Section 10.3

2.a.

outcome of die	obtained frequency (O)	Expected frequency (E)	$O-E$	$\lvert O-E \rvert$	$(O-E)^2$	$(O-E)^2/E$
1	8	10	-2	2	4	0.4
2	7	10	-3	3	9	0.9
3	13	10	3	3	9	0.9
4	11	10	1	1	1	0.1
5	15	10	5	5	25	2.5
6	6	10	-4	4	16	1.6
Total	60	60	0	18	64	6.4

$$\chi^2 = \Sigma \frac{(O-E)^2}{E} = \frac{2^2}{10} + \frac{3^2}{10} + \frac{3^2}{10} + \frac{1^2}{10} + \frac{5^2}{10} + \frac{4^2}{10} = 6.4$$

5a.

outcome	(E) Expected Number	(O) obtained number	$O-E$	$\lvert O-E \rvert$	$(O-E)^2$	$(O-E)^2/E$
1	10	12	2	2	4	0.4
2	10	7	-3	3	9	0.9
3	10	14	4	4	16	1.6
4	10	7	-3	3	9	0.9
Total	40	40	0	12	38	3.8

$$\chi^2 = \Sigma \frac{(O-E)^2}{E} = \frac{2^2}{10} + \frac{3^2}{10} + \frac{4^2}{10} + \frac{3^2}{10} = 3.8$$

11.

a. For set A, the observed frequencies are rather close to the expected frequencies. For set B, the observed frequencies are either twice, or about half of the expected frequencies.

b. set A:

$$(105-100)^2+(97-100)^2+(98-100)^2 = 38$$

set B

$$(10-5)^2+(2-5)^2+(3-5)^2 = 38$$

c. Dividing $(O-E)^2$ by E is important because this allows us to put the differences between observed frequencies and expected frequencies into "perspective", i.e., suppose $O=110$ and $E=100$. Then $O-E=10$ which is interpreted as the observed frequency is only 10% larger than what we expected. But if $E=10$ and $O=20$ (so that $O-E=10$), then the observed frequency is twice as large as the expected frequency. Dividing $(O-E)^2$ by E allows us to determine if the deviation from expectation is "large" or "small" relative to the size of the expected frequency.