Question Number	Scheme	Marks
3 (a) (i)	$X \sim \mathrm{B}(10, 0.1)$	
	$\mathrm{P}(X \geqslant 4) = 1 - \mathrm{P}(X \leqslant 3) = 1 - 0.9872$	M1
	$= 0.0128$ awrt 0.0128	A1
(ii)	$\mathrm{P}(1 < X < 5) = \mathrm{P}(X \leqslant 4) - \mathrm{P}(X \leqslant 1) = 0.9984 - 0.7361$ or $\mathrm{P}(X = 2) + \mathrm{P}(X = 3) + \mathrm{P}(X = 4) = 0.1937 + 0.0574 + 0.0112$	M1
	$= 0.2623$ awrt 0.262	A1
		(4)
(b)	$\mathrm{H}_0 : p = 0.1 \quad \mathrm{H}_1 : p < 0.1$	B1
	$X \sim \mathrm{B}(50, 0.1)$	
	$\mathrm{P}(X \leqslant 2) = 0.1117$ or CR $X \leqslant 1$	B1
	Do not reject H_0/Not in the critical region	M1
	There is insufficient evidence to suggest that this result supports the managing director's claim/not enough evidence to suggest a reduction in the probability of a tennis ball failing the bounce test	A1
		(4)
(c)	$X \sim \mathrm{B}(n, 0.1)$ and we reject H_0 if $\mathrm{P}(X = 0) < 0.01$	
	$\mathrm{P}(X = 0) = \left[{}^{n}C_0 \times 0.1^0 \right] \times 0.9^n [< 0.01]$	M1
	$0.9^{44} = 0.00969... [< 0.01]$ | $n > \dfrac{\ln 0.01}{\ln 0.9} \Rightarrow n > 43.7$	M1
	$n = 44$	A1
		(3)

		Notes	Total 11
(a) (i)	**M1**	for writing or using $\mathrm{P}(X \geqslant 4) = 1 - \mathrm{P}(X \leqslant 3)$	
	A1	awrt 0.0128	
(ii)	**M1**	for writing or using $\mathrm{P}(X \leqslant 4) - \mathrm{P}(X \leqslant 1)$ or for writing or using $\mathrm{P}(X = 2) + \mathrm{P}(X = 3) + \mathrm{P}(X = 4)$	
	A1	awrt 0.262	
(b)	**B1**	Both hypotheses correct. Must be in terms of p or π Must be attached to H_0 and H_1	
	B1	awrt 0.112 or CR $\leqslant 1$	
	M1	A correct ft statement consistent with their p –value and 0.05 **or** their CR and 2– no context needed but do not allow contradicting non contextual comments. The comparison of their p-value and the significance level is not counted as a non contextual statement. May be implied by a correct ft conclusion in context. Must have a p-value or CR to access this mark.	
	A1	Correct conclusion in context which must be **not rejecting** H_0. Must use underlined words (oe). No hypotheses then A0	
(c)	**M1**	For recognising $\mathrm{P}(X=0) = 0.9^n$	
	M1	For $0.9^{44} (= 0.00969...)$ or $0.9^{43} (= 0.01077...)$ or rearranging to $n > \dfrac{\ln 0.01}{\ln 0.9}$ … (Allow =) $n >$ awrt 43.7 implies M1M1 (Allow n = awrt 43.7 for M1M1)	
	A1	Cao	
	SC	Use of tables only, $n = 40$, $p = 0.0148$ **and** $n = 50$, $p = 0.0052$ scores M1M0A0	