The χ^2 test: can students pick numbers at random?

A group of 16 University students were asked to write a whole number between 0 and 9 at random on a sticky note. Data was tallied and the frequencies below were found...

Step 1: Null hypothesis is 'no difference between observed and expected values'

Step 2: Go for 5% again (common value)

Step 3: Organise results into table showing expected values based on *experimental* hypothesis (in this case equal probability of picking any number between 0 and 9) and observed values.

Score	0	1	2	3	4	5	6	7	8	9
O	0	0	0	2	3	3	1	3	3	1
E	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
(O-E)										
$\frac{(O-E)^2}{E}$										

Add the values in the last row... $\chi^2 =$_____. The formula is $\chi^2 = \sum \frac{(O-E)^2}{E}$

Step 4: p = 0.05, degrees of freedom is 10 – 1 = 9 (I'll explain degrees of freedom verbally), so critical value of $\chi^2 = 16.92$. If the χ^2 value you calculated is less than 16.92, you *can't* reject the Null hypothesis of no difference. Note: you have not *proved* anything!
If your calculated value of χ^2 is larger than 16.92, you can reject the null hypothesis and you can say that the numbers were *not* chosen randomly (at a p = 0.05 probability level)

Table of percentage points of the χ^2 distribution

Degrees of Freedom	**Probability, *p***				
	0.99	**0.95**	**0.05**	**0.01**	**0.001**
1	0.000	0.004	3.84	6.64	10.83
2	0.020	0.103	5.99	9.21	13.82
3	0.115	0.352	7.82	11.35	16.27
4	0.297	0.711	9.49	13.28	18.47
5	0.554	1.145	11.07	15.09	20.52
6	0.872	1.635	12.59	16.81	22.46
7	1.239	2.167	14.07	18.48	24.32
8	1.646	2.733	15.51	20.09	26.13
9	2.088	3.325	16.92	21.67	27.88
10	2.558	3.940	18.31	23.21	29.59
11	3.05	4.58	19.68	24.73	31.26
12	3.57	5.23	21.03	26.22	32.91
13	4.11	5.89	22.36	27.69	34.53
14	4.66	6.57	23.69	29.14	36.12
15	5.23	7.26	25.00	30.58	37.70