

Question Number	Scheme	Marks
1.	<p>(a) Continuous uniform (Rectangular) $U(-0.5, 0.5)$</p> <p>(b) $P(\text{error within } 0.2 \text{ cm}) = 2 \times 0.2 = 0.4$</p> <p>(c) $P(\text{both within } 2 \text{ cm}) = 0.4^2 = 0.16$</p>	<p>B1 B1 (2)</p> <p>M1 A1 (2)</p> <p>M1 A1 (2)</p> <p>(6 marks)</p>
2.	<p>(a) $X \sim \text{Po}(7)$</p> <p>$P(X \leq 2) = 0.0296$</p> <p>$P(X \geq 13) = 1 - 0.9370 = 0.0270$</p> <p>Critical region is $(X \leq 2) \cup (X \geq 13)$</p> <p>(b) Significance level = $0.0296 + 0.0270 = 0.0566$</p> <p>(c) $x = 5$ is not the critical region \Rightarrow insufficient evidence to reject H_0</p>	<p>B1</p> <p>B1</p> <p>M1 A1</p> <p>A1 (5)</p> <p>B1 (1)</p> <p>M1 A1 (2)</p> <p>(8 marks)</p>
3.	<p>(a) Weeds grow independently, singly, randomly and at a constant rate (weeds/m²) any 2</p> <p>(b) Let X represent the number of weeds/m²</p> <p>$X \sim \text{Po}(0.7)$, so in 4 m^2, $\lambda = 4 \times 0.7 = 2.8$</p> <p>$P(Y < 3) = P(Y = 0) + P(Y = 1) + P(Y = 2)$</p> $= e^{-2.8} \left(1 + 2.8 + \frac{2.8^2}{2} \right)$ <p>$= 0.46945$</p> <p>(c) Let X represent the number of weeds per 100 m^2</p> <p>$X \sim \text{Po}(100 \times 0.7 = 70)$</p> <p>$P(X > 66) \approx P(Y > 66.5)$ where $Y \sim N(70, 70)$</p> $\approx P\left(Z > \frac{66.5 - 70}{\sqrt{70}}\right)$ <p>$\approx P(Z > -0.41833...) = 0.6628$</p>	<p>B1 B1 (2)</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>A1 (4)</p> <p>B1</p> <p>M1 M1 A1</p> <p>M1</p> <p>A1 (6)</p> <p>(12 marks)</p>

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

Question Number	Scheme	Marks
5.	<p>(a) Let X represent the number of double yolks in a box of eggs $\therefore X \sim B(12, 0.05)$ $P(X = 1) = P(X \leq 1) - P(X \leq 0) = 0.8816 - 0.5404 = 0.3412$</p> <p>(b) $P(X > 3) = 1 - P(X \leq 3) = 1 - 0.9978 = 0.0022$</p> <p>(c) $P(\text{only } 2) = C_2^3 (0.3412)^2 (0.6588)^2$ $= 0.230087$</p> <p>(d) Let X represent the number of double yolks in 10 dozen eggs $\therefore X \sim B(120, 0.05) \Rightarrow X = \text{Po}(6)$ $P(X \geq 9) = 1 - P(X \leq 8) = 1 - 0.8472$ $= 0.1528$</p> <p>(e) Let X represent the weight of an egg $\therefore W \sim N(65, 2.4^2)$ $P(X > 68) = P\left(Z > \frac{68 - 65}{2.4}\right)$ $= P(Z > 1.25)$ $= 0.1056$</p>	<p>B1 B1 M1 A1 (3) M1 A1 (2) M1 A1 A1 (3) B1 M1 A1 A1 M1 A1 A1 A1 (3) (15 marks)</p>

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