Question	Scheme	Marks
2(a)	$E \sim B(6, 0.35)$	B1
(i)	$P(E = 2) = P(E \le 2) - P(E \le 1)$ or $\left({}^6C_2\right)0.35^2(1-0.35)^4$	M1
	$= 0.6471 - 0.3191$	
	$= 0.328$ awrt **0.328**	A1
(ii)	$P(E \ge 4) = 1 - P(E \le 3)$ or $1 - 0.8826$	M1
	$= 0.1174$ awrt **0.117**	A1
		(5)
(b)	$H_0 : p = 0.35$ $H_1 : p > 0.35$	B1
	$L \sim B(50, 0.35)$ $P(L \ge 25) = 1 - P(L \le 24)$ $P(L \ge 24) = 0.0396$	M1
	$= 1 - 0.9793$ $P(L \ge 23) = 0.071$	
	$= 0.0207$ CR $L \ge 24$	A1
	Reject H_0 or Significant or 25 does lie in the critical region	dM1
	There is evidence to support Kiyoshi's **belief** oe <u>or</u> that the **proportion/number** oe of **large eggs** has increased after adding the supplement	A1cso
		(5)
(c)	Expected profit before supplement = $"0.1174" \times 1.20 + (1 - "0.1174") \times 0.60$	M1
	$= (£)0.67044$	
	$P(X \ge 4) = 0.2553$ awrt 0.255	B1
	Expected profit per box after supplement = $"0.2553" \times 1.20 + (1 - "0.2533") \times 0.60 - "0.67044"$	M1
	$= (£)0.08274$	A1
	OR Expected profit per box after supplement = $"0.2553" \times 1.20 + (1 - "0.2553") \times 0.60 - 0.10$	(M1)
	$= (£)0.65318$	(A1)
	Kiyoshi should not continue to add the supplement (as 0.0827 < 0.10 or 0.653 < 0.67[0])	A1cso
		(5)
		Total 15

Notes

2(a)	**B1**	Using or writing B(6,0.35) in either part
(i)	**M1**	Using or writing $P(E \le 2) - P(E \le 1)$ oe or writing $\left({}^6C_2\right)0.35^2(1-0.35)^4$ oe
	A1	awrt 0.328
(ii)	**M1**	Either writing or using $P(E \ge 4)$ or $1 - P(E \le 3)$ or P(E = 4) + P(E = 5) + P(E = 6) oe
	A1	awrt 0.117 (Correct answers imply all previous marks in part (a))
(b)	**B1**	Both hypotheses correct with p or π
	M1	Writing or using $L \sim B(50, 0.35)$ **and** $1 - P(L \le 24)$ **or** writing P($L \ge 24$) = 0.0396 or P($L \ge 23$) = 0.071 **leading to a CR**. Condone use of normal approx $M \sim N(17.5,$ awrt $11.4)$ **and** 1 – P(M < 24.5) for the M1
	A1	awrt 0.0207 or $L \ge 24$ allow any letter
	dM1	dep on previous M being awarded for a correct statement (condone Accept H_1) ft their probability or CR Do not allow contradicting non-contextual comments.
	A1cso	All previous marks must be awarded. A correct statement in context. Need **bold words. NB** award M1A1 for a correct contextual statement on its own.
(c)	**Note:**	Some candidates may multiply by n or an integer so allow these multiples throughout.
	M1	$"\text{their (ii)} \times 1.20 + (1 - "\text{their(ii)}") \times 0.60$
Allow £ or pence in part (c)	**B1**	awrt 0.255
	M1	$"p" \times 1.20 + (1 - "p") \times 0.60 - "\text{their } 0.67044"$ or $"p" \times 1.20 + (1 - "p") \times 0.60 - 0.10$ oe where $p > 0.1174$ (do not allow $p = 0.45$ for this mark)
	A1	awrt (£)0.083 or awrt (£)0.65
	A1cso	Dep on all previous marks in (c). Correct conclusion with correct supporting figures.