Question	Scheme	Marks	AOs
5(a)	$P(X \geqslant 16) = 1 - P(X \leqslant 15)$	M1	1.1b
	$= 1 - 0.949077\ldots$ $\qquad = $ awrt **0.0509**	A1	1.1b
		(2)	
(b)	$H_0 : p = 0.3$ $\qquad$ $H_1 : p \neq 0.3$ $\qquad$ (Both correct in terms of p or π)	B1	2.5
		(1)	
(c)	$[Y \sim B(20, 0.3)]$ sight of $P(Y \leqslant 2) = 0.0355$ or $P(Y \leqslant 9) = 0.9520$	M1	2.1
	Critical region is $\{Y \leqslant \mathbf{2}\}$ or $\qquad$ (o.e.)	A1	1.1b
	$\{ Y \geqslant \mathbf{10}\}$ $\qquad$ (o.e.)	A1	1.1b
		(3)	
(d)	$[0.0355 + (1 - 0.9520)] = 0.0835$ **or** **8.35%**	B1ft	1.1b
		(1)	
(e)	(Assuming that the 20 customers represent a random sample then) 12 is in the CR so the manager's suspicion is supported	B1ft	3.2a
		(1)	
(f)	e.g. (e) requires the 20 customers to be a random sample or independent and the members of the scout group may invalidate this so binomial distribution would not be valid (and conclusion in (e) is probably not valid)	B1	3.5a
		(1)	
		(9 marks)	

Continued question 5	
Notes:	
(a)	
M1:	For dealing with $P(X \geqslant 16)$ – they need to use cumulative prob. function on calc
A1:	awrt 0.0509 (from calculator)
(b)	
B1:	For both hypotheses in terms of p or π and H_1 must be 2-tail
(c)	
M1:	For correct use of tables to find probability associated with critical value
A1:	For the correct lower limit of the CR. Do not award for $P(Y \leqslant 2)$
A1:	For the correct upper limit
(d)	
B1:	ft on their 0.0355 and (1 – their 0.9520) provided each probability is less than 0.05
(e)	
B1:	ft for a comment that relates 12 to their CR and makes a consistent comment relating this to the manager's suspicion
(f)	
BI:	For a comment that: gives a suitable reason based on lack of independence **or** the sample not being random **so** the binomial model is not valid