Question Number	Scheme	Marks
7 (a)	H_0 : The observed distribution can be modelled by a discrete uniform distribution H_1 : The observed distribution cannot be modelled by a discrete uniform distribution	B1 (1)
(bi)	See table below	B1 M1
	$X^2 = \sum \frac{(O-E)^2}{E}$ or $\sum \frac{O^2}{E} - 6x$; $\frac{230}{x}$ or $\frac{6x^2+230}{x} - 6x$	M1 ; A1
	$\nu = 6-1=5$; $c\,{}^2_5(0.05) = 11.070 \Rightarrow$ CR: X^2 … 11.070	B1 ; B1
	Do not reject H_0 if $\frac{230}{x}$,, '11.070' or $\frac{6x^2+230}{x} - 6x$,, '11.070'	M1
	x … 20.7768... So $x = 21$	A1 (8)
(bii)	Hence the die was rolled "21" × 6 = 126 times	M1 A1 (2)

Observed	Expected	$\frac{(O-E)^2}{E}$	$\frac{O^2}{E}$
$x + 6$	x	$\frac{36}{x}$	$\frac{(x+6)^2}{x}$
$x - 8$	x	$\frac{64}{x}$	$\frac{(x-8)^2}{x}$
$x + 8$	x	$\frac{64}{x}$	$\frac{(x+8)^2}{x}$
$x - 5$	x	$\frac{25}{x}$	$\frac{(x-5)^2}{x}$
$x + 4$	x	$\frac{16}{x}$	$\frac{(x+4)^2}{x}$
$x - 5$	x	$\frac{25}{x}$	$\frac{(x-5)^2}{x}$
Total = $6x$	Total = $6x$	Total = $\frac{230}{x}$	Total = $\frac{6x^2+230}{x}$

Notes **Total 11**

(a)	**B1**	for both hypotheses correct Allow H_0 : the die is not biased H_1 : the die is biased
(bi)	**B1**	for expected frequency = x
	M1	for one correct $\frac{(O-E)^2}{E}$ or $\frac{O^2}{E}$ ft their expected frequency
	M1	for an attempt at X^2 ft their values (At least 4 of these need to be seen and added)
	A1	for either $\frac{230}{x}$ or $\frac{6x^2+230}{x} - 6x$
	B1	for $\nu = 6-1=5$ May be implied by a correct critical value
	B1	for a correct critical value ft their DOF (**NB** common error is $\nu = 4$ so $c\,{}^2_4(0.05) = 9.488$)
	M1	for either $\frac{230}{x}$,, their CV or $\frac{6x^2+230}{x} - 6x$,, their CV Allow < rather than ,,
	A1	for $x = 21$ provided the previous M mark has been awarded
(bii)	**M1**	for their 21 × 6 Allow 6 × x or the answer to 6 × their value for x
	A1	cao

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