

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Centre Number		Candidate Number	
Pearson Edexcel International Advanced Level			
Friday 13 June 2025			
Afternoon (Time: 1 hour 30 minutes)		Paper reference	WST03/01
Mathematics			
International Advanced Subsidiary/Advanced Level			
Statistics S3			
You must have: Mathematical Formulae and Statistical Tables (Yellow), calculator			Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for symbolic 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.
- Values from the statistical tables should be quoted in full. If a calculator is used instead of the tables, the value should be given to an equivalent degree of accuracy.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 8 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.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ►

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1. A golf club has 360 members. The captain of the golf club needs to select 20 players from the club to play in a charity tournament.

The 360 members of the golf club are listed by their randomly allocated membership numbers.

The captain decides to use systematic sampling to select the 20 players.

- (a) Give a reason for using systematic sampling in this case. (1)

The members are numbered from 001 to 360 and the 5th member on the list is randomly selected as the first player and then every x th member thereafter is selected.

- (b) Write down the value of x (1)

- (c) Write down the probability that the sample includes both the 5th and the 6th member on the list. (1)

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Question 1 continued

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(Total for Question 1 is 3 marks)

2. At a local talent show 2 judges were asked to rank 10 performances, in order of preference. The results are shown in the following table.

Performance	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>
Judge 1	1	3	5	7	9	10	2	6	8	4
Judge 2	2	1	3	7	9	4	5	8	10	6

- (a) Calculate Spearman's rank correlation coefficient for these data.
Show your working clearly.

(3)

- (b) Stating your hypotheses clearly, test at the 1% level of significance, whether or not there is evidence of a positive correlation between the ranks of Judge 1 and the ranks of Judge 2

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Question 2 continued

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(Total for Question 2 is 7 marks)

Question 3 continued

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Question 3 continued

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Question 3 continued

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(Total for Question 3 is 9 marks)

4. A biologist claims that the mean weight of grey squirrels is 200 grams more than the mean weight of red squirrels.

A research student believes that the mean weight of grey squirrels is greater than 200 grams more than the mean weight of red squirrels.

To test this, the research student collects and weighs a random sample of 80 grey squirrels and 80 red squirrels.

The results are summarised below, where

- x denotes the weights, in grams, of the grey squirrels
- y denotes the weights, in grams, of the red squirrels

$$\bar{x} = 500 \quad s_x^2 = 1156 \quad \sum y = 23\,200 \quad \sum y^2 = 6\,741\,351$$

- (a) Find an unbiased estimate of the mean and an unbiased estimate of the variance for the weights of the red squirrels.

(3)

- (b) Stating your hypotheses clearly, carry out a suitable test to assess the research student's belief.

Use a 5% level of significance and state your critical value.

(7)

- (c) State an assumption you have made in carrying out the test in part (b)

(1)

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Question 4 continued

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(Total for Question 4 is 11 marks)



Question 5 continued

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(Total for Question 5 is 11 marks)



6. A population has an unknown mean μ and an unknown variance σ^2

A random sample represented by $X_1, X_2, \dots, X_{20}$ is taken from the population.

- (a) Explain why $\frac{1}{2}X_1 + \frac{3}{4}X_{20}$ is a statistic. (1)

- (b) Show that $R = \frac{1}{2}X_1 + \frac{3}{4}X_{20}$ is a biased estimator of μ (2)

- (c) Hence find the bias, in terms of μ , when R is used as an estimator of μ (1)

Given that $S = \frac{aX_1 - bX_2}{2}$ and $T = \frac{\sum_{i=1}^{14} aX_i + \sum_{i=15}^{20} bX_i}{20}$ are each used as an unbiased estimator of μ , where a and b are constants,

- (d) find the value of a and the value of b (4)

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Question 6 continued

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(Total for Question 6 is 8 marks)

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7. The random variable X is such that $X \sim N(\mu, \sigma^2)$

The mean of a random sample of n observations of X is denoted by $\bar{X}_n$

Given that

$$P(\bar{X}_n < 45.2) = 0.3446 \text{ and } P(\bar{X}_n > 75.2) = 0.0179$$

and using the statistical tables provided,

(a) show that $\sigma = 12\sqrt{n}$ (6)

(b) Hence, find the value of μ (2)

(c) Find $P(\bar{X}_n > 59)$ (3)

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Question 7 continued

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Question 7 continued

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Question 7 continued

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(Total for Question 7 is 11 marks)

8. The weights, S kg, of bags of sand are such that

$$S \sim N(18, 0.03^2)$$

Three bags of sand are selected at random.

- (a) Using standardisation, calculate the probability that their total weight is more than 54.1 kg.

(4)

The weights, C kg, of bags of cement are such that

$$C \sim N(25, 0.03^2)$$

Two bags of cement are selected at random.

- (b) Using standardisation, calculate the probability that their weights differ by more than 0.02 kg.

(5)

The weights, P kg, of pallets are such that

$$P \sim N(15, 0.2^2)$$

The random variable T represents the total weight, in kg, of 28 bags of sand with 5 bags of cement and a single pallet of weight P_1

- (c) Using standardisation, calculate the probability that $T < 30P_1 + 190$

(6)

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Question 8 continued

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(Total for Question 8 is 15 marks)**TOTAL FOR PAPER IS 75 MARKS**