2) = 0.0296$	B1
	$P(X \ge 13) = 1 - 0.9370 = 0.0270$	M1 A1
	Critical region is $(X \le 2) \cup (X \ge 13)$	A1 (5)
(*b*)	Significance level = 0.0296 + 0.0270 = 0.0566	B1 (1)
(*c*)	$x = 5$ is not the critical region $\Rightarrow$ insufficient evidence to reject H_0	M1 A1 (2)
		(8 marks)
3. (*a*)	Weeds grow independently, singly, randomly and at a constant rate (weeds/m^2) any 2	B1 B1 (2)
(*b*)	Let X represent the number of weeds/m^2	
	$X \sim \text{Po}(0.7)$, so in 4 m^2, $\lambda = 4 \times 0.7 = 2.8$	B1
	$P(Y < 3) = P(Y = 0) + P(Y = 1) + P(Y = 2)$	M1
	$= e^{-2.8}\left(1 + 2.8 + \frac{2.8^2}{2}\right)$	A1
	$= 0.46945$	A1 (4)
(*c*)	Let X represent the number of weeds per 100 m^2	
	$X \sim \text{Po}(100 \times 0.7 = 70)$	B1
	$P(X > 66) \approx P(Y > 66.5)$ where $Y \sim N(70, 70)$	M1 M1 A1
	$\approx P\left(Z > \frac{66.5 - 70}{\sqrt{70}}\right)$	M1
	$\approx P(Z > -0.41833\ldots) = 0.6628$	A1 (6)
		(12 marks)

Question Number	Scheme	Marks
4. (*a*)	$P(X > 0.7) = 1 - F(0.7) = 0.4267$	M1 A1 (2)
(*b*)	$f(x) = \frac{d}{dx}F(x) = \frac{4}{3} \times 2x - \frac{4x^2}{3}$	M1
	$= \frac{4x}{3}(2 - x^2)$ for $0 \le x \le 1$	A1 (2)
(*c*)	$E(X) = \int_0^1 \frac{4}{3}(2x^2 - x^4)\, dx = \left[\frac{4}{3}\left(\frac{2x^3}{3} - \frac{x^5}{5}\right)\right]_0^1$	M1 A1
	$= \frac{28}{45} = 0.622$	A1
	$\text{Var}(X) = \int_0^1 \frac{4}{3}(2x^3 - x^5)\, dx - \left(\frac{28}{45}\right)^2$	M1
	$= \left[\frac{4}{3}\left(\frac{2x^4}{4} - \frac{x^6}{6}\right)\right]_0^1 - \left(\frac{28}{45}\right)^2$	A1
	$= \frac{116}{2025} = 0.05728$	A1 (6)
(*d*)	$f(x) = \frac{4}{3}(2 - 3x^2) = 0$	M1
	$\Rightarrow$ mode $= \sqrt{\frac{2}{3}} = 0.816496$	A1
	skewness $= \dfrac{\frac{28}{45} - \sqrt{\frac{2}{3}}}{\sqrt{\frac{116}{2025}}} = -0.81170$	M1 A1 (4)
		(14 marks)

Question Number	Scheme	Marks
5. (*a*)	Let X represent the number of double yolks in a box of eggs	B1
	$\therefore\ X \sim \mathrm{B}(12, 0.05)$	B1
	$\mathrm{P}(X = 1) = \mathrm{P}(X \le 1) - \mathrm{P}(X \le 0) = 0.8816 - 0.5404 = 0.3412$	M1 A1 (3)
(*b*)	$\mathrm{P}(X > 3) = 1 - \mathrm{P}(X \le 3) = 1 - 0.9978 = 0.0022$	M1 A1 (2)
(*c*)	$\mathrm{P}(\text{only } 2) = \mathrm{C}_2^3\,(0.3412)^2(0.6588)^2$	M1 A1
	$= 0.230087$	A1 (3)
(*d*)	Let X represent the number of double yolks in 10 dozen eggs	
	$\therefore\ X \sim \mathrm{B}(120, 0.05) \Rightarrow X = \mathrm{Po}(6)$	B1
	$\mathrm{P}(X \ge 9) = 1 - \mathrm{P}(X \le 8) = 1 - 0.8472$	M1 A1
	$= 0.1528$	A1
(*e*)	Let X represent the weight of an egg $\therefore\ W \sim \mathrm{N}(65, 2.4^2)$	M1
	$\mathrm{P}(X > 68) = \mathrm{P}\left(Z > \dfrac{68 - 65}{2.4}\right)$	A1
	$= \mathrm{P}(Z > 1.25)$	A1
	$= 0.1056$	A1 (3)
		(15 marks)

Question Number	Scheme	Marks	
6. (*a*)	All subscribers to the magazine	B1	(1)
(*b*)	A list of all members that had paid their subscriptions	B1	(1)
(*c*)	Members who have paid	B1	(1)
(*d*)	Advantage: total accuracy	B1	
	Disadvantage: time consyming to obtain data and analyse it	B1	(2)
(*e*)	Let X represent the number agreeing to change the name		
	$\therefore\ X \sim \mathrm{B}(25, 0.4)$	B1	
	$\mathrm{P}(X = 10) = \mathrm{P}(X \leq 10) - \mathrm{P}(X \leq 9) = 0.1612$	M1 A1	(3)
(*f*)	H_0: $p = 0.40$, H_1: $p < 0.40$	B1, B1	
	$\mathrm{P}(X \leq 6) = 0.0736 > 0.05 \Rightarrow$ not significant	M1 A1	
	No reason to reject H_0 and conclude % is less than the editor believes	A1	(5)
(*g*)	Let X represent the number agreeing to change the name $\therefore\ X \sim \mathrm{B}(200, 0.4)$		
	$\mathrm{P}(71 \leq X < 83) \approx \mathrm{P}(70.5 \ \leq Y < 82.5)$ where $Y \sim \mathrm{N}(80, 48)$	B1 B1	
	$\approx \mathrm{P}\left(\dfrac{70.5-80}{\sqrt{48}} \leq X < \dfrac{82.5-80}{\sqrt{48}}\right)$	M1 M1	
	$\approx \mathrm{P}(-1.37 \leq X < 0.36)$	A1 A1	
	$= 0.5533$	A1	(7)
			(20 marks)