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Surname

Other names

Pearson Edexcel
Level 3 GCE

Centre Number

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Candidate Number

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Further Mathematics

Advanced

Further Mathematics Option 2

Paper 4: Further Statistics 2

Sample Assessment Material for first teaching September 2017

Time: 1 hour 30 minutes

Paper Reference

9FM0/4E

You must have:

Mathematical Formulae and Statistical Tables, calculator

Total Marks

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Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

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** 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.
- 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.*

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.

Turn over ►

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3. A nutritionist studied the levels of cholesterol, X mg/cm³, of male students at a large college. She assumed that X was distributed $N(\mu, \sigma^2)$ and examined a random sample of 25 male students. Using this sample she obtained unbiased estimates of μ and σ^2 as $\hat{\mu}$ and $\hat{\sigma}^2$

A 95% confidence interval for μ was found to be (1.128, 2.232)

- (a) Show that $\hat{\sigma}^2 = 1.79$ (correct to 3 significant figures) (4)
- (b) Obtain a 95% confidence interval for σ^2 (3)

4. The times, x seconds, taken by the competitors in the 100 m freestyle events at a school swimming gala are recorded. The following statistics are obtained from the data.

	No. of competitors	Sample mean \bar{x}	$\sum x^2$
Girls	8	83.1	55 746
Boys	7	88.9	56 130

Following the gala, a mother claims that girls are faster swimmers than boys. Assuming that the times taken by the competitors are two independent random samples from normal distributions,

- (a) test, at the 10% level of significance, whether or not the variances of the two distributions are the same. State your hypotheses clearly. (7)
- (b) Stating your hypotheses clearly, test the mother's claim. Use a 5% level of significance. (6)

Question 4 continued

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5. Scaffolding poles come in two sizes, long and short. The length L of a long pole has the normal distribution $N(19.6, 0.6^2)$. The length S of a short pole has the normal distribution $N(4.8, 0.3^2)$. The random variables L and S are independent.

A long pole and a short pole are selected at random.

- (a) Find the probability that the length of the long pole is more than 4 times the length of the short pole. Show your working clearly.

(6)

Four short poles are selected at random and placed end to end in a row. The random variable T represents the length of the row.

- (b) Find the distribution of T .

(3)

- (c) Find $P(|L - T| < 0.2)$

(4)

Question 5 continued

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(Total for Question 5 is 13 marks)

6. A random sample of 10 female pigs was taken. The number of piglets, x , born to each female pig and their average weight at birth, m kg, was recorded. The results were as follows:

Number of piglets, x	4	5	6	7	8	9	10	11	12	13
Average weight at birth, m kg	1.50	1.20	1.40	1.40	1.23	1.30	1.20	1.15	1.25	1.15

(You may use $S_{xx} = 82.5$ and $S_{mm} = 0.12756$ and $S_{xm} = -2.29$)

- (a) Find the equation of the regression line of m on x in the form $m = a + bx$ as a model for these results. (2)
- (b) Show that the residual sum of squares (RSS) is 0.064 to 3 decimal places. (2)
- (c) Calculate the residual values. (2)
- (d) Write down the outlier. (1)
- (e) (i) Comment on the validity of ignoring this outlier.
(ii) Ignoring the outlier, produce another model.
(iii) Use this model to estimate the average weight at birth if $x = 15$
(iv) Comment, giving a reason, on the reliability of your estimate. (5)

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Question 6 continued

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Question 6 continued

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(Total for Question 6 is 12 marks)

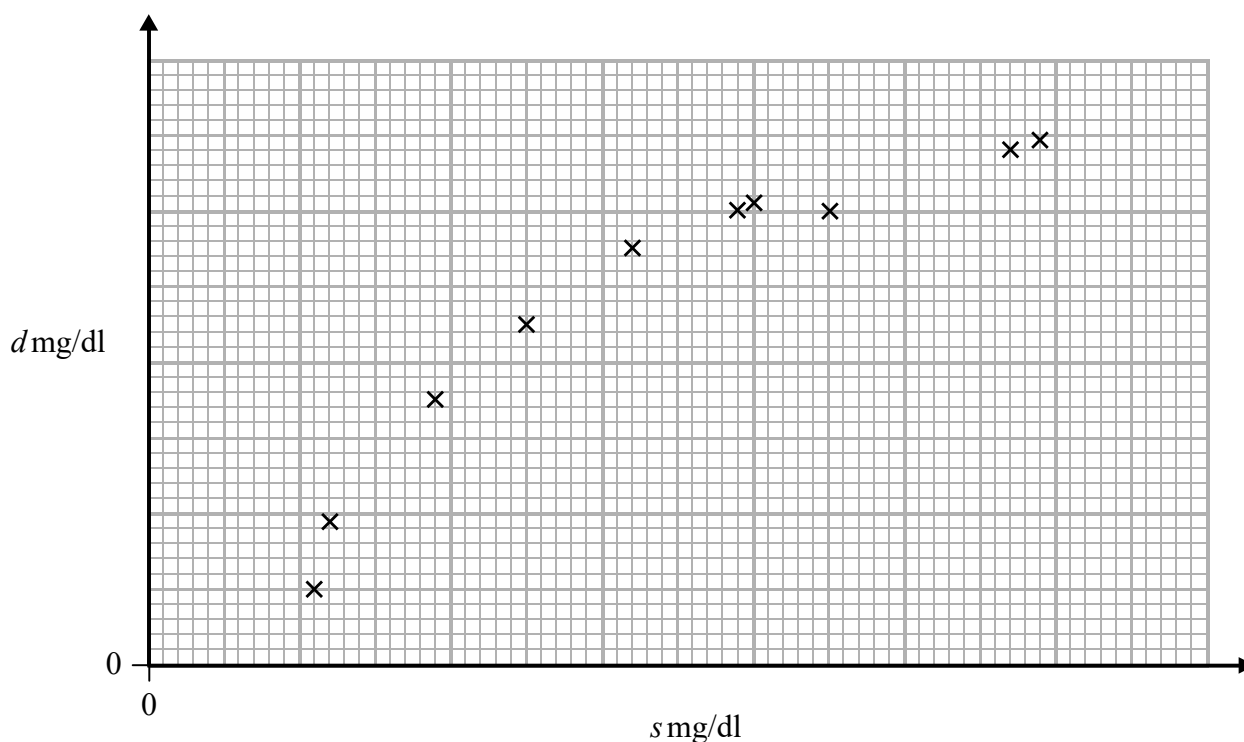
7. Over a period of time, researchers took 10 blood samples from one patient with a blood disease. For each sample, they measured the levels of serum magnesium, s mg/dl, in the blood and the corresponding level of the disease protein, d mg/dl. One of the researchers coded the data for each sample using $x = 10s$ and $y = 10(d - 9)$ but spilt ink over his work.

The following summary statistics and unfinished scatter diagram are the only remaining information.

$$\sum d^2 = 1081.74 \quad S_{ds} = 59.524$$

and

$$\sum y = 64 \quad S_{xx} = 2658.9$$



- (a) Use the formula for S_{xx} to show that $S_{ss} = 26.589$ (3)
- (b) Find the value of the product moment correlation coefficient between s and d . (4)
- (c) With reference to the unfinished scatter diagram, comment on your result in part (b). (1)

Question 7 continued

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Question 7 continued

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(Total for Question 7 is 8 marks)

TOTAL FOR PAPER IS 75 MARKS