Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 3 GCE

Friday 23 May 2025

Afternoon

Paper reference **8MA0/21**

Mathematics

Advanced Subsidiary

PAPER 21: Statistics

You must have:
Mathematical Formulae and Statistical Tables (Green), calculator

Total Marks

Candidates may use any calculator allowed by Pearson regulations. Calculators must not have the facility for symbolic algebra 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 statistical tables should be quoted in full. If a calculator is used instead of 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.
- The total mark for this part of the examination is 30. There are 5 questions.
- 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.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.
- Check your answers if you have time at the end.

1. The random variable $X \sim B(20, 0.37)$

(a) Find $P(X = 8)$

(1)

(b) Find $P(X \leqslant 5)$

(1)

(c) Find $P(X \leqslant 5.7)$

(1)

Question 1 continued

(Total for Question 1 is 3 marks)

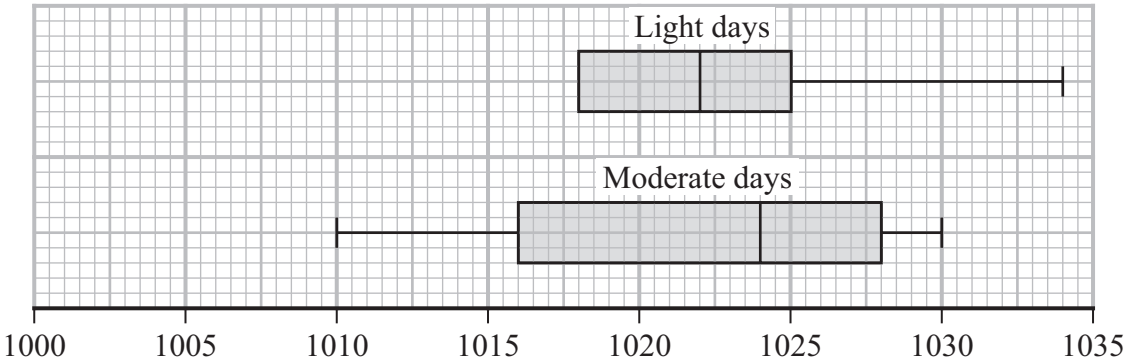
2. Jasper is investigating the relationship between Daily Mean Pressure and Daily Mean Windspeed (Beaufort conversion) for Perth in 2015 using the data from the large data set.
Treating the large data set for Perth in 2015 as the population, Jasper decides to use all the data available.

(a) Write down the name given to this method of data collection.

(1)

All of the Daily Mean Windspeed data for Perth in 2015 are classed as either "Light" or "Moderate".

Jasper splits the data for Perth in 2015 into Light days and Moderate days and draws a box plot for each set of data, but omits the lower tail for Light days.



The smallest three values of Daily Mean Pressure for Light days for Perth in 2015 are 1007, 1009 and 1010 hPa.

An outlier in the first quartile is defined as any value more than $1.5 \times$ IQR below Q_1

(b) (i) Determine if there are any outliers in the first quartile of Daily Mean Pressure for Light days.

(2)

(ii) Hence, complete the box plot of Daily Mean Pressure for Light days.

(1)

The box plot for Light days is based on data for 161 days.

(c) Using your knowledge of the large data set, estimate the number of Moderate days with a Daily Mean Pressure of 1028 hPa and higher in the large data set for Perth in 2015.

(2)

Question 2 continued

(Total for Question 2 is 6 marks)

3. A bag contains red counters, green counters and white counters only.
The table shows the proportion of each colour of counter that Elsa believes to be in the bag.

Colour	red	green	white
Proportion	p	0.2	$4p$

Elsa selects at random 40 counters from the bag, one at a time, with replacement.

Assuming Elsa's belief is true,

(a) find the distribution of the number of red counters Elsa selects.

(3)

Jayda believes that the true proportion of green counters in the bag is greater than 0.2

She takes a random sample of 40 counters from the bag, one at a time, with replacement.

There are 11 green counters in her sample.

(b) (i) Use a suitable test to assess Jayda's belief.

You should

- state your hypotheses clearly
- use a 5% level of significance
- state the p-value for the test

(4)

(ii) Find the acceptance region for the test in part (i).

(2)

Question 3 continued

(Total for Question 3 is 9 marks)

4. Giovanni believes there is a relationship between the mass of a car, m kg, and its fuel consumption, c miles per gallon (mpg).
For a sample of 25 cars, he obtains the following summary statistic.

$$\sum (c - \bar{c})^2 = 394$$

(a) Find the standard deviation of the fuel consumption of the 25 cars.

(1)

Using m as the explanatory variable, Giovanni creates the linear regression model

$$c = a + bm$$

where a and b are constants.

Using his model, he concludes that, on average

- the fuel consumption is 3.5 mpg lower for each additional 500 kg of mass
- the fuel consumption of a car with a mass of 1700 kg is 20 mpg

(b) (i) Find the value of b

(2)

(ii) Find the value of a

(2)

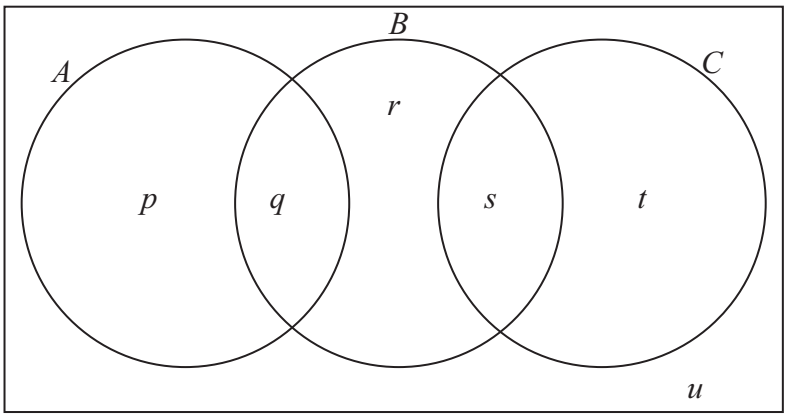
Question 4 continued

(Total for Question 4 is 5 marks)

5. Events A, B and C are such that

- $P(A \text{ or } C) = 0.55$
- the probability that none of the events occur is 0.23
- the probability that exactly two of the events occur is 0.18
- A and B are independent
- $P(B) = P(A) + 0.1$

The Venn diagram represents the events A, B and C and their associated probabilities p, q, r, s, t and u



(a) Write down the value of u

(1)

(b) Find the value of r

(2)

(c) Find

(i) the value of p

(ii) the value of q

(iii) the value of s

(iv) the value of t

(4)

Question 5 continued

Question 5 continued

(Total for Question 5 is 7 marks)

TOTAL FOR STATISTICS IS 30 MARKS