Pearson Edexcel AS Further Mathematics 8FM0

FurStats 1 – 3 Chi Squared Tests

Time allowed: 45 **minutes**

School: www.CasperYC.club

Name:

Teacher:

Question	Points	Score
1	8	
2	10	
3	15	
4	7	
5	7	
6	6	
Total:	53	

How I can achieve better:

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Last updated: February 3, 2026

1. In a survey, 200 people aged 25 and older were randomly selected and asked how much time they spend on social media each day. The table below shows a summary of the results.

		< 1	≥ 1
Age	25 to 54	60	74
	55 and older	32	34

Noah carries out a test, at the 5% level of significance, to see if there is an association between age and time spent on social media. He uses the hypotheses

H_0 : There is no association between age and time spent on social media.

H_1 : There is an association between age and time spent on social media.

He calculates $\sum \frac{(O-E)^2}{E} = 0.245$ for this information.

(a) State the conclusion of the test. Justify your answer. [2]

(b) Explain why having a large number of age groups may cause a problem when carrying out the hypothesis test. [1]

Jade decides to take the same information and subdivide the age groups. She then uses the information in the partially complete table below to carry out a test, at the 5% level of significance, of the same hypotheses.

		Observed		$\frac{(O-E)^2}{E}$	
		< 1	≥ 1	< 1	≥ 1
Age	25 to 34	18	28	0.47	0.40
	35 to 44	20	25	0.02	0.02
	45 to 54	22	21	0.25	0.21
	55 to 64	25	15	2.37	2.02
	65 and older	7	19		

(c) Complete Jade's hypothesis test. [4]

State clearly the degrees of freedom and the critical value used in the test.

(d) State, giving a reason, which of the conclusions in part (a) and part (c) you believe to be the more reliable. [1]

Total: 8

2. A hotel has 30 rooms. The manager models the number of empty rooms each Friday night using a binomial distribution, $B(30, 0.08)$.

   The manager recorded the number of empty rooms in the hotel each Friday night over a period of 80 weeks.

Number of empty rooms	0	1	2	3	4	5	6 or more
Frequency	14	18	22	11	10	5	0

   The table below shows the expected frequencies using the manager's model.

Number of empty rooms	0	1	2	3	4	5 or more
Expected frequency	6.56	17.11	r	17.50	10.27	s

   (a) Find the value of r and the value of s. [2]

   (b) Stating your hypotheses clearly, test the manager's model at the 5% level of significance. [6]

   (c) Suggest an improved model for the number of empty rooms in the hotel each Friday night. [2]

Total: 10

(Q2 continued . . .)

3. In an experiment, James flips a coin 3 times and records the number of heads. He carries out the experiment 100 times with his left hand and 100 times with his right hand.

	Number of heads			
	0	1	2	3
Left hand	7	29	42	22
Right hand	13	35	36	16

(a) Test, at the 5% level of significance, whether or not there is an association between the hand he flips the coin with and the number of heads. [7]

You should state your hypotheses, the degrees of freedom and the critical value used for this test.

(b) Assuming the coin is unbiased, write down the distribution of the number of heads in 3 flips. [1]

(c) Carry out a χ^2 test, at the 10% level of significance, to test whether or not the distribution you wrote down in part (b) is a suitable model for the number of heads obtained in the 200 trials of James' experiment. [7]

You should state your hypotheses, the degrees of freedom and the critical value used for this test.

Total: 15

(Q3 continued . . .)

4. Abram carried out a survey of two treatments for a plant fungus. The contingency table below shows the results of a survey of a random sample of 125 plants with the fungus. [7]

		Treatment		
		No action	Plant sprayed once	Plant sprayed every day
Outcome	Plant died within a month	15	16	25
	Plant survived for 1–6 months	8	25	10
	Plant survived beyond 6 months	7	14	5

Abram calculates expected frequencies to carry out a suitable test.

Seven of these are given in the partly–completed table below.

		Treatment		
		No action	Plant sprayed once	Plant sprayed every day
Outcome	Plant died within a month			17.92
	Plant survived for 1–6 months	10.32	18.92	13.76
	Plant survived beyond 6 months	6.24	11.44	8.32

The value of $\sum \frac{(O-E)^2}{E}$ for the 7 given values is 8.29.

Test at the 2.5% level of significance, whether or not there is an association between the treatment of the plants and their survival. State your hypotheses and conclusion clearly.

(Q4 continued . . .)

5. A spinner used for a game is designed to give scores with the following probabilities [7]

Score	1	2	3	4	6
Probability	$\frac{3}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{2}{5}$	$\frac{1}{10}$

The spinner is spun 80 times and the results are as follows

Score	1	2	3	4	6
Frequency	15	4	12	41	8

Test, at the 10% level of significance, whether or not the spinner is giving scores as it is designed to do. Show your working and state your hypotheses clearly.

(Q5 continued . . .)

6. A leisure club offers a choice of one of three activities to its 150 members on a Tuesday evening. The manager believes that there may be an association between the choice of activity and the age of the member and collected the following data.

Activity / Age a years	Badminton	Bowls	Snooker
$a < 20$	9	3	3
$20 \leqslant a < 40$	10	10	14
$40 \leqslant a < 50$	16	15	5
$50 \leqslant a < 60$	15	13	11
$a \geqslant 60$	4	19	3

(a) Write down suitable hypotheses for a test of the manager's belief. [1]

The manager calculated expected frequencies to use in the test.

(b) Calculate the expected frequency of members aged 60 or over who choose snooker, used by the manager. [1]

(c) Explain why there are 6 degrees of freedom used in this test. [2]

The test statistic used to test the manager's belief is 19.583.

(d) Using a 5% level of significance, complete the test of the manager's belief. [2]

Total: 6

(Q6 continued . . .)