1. Some of the customers in each café were given survey forms to complete to find out if they were satisfied with the standard of service they received.

	Pete's Eats	**Alan's Diner**	**Sarah's Snackbar**	**Total**
Dissatisfied	16	8	16	40
Satisfied	26	20	34	80
Total	42	28	50	120

One of the survey forms was chosen at random, find the probability that

(a) the form showed "Dissatisfied";

(2)

(b) the form showed "Satisfied" and was completed at Sarah's Snackbar;

(2)

(c) the form showed "Dissatisfied", given that it was completed at Alan's Diner.

(2)

A χ^2 test at the 5 % significance level was carried out to determine whether there was any difference in the level of customer satisfaction in each of the cafés.

(d) Write down the null hypothesis, H_0, for the χ^2 test.

(1)

(e) Write down the number of degrees of freedom for the test.

(1)

(f) Using your graphic display calculator, find χ^2_{calc}.

(2)

(g) State, giving a reason, the conclusion to the test.

(2)

(Total 12 marks)

2. A manufacturer claims that fertilizer has an effect on the height of rice plants.
He measures the height of fertilized and unfertilized plants. The results are given in the following table.

Plant height	Fertilized plants	Unfertilized plants
> 75 cm	115	80
50 – 75 cm	45	65
< 50 cm	20	35

A chi-squared test is performed to decide if the manufacturer's claim is justified at the **1 %** level of significance.

(a) Write down the null and alternate hypotheses for this test.

(2)

(b) For the number of fertilized plants with height greater than 75 cm, show that the expected value is 97.5.

(3)

(c) Write down the value of χ^2_{calc}.

(2)

(d) Write down the number of degrees of freedom.

(1)

(e) Write down the critical value of χ^2, at the **1 %** level of significance.

(1)

(f) Is the manufacturer's claim justified? Give a reason for your answer.

(2)

(Total 11 marks)

3. Jorge conducted a survey of 200 drivers. He asked two questions:

How long have you had your driving licence?
Do you wear a seat belt when driving?

The replies are summarized in the table below.

	Wear a seat belt	**Do not wear a seat belt**
Licence less than 2 years	38	42
Licence between 2 and 15 years	30	45
Licence more than 15 years	30	15

(a) Jorge applies a χ^2 test at the 5 % level to investigate whether wearing a seat belt is associated with the time a driver has had their licence.

(i) Write down the null hypothesis, H_0.

(ii) Write down the number of degrees of freedom.

(iii) Show that the expected number of drivers that wear a seat belt and have had their driving licence for more than 15 years is 22, correct to the nearest whole number.

(iv) Write down the χ^2 test statistic for this data.

(v) Does Jorge accept H_0? Give a reason for your answer.

(8)

(b) Consider the 200 drivers surveyed. One driver is chosen at random.
Calculate the probability that

(i) this driver wears a seat belt;

(ii) the driver does not wear a seat belt, **given that** the driver has held a licence for more than 15 years.

(4)

(c) Two drivers are chosen at random. Calculate the probability that

(i) both wear a seat belt.

(ii) at least one wears a seat belt.

(6)
(Total 18 marks)