

Write your name here	
Surname	Other names
Pearson Edexcel GCE	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> Centre Number <div style="border: 1px solid black; width: 30px; height: 30px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 30px; height: 30px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 30px; height: 30px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 30px; height: 30px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 30px; height: 30px; margin: 0 auto;"></div> </div> <div style="text-align: center;"> Candidate Number <div style="border: 1px solid black; width: 30px; height: 30px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 30px; height: 30px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 30px; height: 30px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 30px; height: 30px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 30px; height: 30px; margin: 0 auto;"></div> </div> </div>
A level Further Mathematics Further Statistics 1 Practice Paper 2	
You must have: Mathematical Formulae and Statistical Tables (Pink)	Total Marks <div style="border: 1px solid black; width: 80px; height: 40px; margin: 0 auto;"></div>

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all the questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet ‘Mathematical Formulae and Statistical Tables’ is provided.
- There are 7 questions in this question paper. The total mark for this paper is **75**.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.
- Calculators must not be used for questions marked with a * sign.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

1. Accidents occur randomly at a road junction at a rate of 18 every year.
The random variable X represents the number of accidents at this road junction in the next 6 months.
- (a) Write down the distribution of X . (2)
- (b) Find $P(X > 7)$. (2)
- (c) Show that the probability of at least one accident in a randomly selected month is 0.777 (correct to 3 decimal places). (3)
- (d) Find the probability that there is at least one accident in exactly 4 of the next 6 months. (3)

(Total 10 marks)

2. (a) Define
- (i) a Type I error,
- (ii) a Type II error. (2)
- Rolls of material, manufactured by a machine, contain defects at a mean rate of 6 per roll.
- The machine is modified. A single roll is selected at random and a test is carried out to see whether or not the mean number of defects per roll has decreased. The significance level is chosen to be as close as possible to 5%.
- (b) Calculate the probability of a Type I error for this test. (3)
- (c) Given that the true mean number of defects per roll of material made by the machine is now 4, calculate the probability of a Type II error. (2)

(Total 7 marks)

3. (a) Write down the two conditions needed to approximate the binomial distribution by the Poisson distribution.

(2)

A machine which manufactures bolts is known to produce 3% defective bolts. The machine breaks down and a new machine is installed. A random sample of 200 bolts is taken from those produced by the new machine and 12 bolts are defective.

- (b) Using a suitable approximation, test at the 5% level of significance whether or not the proportion of defective bolts is higher with the new machine than with the old machine. State your hypotheses clearly.

(7)

(Total 9 marks)

4. An archer shoots at a target until he hits it. The random variable S is the number of shots needed by the archer to hit the target.

- (a) State a suitable distribution to model S .

(1)

Given that the mean of S is 8, calculate the probability of the archer

- (b) hitting the target for the first time on his 5th shot,

(3)

- (c) taking at least 3 shots to hit the target for the first time.

(3)

- (d) State any assumptions you have made in using this model.

(2)

(Total 9 marks)

5. A total of 100 random samples of 6 items are selected from a production line in a factory and the number of defective items in each sample is recorded. The results are summarised in the table below.

Number of defective items	0	1	2	3	4	5	6
Number of samples	6	16	20	23	17	10	8

- (a) Show that the mean number of defective items per sample is 2.91.

(2)

A factory manager suggests that the data can be modelled by a binomial distribution with $n = 6$. He uses the mean from the sample above and calculates expected frequencies as shown in the table below.

Number of defective items	0	1	2	3	4	5	6
Expected frequency	1.87	10.54	24.82	a	22.01	8.29	b

- (b) Calculate the value of a and the value of b , giving your answers to 2 decimal places.

(4)

- (c) Test, at the 5% level, whether or not the binomial distribution is a suitable model for the number of defective items in samples of 6 items. State your hypotheses clearly.

(8)

(Total 14 marks)

6. The probability generating function of the random variable X is given by

$$G_X(t) = k(1 + 2t + 2t^2)^2.$$

- (a) Show that $k = \frac{1}{25}$.

(2)

- (b) Find $P(X = 2)$.

(2)

- (c) Calculate $E(X)$ and $\text{Var}(X)$.

(8)

- (d) Write down the probability generating function of $2X + 1$.

(2)

(Total 14 marks)

7. The random variable Y is the number of times a biased coin is tossed until 3 heads have occurred. The variance of Y is 60.

(a) Find the probability of obtaining a head.

(5)

(b) Find $P(Y = 8)$.

(2)

(c) Find $P(Y \leq 10 \mid \text{the first head was gained on the second toss})$.

(5)

(Total 12 marks)

TOTAL FOR PAPER: 75 MARKS