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 12 June 2026

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 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.
- 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. Nine swimmers, *A*, *B*, *C*, *D*, *E*, *F*, *G*, *H* and *I*, competed in both a 100 m freestyle race and a 200 m freestyle race. The positions of each swimmer were recorded in each of the two races.

The table below shows the results.

Swimmer	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
Position in 100 m race	6	4	2	8	3	7	1	5	9
Position in 200 m race	7	5	4	9	3	6	1	2	8

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

(3)

(b) Stating your hypotheses clearly, test at the 5% level of significance, whether or not there is evidence to suggest that the higher a swimmer's position is in the 100 m freestyle race, the higher their position is in the 200 m freestyle race.

(4)

(c) Without recalculating the coefficient, explain how Spearman's rank correlation coefficient would change if swimmer *E* was disqualified from both the 100 m freestyle race and the 200 m freestyle race.

(2)

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Question 1 continued

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Question 1 continued

(Total for Question 1 is 9 marks)

2. A survey of 250 adults was conducted to collect information about their salary, S, and whether or not they had a university education.

The results of the survey are given in the table.

Salary (S)	$S <$ £30 000	$S \geqslant$ £30 000
University education	52	78
No university education	63	57

These data are to be used in a test to determine whether there is an association between salaries and a university education.

(a) Calculate the expected frequency for adults with a university education and a salary of less than £30 000

(2)

Given that for the other 3 classes $\sum \frac{(O-E)^2}{E} = 2.908$ to 3 decimal places,

(b) test at the 5% level of significance, whether or not there is an association between salaries and a university education.
You should state your hypotheses, the test statistic, the degrees of freedom and the critical value used for this test.

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Question 2 continued

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Question 2 continued

(Total for Question 2 is 9 marks)

3. A zoologist collected the weights of a random sample of 90 Western grey kangaroos and a random sample of 90 Eastern grey kangaroos.

The results are summarised below, where x denotes the weights, in kg, of the Western grey kangaroos and y denotes the weights, in kg, of the Eastern grey kangaroos.

$$\bar{x} = 40 \qquad s_x^2 = 18.49 \qquad \sum y = 3780 \qquad \sum y^2 = 164599.29$$

(a) Find unbiased estimates for the mean **and** variance of the weights of the Eastern grey kangaroos.

(3)

The zoologist claims that the mean weight of the Western grey kangaroo is less than the mean weight of the Eastern grey kangaroo.

(b) Stating your hypotheses clearly, carry out a suitable test to assess the zoologist's claim.
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 3 continued

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Question 3 continued

(Total for Question 3 is 11 marks)

4. Four identical six-sided dice were rolled 200 times. On each occasion the number of sixes landing upwards, X, was recorded.

The results were as follows.

Number of sixes	0	1	2	3	4
Frequency	110	64	18	5	3

Assuming that each face is equally likely to land upwards,

(a) write down a suitable model for X

(1)

(b) Using a 1% significance level, test the suitability of your model for these data. You should clearly state your hypotheses, the degrees of freedom and the critical value used.

(10)

(c) If it had **not** been assumed that each face is equally likely to land upwards,

(i) state how this would change the answer to part (a)

(ii) explain another change that would be needed to your test procedure in part (b)

(2)

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Question 4 continued

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Question 4 continued

(Total for Question 4 is 13 marks)

5. The random variable X is normally distributed with unknown mean μ and known variance σ^2

A random sample of 36 observations of X resulted in a 90% confidence interval for μ of (24.7034, 26.8966)

(a) Find the mean of the sample.

(1)

(b) Show that the standard deviation of X is 4

(3)

The r% confidence interval using the 36 observations has a width of 1.6

(c) Calculate the value of r

(5)

A second independent sample of size n is taken from X

(d) Find the smallest value of n required to obtain a 90% confidence interval for μ of width at most 0.6

(3)

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Question 5 continued

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Question 5 continued

(Total for Question 5 is 12 marks)

6. **In this question solutions relying entirely on calculator technology are not acceptable.**

Petra travels to work by bus. A bus leaves the bus station every 15 minutes and Petra's arrival at the bus station is independent of when the bus is due to leave.

(a) Write down a suitable model for the distribution of the time, T minutes, that Petra has to wait for a bus to leave.

(1)

(b) Find the mean and standard deviation of T

(3)

During a 15-week period, Petra travels to work by bus on 50 occasions.

(c) Estimate the probability that the mean length of time that Petra has to wait for a bus to leave is between 7.2 and 7.8 minutes.

(5)

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Question 6 continued

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Question 6 continued

(Total for Question 6 is 9 marks)

7. Three independent random samples of size 3

- W_1, W_2, W_3
- X_1, X_2, X_3
- Y_1, Y_2, Y_3

are each taken from a normal population with mean μ and variance σ^2

A random variable C is given by

$$C = 4W_1 - 3X_2 - \overline{Y}$$

(a) Find the distribution of C

(3)

(b) Hence find, using standardisation, $\mathrm{P}(4W_1 < 3X_2 + \overline{Y} + \sigma)$

(3)

A random variable Q is given by

$$Q = 4W_1 - 3W_2 - \overline{W}$$

(c) Find, using standardisation, $\mathrm{P}(Q < 2\sigma)$

(6)

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Question 7 continued

Question 7 continued

(Total for Question 7 is 12 marks)

TOTAL FOR PAPER IS 75 MARKS

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