

Qu 4	Scheme	Marks	AO
(a)	$H_0 : p = 0.1$ $H_1 : p \neq 0.1$ [Allow 10% for 0.1]	B1	2.5
	$[X \sim B(40, 0.1)] \Rightarrow P(X = 0) = 0.0148$ [Allow any letter for X]	M1	3.3
	$P(X \geq 9) = 1 - P(X \leq 8) = 1 - 0.9845 = 0.0155$	A1	1.1b
	Critical region is <u><math>\{X = 0\} \cup \{X \geq 9\}</math></u> (o.e.)	A1	1.1b
(b)	$["0.0148" + "0.0155"] = 0.0303$	B1ft	1.1b
(c)	[Provided 7 is not in their CR ] insufficient evidence to support Freya's belief	(4)	
		B1	2.2b
		(1)	
<b>( 6 marks)</b>			

**Notes**

**Mark (a) and (b) together for sight of the probabilities.**

- (a) B1 for both hypotheses in terms of  $p$  or  $\pi$ . Must be attached to  $H_0$  and  $H_1$   
M1 for use of the correct model. Implied by sight of at least one probability truncated or rounded to at least 2sf from: 0.0155, 0.0148, 0.0805, 0.9845, 0.9581, 0.9949  
Implied by sight of fully correct CR (with no probs) so e.g.  $X = 0, X > 8$  scores M1A0A0  
1<sup>st</sup> A1 for at least one correct probability (to at least 3sf) with its probability statement  
i.e. for  $P(X = 0) = \text{awrt } 0.0148$  or  $P(X \geq 9) = \text{awrt } 0.0155$   
2<sup>nd</sup> A1(**dep on M1 and 1<sup>st</sup> A1** but not on B1)  
for both correct probs (to at least 3 sf) and the correct critical region  
Do not need set notation. Allow  $X < 1$  and  $X > 8$  or words e.g. "0 or greater than 8" etc  
Allow "," or "and" or "or" or " $\cap$ " between  $X \leq 0$  and  $X \geq 9$   
 $P(X = 0)$  and  $P(X \geq 9)$  is 2<sup>nd</sup> A0
- (b) B1ft for awrt 3.03% or correct sum of their two probabilities (provided each is less than 0.5)  
Their probabilities must be to at least 2sf and relate to their CR
- To score in (c) they must have a CR of the form  $(X = 0 \text{ or } X < a)$  and  $X > b$ , where  $b$  is  $\geq 7$   
**May be implied by  $P(X < a)$  and  $P(X > b)$  i.e. 2<sup>nd</sup> A0 in (a) but correct form. Need  $b > a$****
- (c) B1 for a suitable comment in context that suggests no support for Freya's belief/claim  
**or** e.g. insufficient evidence of change in proportion/percentage of left-handed adults  
**or** e.g. proportion/percentage of left-handed adults is not different from 10% (**or ...is 10%**)  
**or** e.g. 10% of adults in the country are left-handed  
Do not allow contradictory comments e.g. "in CR so no support for Freya's belief" is B0

**NB** A correct contextual answer in (c) using an **acceptance region** please send to review.