Question	Answer	Marks	AO	Guidance
12	$H_0: p = 0.1$ $H_1: p \neq 0.1$	**B1**	**1.1**	allow equivalent in words; do not allow percentages allow other variable only if correctly defined
	p is the probability that a (British) adult (selected at random) is a vegetarian	**B1**	**2.5**	or p is the proportion of adults that are vegetarian **B1B1** if other symbol instead of p used if correctly defined
	$P(X \geq k)$ found using B(112, 0.1), where k = 18, 19 or 20	**M1***	**3.3**	may be implied by $(P(X \geq 18)) = 0.0295 - 0.030$ or $(P(X \geq 19)) = 0.015 - 0.015331$ or $(P(X \geq 20)) = 0.0075 - 0.00754$ **NB M0** for $P(X = 19) = 0.00779$ **NB** $P(X \leq 17) = 0.97049\ldots$, $P(X \leq 18) = 0.984669$ ... and $P(X \leq 19) = 0.99246$ ... imply **M1**
	$[P(X \geq 19) =] 0.015 - 0.015331$	**A1**	**1.1**	or $[P(X \leq 18) =] 0.984669 - 0.985$ or 0.98
	their 0.015 correctly compared with 0.025 **or** their 0.985 correctly compared with 0.975	**M1dep***	**3.4**	
	do not accept H_0 **or** reject H_0 **or** accept H_1 **or** significant	**A1FT**	**1.1**	**A0** if their 0.015 > 0.025 or their 0.985 < 0.975
	sufficient evidence at the 5% level to **suggest** that the **probability** that an adult is vegetarian **is not** 0.10 **oe**	**A1**	**3.5a**	dependent on award of all other marks apart from second **B1** do not allow eg conclude / prove / indicate or other assertive statement instead of suggest
		[7]		

Question	Answer	Marks	AO	Guidance
12	*Alternatively, using critical region*			
	H_0 $p = 0.1$ H_1 $p \neq 0.1$	**B1**		allow equivalent in words; do not allow percentages allow other variable only if correctly defined
	p is the probability that a (British) adult (selected at random) is a vegetarian	**B1**		or p is the proportion of adults that are vegetarian **B1B1** if other symbol instead of p used if correctly defined
	critical region is $X \leq k \cup X \geq l$ $X \geq k$ found from calculation of probability; allow $k = 4$ or 5, $l = 18$, 19 or 20	**M1***		allow calculation of upper tail only for **M1**
	[critical region is X] ≥ 19 $\cup$ [X] $\leq$ 4	**A1**		from $P(X \geq 19) = 0.015 - 0.015331$ and $P(X \leq 4) = 0.010$ must see both tails for **A1**
	19 correctly compared with their critical value	**M1dep***	**3.4**	
	do not accept H_0 **or** reject H_0 **or** accept H_1 **or** significant	**A1FT**	**1.1**	**A0** if 19 < their critical value
	sufficient evidence at the 5% level to **suggest** that the **probability** that an adult is vegetarian **is not** 0.10 **oe**	**A1**	**3.5a**	dependent on award of all other marks apart from second **B1** do not allow eg conclude / prove / indicate or other assertive statement instead of suggest
		[7]		

Question	Answer	Marks	AO	Guidance
12	*Alternatively, using Normal approximation* H_0 $p = 0.1$ H_1 $p \neq 0.1$	**B1**		allow equivalent in words; do not allow percentages allow other variable only if correctly defined
	p is the probability that a (British) adult (selected at random) is a vegetarian	**B1**		or p is the proportion of adults that are vegetarian **B1B1** if other symbol instead of p used if correctly defined
	$P(X \geq 18.5)$ or $P(X \geq 19.5)$ found using N(11.2, 10.08) **or** $P(X \geq 19.5) = 0.00447(1)$	**M1***		**NB M0** for $P(X = 19) = 0.006145$ (from normPdf(19, 11.2,$\sqrt{10.08}$) or $P(X = 19) = 0.00627$ (from using continuity correction, may see normCdf(18.5,19.5, 11.2,$\sqrt{10.08}$)) **NB** $P(X \leq 19.5) = 0.99553...$ and $P(X \leq 18.5) = 0.989255…$ imply **M1**
	[$P(X \geq 18.5) =$]$0.0107 - 0.011$	**A1**		
	their 0.0107 correctly compared with 0.025 or their 0.989 correctly compared with 0.975	**M1dep***		
	do not accept H_0 **or** reject H_0 **or** accept H_1 **or** significant	**A1FT**		**A0** if their $0.0107 > 0.025$ or their $0.989 < 0.975$
	sufficient evidence at the 5% level to **suggest** that the **probability** that an adult is vegetarian **is not** 0.10 **oe**	**A1**		dependent on award of all other marks apart from second **B1** do not allow eg conclude / prove / indicate or other assertive statement instead of suggest
		[7]		