Chi-squared tests 6B

1 The data will be presented as seven frequencies, with a specified total of 50, so there are six degrees of freedom.

2 From the tables $\chi^2_5(5\%) = 11.070$

3 **a** $\chi^2_5(5\%) = 11.070$

b $\chi^2_8(1\%) = 20.090$

c $\chi^2_{10}(10\%) = 23.209$

4 $\chi^2_{10}(5\%) = 18.307$

5 $\chi^2_8(10\%) = 13.362$

6 $\chi^2_8(99\%) = 1.646$, so $P(\chi^2_8 > 1.646) = 99\%$
So $y = 1.646$

7 $\chi^2_5(95\%) = 1.145$, so $P(\chi^2_5 > 1.145) = 95\%$
So $y = 1.145$

8 **a** $P(Y < y) = 1 - P(Y > y)$
So $P(Y < y) = 0.05 \Rightarrow P(Y > y) = 0.95$
$\chi^2_{12}(95\%) = 5.226$, so $P(\chi^2_{12} > 5.226) = 95\%$
$y = 5.226$

b $P(Y < y) = 0.95 \Rightarrow P(Y > y) = 0.05$
$\chi^2_{12}(5\%) = 21.026$, so $P(\chi^2_{12} > 21.026) = 5\%$
$y = 21.026$

9 **a** Let $X \sim \text{Geo}(0.5)$. $P(X = x) = 0.5^x$ so the expected results should be 50×0.5^x
The final column must be adjusted to be $x \geqslant 5$ as X is assumed to have a geometric distribution and can take values greater than 5. So the final expected result is $50 \times (P(X = x) \geqslant 5)$

x	1	2	3	4	$\geqslant 5$
Observed (O_i)	24	13	6	6	2
Expected (E_i)	25	12.5	6.25	3.125	3.125

Since we require all expected values to be at least 5, the final two columns must be combined to a single column for $x \geqslant 4$, with observed value 8 and expected value 6.25.

b After combining the cells, there remain 4 data cells with a constraint, so $\nu = 3$
So the critical value is $\chi^2_3(1\%) = 11.345$.