

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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## Pearson Edexcel Level 3 GCE

Monday 18 October 2021 – Afternoon

Paper  
reference

**9MA0/31**

### Mathematics

Advanced

**PAPER 31: Statistics**

Shadow Set 1

**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 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 answer every question.
- Check your answers if you have time at the end.

Turn over ►

1. (a) State one disadvantage of using opportunity sampling. (1)

In a university 12% of students are members of the university ski club.

A random sample of 42 students is taken from the university.

The random variable  $X$  represents the number of these students who are members of the ski club.

- (b) Using a suitable model for  $X$ , find
- (i)  $P(X = 8)$
  - (ii)  $P(X \geq 10)$
- (3)

Only 35% of the university ski club members can also snowboard.

- (c) Find the probability that a student is a member of the university ski club and can snowboard. (1)

A random sample of 65 students is taken from the university.

- (d) Find the probability that fewer than 4 of these students are members of the university ski club and can snowboard. (2)

**(Total for Question 1 is 7 marks)**

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2. Robert took a random sample of 12 days over a term at a local secondary school and recorded
- the temperature outside,  $x$ .
  - the number of hot meals sold  $y$ , in the canteen

His results are shown in the scatter diagram on the next page.

- (a) Describe the correlation between  $x$  and  $y$ . (1)

Robert suggests that the warmer the weather the less hot meals sold.

- (b) Using the scatter diagram comment on Robert's suggestion, giving a reason for your answer. (1)

The results from Robert's random sample of 12 observations are given in the table below.

$x$	8	9	6	12	10	14	16	18	7	9	15	19
$y$	40	38	39	20	18	12	12	11	30	35	15	8

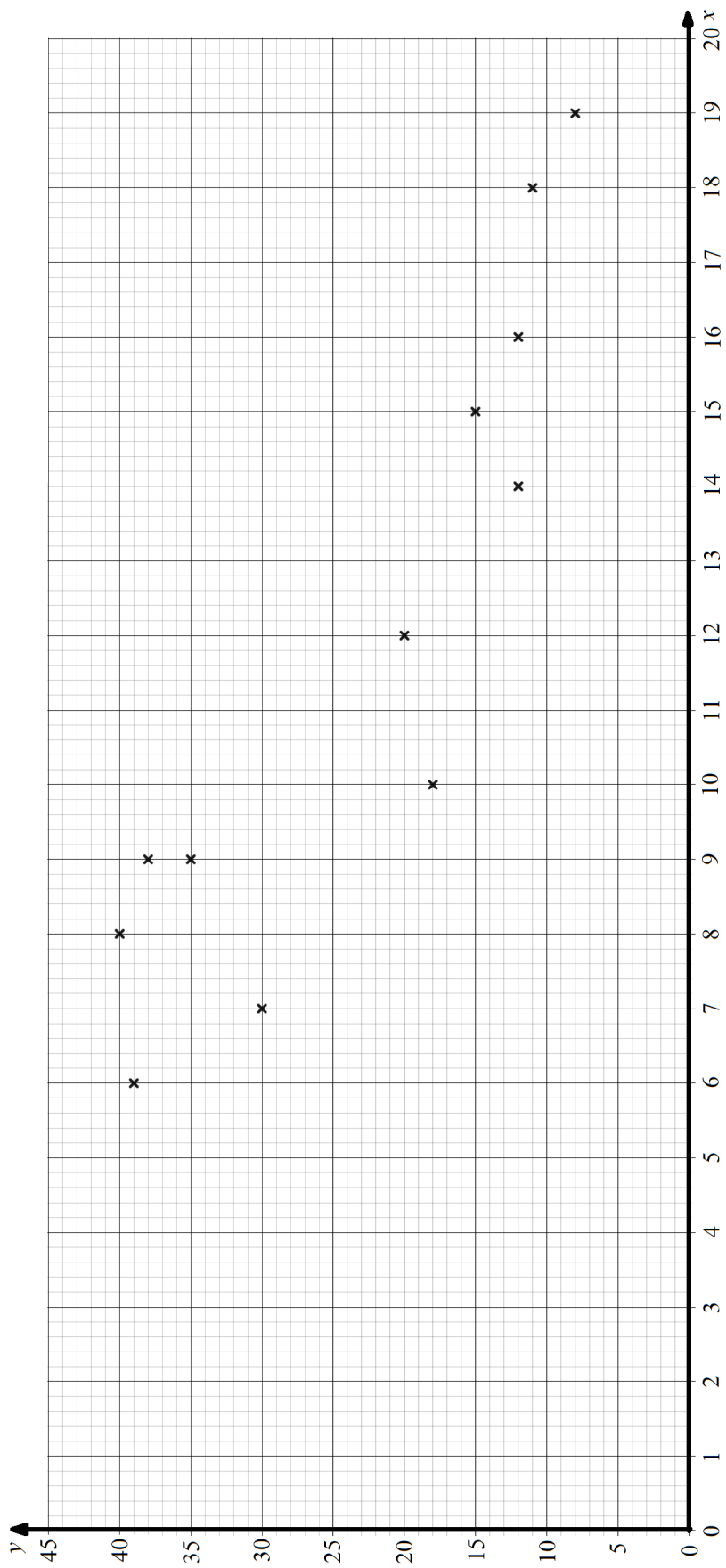
- (c) Use your calculator to find the product moment correlation coefficient between  $x$  and  $y$  for these data. (1)
- (d) Test whether or not there is evidence of a negative correlation between the temperature outside and the number of hot meals sold.

You should

- state your hypotheses clearly
  - use a 5% level of significance
- (3)

**(Total for Question 2 is 6 marks)**

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3. Stav is studying the large data set for June 1987

He codes the variable Daily Mean Temperature,  $x$ , using the formula  $y = x - 7$

The data for all 30 days from Hurn are summarised by

$$\sum y = 199.5 \quad \sum y^2 = 5824.648$$

(a) State the units of the variable  $x$  (1)

(b) Find the mean Daily Mean Temperature for these 30 days. (2)

(c) Find the standard deviation of Daily Mean Temperature for these 30 days. (4)

(d) What type of variable is daily mean pressure? (1)

**(Total for Question 3 is 8 marks)**

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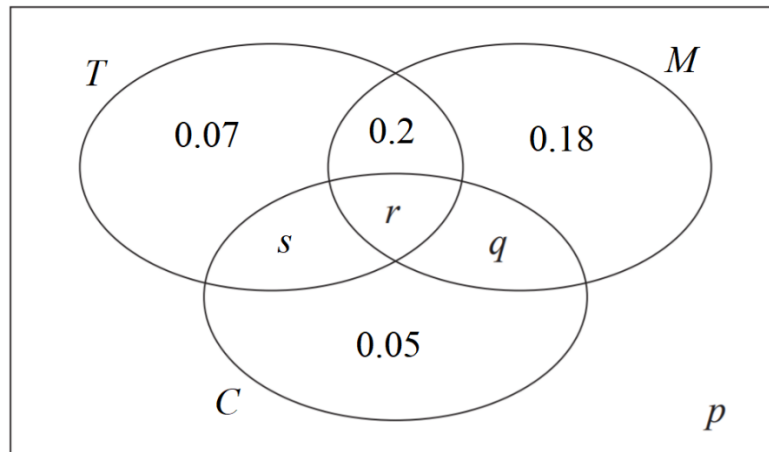
4. The Venn diagram shows the results from a random sample of people.

$T$  is the event that the person drinks tea

$M$  is the event that the person drinks milk

$C$  is the event the person drinks coffee

The Venn diagram, where  $p, q, r$  and  $s$  are probabilities, gives the probability for each subset.



(a) Find the proportion of people who drink exactly one of the drinks.

(1)

No person likes all three drinks and  $P(T) = 0.41$

(b) Find

(i) the value of  $r$

(ii) the value of  $s$

(3)

Given that  $P(M | C) = \frac{30}{49}$

(c) find

(i) the value of  $q$

(ii) the value of  $p$

(4)

(d) Determine whether or not the events  $(T \cap M')$  and  $C$  are independent. Show your working clearly.

(3)

**(Total for Question 4 is 11 marks)**

5. The heights of males from a country are normally distributed with

- a mean of 180.5 cm
- a standard deviation of 6.7 cm

Given that 1% of males from this country are shorter than  $k$  cm,

(a) find the value of  $k$  (2)

(b) Find the proportion of males from this country with heights between 170 cm and 185 cm (1)

A male, from this country, is chosen at random from those with heights between 170 cm and 185 cm

(c) Find the probability that her height is more than 177 cm (4)

The heights of males from a different country are normally distributed with a standard deviation of 7.5 cm

Mia believes that the mean height of males from this country is less than 180.5 cm

Mia takes a random sample of 60 males from this country and finds the mean of her sample is 178.8 cm

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

You should

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

(4)

**(Total for Question 5 is 11 marks)**

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6. The discrete random variable  $X$  has the following probability distribution

$x$	$a$	$b$	$c$
$P(X=x)$	$\log_{30} a$	$\log_{30} b$	$\log_{30} c$

where

- $a, b$  and  $c$  are distinct integers ( $a < b < c$ )
- all the probabilities are greater than zero

(a) Find

(i) the value of  $a$

(ii) the value of  $b$

(iii) the value of  $c$

Show your working clearly.

(5)

The independent random variables  $X_1$  and  $X_2$  each have the same distribution as  $X$

(b) Find  $P(X_1 = X_2)$

(2)

(Total for Question 6 is 7 marks)

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**TOTAL FOR STATISTICS IS 50 MARKS**