Chi-Square Formula:

$$\chi^2 = \sum \frac{(\text{Observed Value} - \text{Expected Value})^2}{(\text{Expected Value})} = \_\_\_\_\_$$

Degrees of freedom (df) = n -1 where n is the number of phenotype classes = _____

Chi-square is a reflection of three factors: size of the deviation, size of the sample, and the number of groups we are considering. Chi-square is larger if the size of the deviation or the number of groups is larger. It is smaller when the expected number is larger (a larger sample). In general, if the chi-square value is larger, the deviations are more likely to be significant, and the data is less likely to fit our expectations. Similarly, if the chi-square is smaller, the deviation is less significant, and the data seems to support the expectations and/or hypothesis. In order to be consistent with other researchers, we use a table for chi-square values with a standard cut off point to define "significance" - any number higher than this cut off value is considered significant, and suggests that the hypothesis (prediction) is incorrect for some reason. The probability (p) that the data are consistent with the predictions is given by the value **p** → in the table below. If the data for a monohybrid analysis showed exactly a 3:1 ratio, the p value would be 1.0. Lower p values indicate less reliability that the data are consistent with the expectations. It should be assumed that results showing **a p value of 0.05 or less do not support the hypothesis predicting that ratio.**

Since chi-square values will be larger when there are more groups or classes to consider, we must control for the number of classes in determining the p value. This is done by the "degrees of freedom" in the table - the degree of freedom is simply one less than the number of classes. To find the p value for your chi-square result, look in the appropriate degree of freedom row to find the chi-square that most closely corresponds to your value, and follow that up to read the "p" value above it.

Chi Square Table

	NO REASON TO DOUBT HYPOTHESIS							REASON TO DOUBT HYPOTHESIS		
	DEVIATIONS INSIGNIFICANT							DEVIATIONS ARE SIGNIFICANT		
p →	**0.99**	**0.95**	**0.80**	**0.50**	**0.30**	**0.20**	**0.10**	**0.05**	**0.02**	**0.01**
degree of freedom ↓										
1	.00016	.0039	.064	.455	1.074	1.642	2.706	3.841	5.412	6.635
2	.0201	.103	.446	1.386	2.408	3.219	4.605	5.991	7.824	9.210
3	.115	.352	1.005	2.366	3.665	4.642	6.251	7.815	9.837	11.341
4	.297	.711	1.649	3.357	4.878	5.989	7.779	9.488	11.668	13.277
5	.554	1.145	2.343	4.351	6.064	7.289	9.236	11.070	13.388	15.086