Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 3 GCE

Thursday 18 June 2026

Afternoon

Paper reference **9MA0/31**

Mathematics

Advanced

PAPER 31: 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.

I nstruc tions

- 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

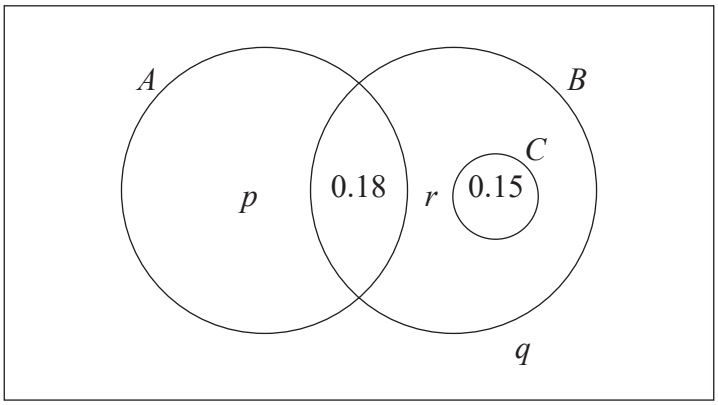
- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- The total mark for this part of the examination is 50. There are 6 questions.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answerevery question.
- Check your answers ifyouhave time at the end.

Turn over ▶

1. The Venn diagram, where p, q and r are probabilities, shows the events A, B and C and their associated probabilities.



(a) State a pair of mutually exclusive events from A, B and C

(1)

Given that P (A) = 0.3

(b) find the value of p

(1)

The events A and B are independent.

(c) Find P (B)

(2)

(d) Find P($A' \cap B'$)

(1)

(e) Find

(i) P (B ½ C)

(ii) P (C ½ B)

(3)

(TotalforQuestion 1 is 8 marks)

2. Ali and Bob assemble components.

For quality control, a supervisor takes the first 25 components assembled.

(a) State the name of the sampling method used by the supervisor.

(1)

The supervisor wants to check that the proportion of faulty components is not more than 0.015

(b) Explain why a binomial distribution may **not** be suitable to model the number of faulty items taken by the supervisor.

(1)

The supervisor takes a **random** sample of 65 components assembled by Bob and finds 3 faulty components.

(c) Use a suitable test to determine whether or not there is evidence that the proportion of faulty components assembled by Bob is more than 0.015
You should
- state your hypotheses and conclusion clearly
- use a 5% level of significance

(4)

Question 2 continued

(TotalforQuestion 2 is 6 marks)

3. Chris is studying the Daily Total Rainfall, x, for Jacksonville from the large data set for 1987

(a) Using your knowledge of the large data set, write down

(i) the units of x

(ii) the modal value of x

(2)

Chris found the following summary statistics

$n = 184$ x 506.8 x^2 10 750

(b) Calculate, giving your answers to 3 significant figures,

(i) the mean of x

(1)

(ii) the standard deviation of x

(2)

Chris believes that the mean Daily Total Rainfall for Jacksonville has increased since 1987

When using the large data set, Chris
- treated the observations from 1987 and 2015 as independent random samples
- used a null hypothesis that there was **no change** in the mean
- carried out a suitable test that had a p-value of 0.0015

(c) Use this information to comment on Chris's belief.
Give a reason for your answer.

(2)

(Total for Question 3 is 7 marks)

4. Nat is studying the displacement, y cm, of an object during a period of 7.5 seconds.

The scatter diagram in Figure 1 shows the results for 11 measurements of y at x seconds.

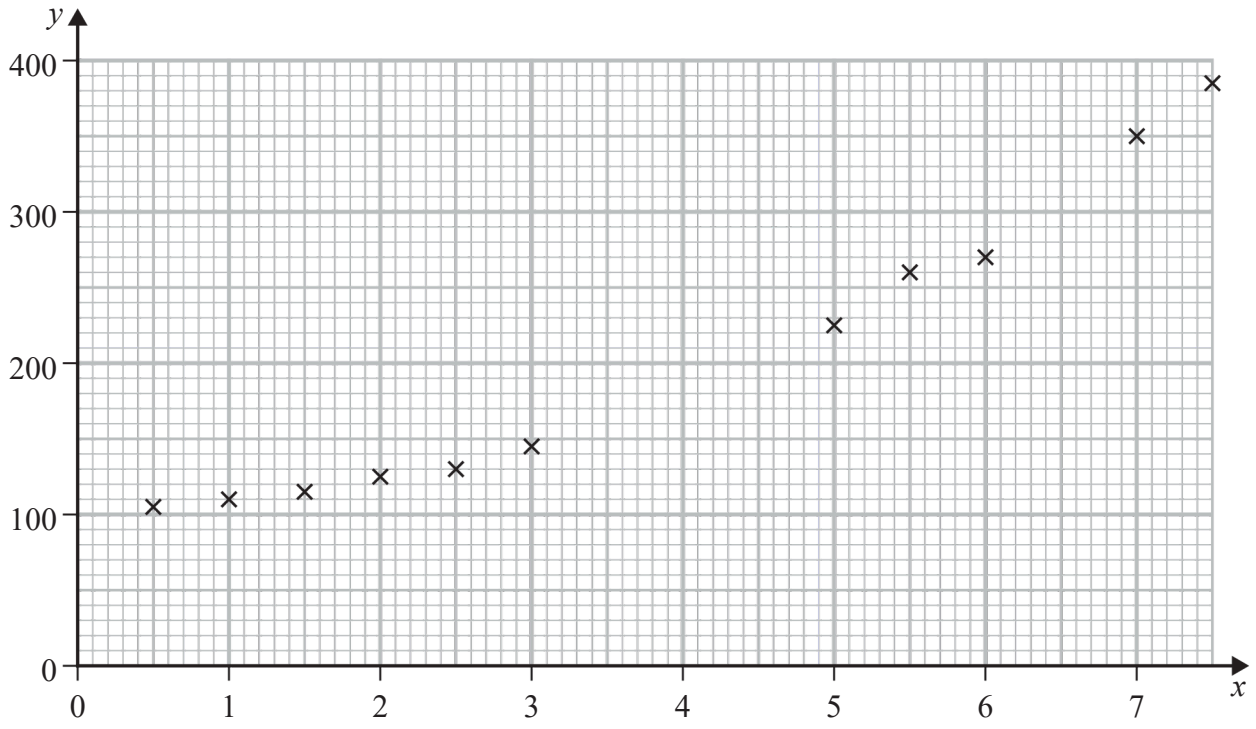


Figure 1

(a) Describe the correlation between x and y

(1)

The equation of the regression line of y on x for these data is $y = 52.4 + 39.6x$

(b) Give an interpretation of the gradient of this line.

(1)

Question 4 continued on page 10

Question 4 continued

Nat drew the regression line on the scatter diagram to give Figure 2

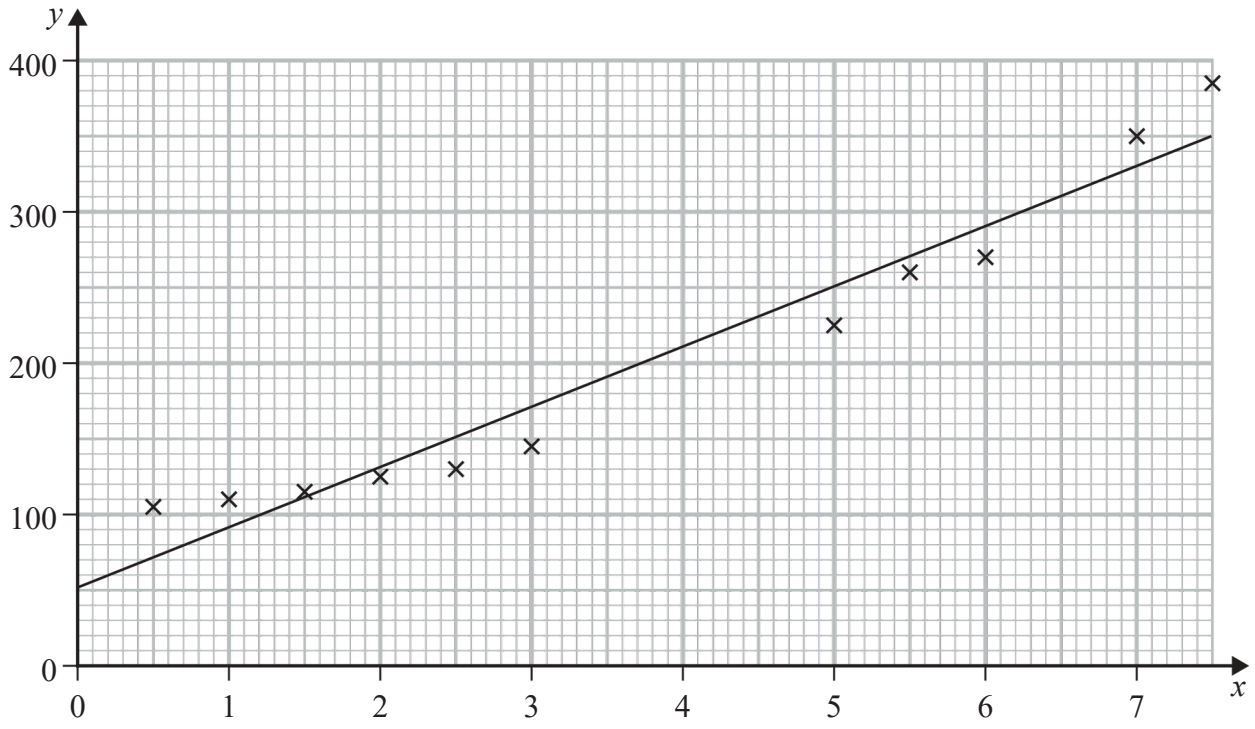


Figure 2

Nat uses the regression line to estimate the displacement at 4 seconds.

(c) (i) Find this estimate.

(ii) State, giving your reason, whether this value is likely to be an underestimate or an overestimate.

(2)

The product moment correlation coefficient for these data is 0.97
However, Nat believes that there is a better model for these data than the linear regression line.

(d) Give a reason why Nat may be correct.

(1)

Nat proposes a new model of the form $y = a + bf(x)$ for these data.

(e) Suggest a suitable expression for $f(x)$

(1)

(TotalforQuestion 4 is 6 marks)

5. Sala has a biased coin for which the probability of a head is $\frac{2}{5}$

In a game, Sala spins the coin repeatedly and stops when

either the 2nd head is obtained
or the coin has been spun 5 times

The random variable X represents the number of times Sala spins the coin in one game.

(a) Explain why a binomial distribution is not an appropriate model for X

(1)

(b) Show that $P(X = 4) = \frac{108}{625}$

(3)

(c) Find the probability distribution of X

(5)

The random variable H represents the number of heads obtained in one game.

(d) Find $P(H = 1)$

(2)

(e) Write down $P(\{H = 1\} \cap \{X = 4\})$

(1)

Using your answer to part (e)

(f) state the relationship between the event $\{H = 1\}$ and the event $\{X = 4\}$

(1)

(TotalforQuestion 5 is 13 marks)

6. Fen makes cheese which is sold in packs.
The weight, in grams, of each pack is normally distributed with mean 540 and standard deviation σ

Fen knows that 80% of the packs have weights between 530 g and 550 g

(a) Find an estimate for the value of σ
Give your answer to 3 decimal places.

(3)

Fen makes 250 packs of this cheese.

(b) Estimate the expected number of these packs that weigh less than 530 g

(2)

Fen also makes yoghurt which is sold in pots.

The volume of yoghurt in a pot is normally distributed with mean 275 ml and standard deviation 11 ml

(c) Find the probability that a randomly chosen pot contains more than 263 ml of yoghurt.

(1)

Fen buys a new machine to put the yoghurt into the pots.

The standard deviation of the volume of yoghurt in each pot is unchanged at 11 ml
However, Fen believes that the mean volume may have changed from 275 ml

A random sample of 36 pots is taken and the mean volume of yoghurt in these pots is 271.7 ml

(d) Carry out a suitable test to assess Fen's belief.

You should
- state your hypotheses clearly
- use a 5% level of significance
- state your conclusion clearly

(4)

Question 6 continued

(Total for Question 6 is 10 marks)

TOTALFORSTATISTICS IS 50 MARKS

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