Question	Scheme	Marks	AOs
4(a)	$H_{0:}\, p = 0.1$ $\quad$ $H_{1:}\, p \neq 0.1$	B1	2.5
		(1)	
(b)	Use of $X \sim B\,(50,\ 0.1)$ implied by sight of one of awrt 0.0052 or awrt 0.9755 or awrt 0.0245	M1	3.4
	Critical regions $X = 0$ or $X \geqslant 10$	A1	1.1b
	$X = 0$ and $X \geqslant 10$ plus $P(X = 0) = $ awrt 0.0052 and $P(X \geqslant 10) = $ awrt 0.0245	A1	1.1b
	SC: Both CR correct with no probabilities and no distribution seen scores M0A1A0		
		(3)	
(c)	0.0297	B1ft	1.1b
		(1)	
(d)	15 is <u>in the critical region</u> therefore there is evidence to support the <u>**manager**</u>'s belief	B1ft	2.2b
		(1)	
		(6 marks)	

		Notes
(a)	**B1**	For both hypotheses in terms of p or π. Connected to H_0 and H_1 correctly Condone 10% but not 10
(b)	**M1**	Using correct distribution to find the probability associated with one tail of the CR If the correct distribution is <u>stated</u> (may be seen in part(a)) allow for one tail of the correct CR **or** one of (awrt 0.025 or awrt 0.005 or awrt 0.975) seen connected to a correct probability statement
	A1	Lower CR $X = 0 \,/\, X < 1 \,/\, X \leqslant 0 /$ $\quad$ [condone eg $P(X = 0)$ labelled as CR] Or Upper CR $X \geqslant 10$ or $X > 9$ $\quad$ [condone $P(X \geqslant 10)$ oe labelled as CR]
	A1	Both CR's correct with the relevant probabilities Allow $\cup$ for "and" and $X > 9$, $X < 1$, $X \leqslant 0$ [**do not allow** $P(X = 0)$ or $P(X \geqslant 10)$ oe] Allow CR in different form eg $(9,\ \infty)$, $[10, \infty)$
(c)	**B1ft**	awrt 0.0297 or 2.97% or ft for the sum of the probabilities in (b) for "their 2 critical regions" if seen. If none seen it must be awrt 0.0297 **SC M0 in (b) for a one tail test** Allow B1ft for their one tail CR in (b) eg 0.0338 or 0.0245 or 0.0579
(d)	**B1ft**	A correct statement about 15 and "their CR" or sight $P(X \geqslant 15) = 0.0000738...$ and comparison with "their 0.0245" **and** a compatible correct statement in context. eg There is evidence that there has been a change in the <u>**proportion/probability**</u> arriving <u>**late**</u> Condone increase rather than change Do not allow contradicting statements. NB No CR given in (b) then B0