A

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

Level 3 Certificate

MATHEMATICAL STUDIES

Paper 2A Statistical Techniques

1350/2A

Time allowed: 1 hour 30 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

JUN221350 2A 01

For this paper you must have:

- **a clean copy of the Preliminary Material, Formulae Sheet and Statistical Table (enclosed)**
- **a scientific calculator or a graphics calculator**
- **a ruler.**

INSTRUCTIONS

- **Use black ink or black ball-point pen. Pencil should only be used for drawing.**
- **Answer ALL questions.**
- **You must answer the questions in the spaces provided. Do not write on blank pages.**
- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**
- **Show all necessary working; otherwise, marks for method may be lost.**

- **Do all rough work in this book. Cross through any work you do not want to be marked.**

- **The FINAL answer to questions should be given to an appropriate degree of accuracy.**

- **You may NOT refer to the copy of the Preliminary Material that was available prior to this examination. A clean copy is enclosed for your use.**

INFORMATION

- **The marks for questions are shown in brackets.**

- **The maximum mark for this paper is 60.**

- **You may ask for more answer paper or graph paper, which must be tagged securely to this answer booklet.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions in the spaces provided.

1 **The plans for a new housing estate include 80 properties of different types.**

The table shows the planned number of each type of property.

TYPE OF PROPERTY	PLANNED NUMBER OF THIS TYPE
1-bedroom flat	10
2-bedroom flat	15
2-bedroom house	25
3-bedroom house	20
4-bedroom house	5
5-bedroom house	5

1 (a) Work out the ratio of houses to flats.

Circle your answer. [1 mark]

5 : 11 11 : 5 5 : 16 16 : 11

The local council must approve the plans for the housing estate.

To be approved, the plans must meet some minimum requirements.

1 (b) Here are the minimum requirements for the number of cycle parking spaces.

- 1 space PER BEDROOM up to and including 3-bedroom properties
- 3 spaces for 4-bedroom properties
- 4 spaces for 5-bedroom properties
- PLUS some visitor cycle parking

The plans for the housing estate include 185 cycle parking spaces.

Do the plans meet the minimum requirements?

You MUST show your working. [3 marks]

[Turn over]

1 (c) The developers building the housing estate want to change their plans.

They make more profit on 2-bedroom houses than on 2-bedroom flats.

To approve the plans, the local council insists that

- there must still be 80 properties
- at least 23% of the properties are classified as ‘affordable housing’.

The table shows which properties are classified as 'affordable housing'.

TYPE OF PROPERTY	AFFORDABLE HOUSING	PLANNED NUMBER OF THIS TYPE
1-bedroom flat	✓	10
2-bedroom flat	✓	
2-bedroom house	×	
3-bedroom house	×	20
4-bedroom house	×	5
5-bedroom house	×	5

[Turn over]

Complete the table, on page 9, to show the number of 2-bedroom flats and 2-bedroom houses that would be approved and make the greatest profit.
[3 marks]

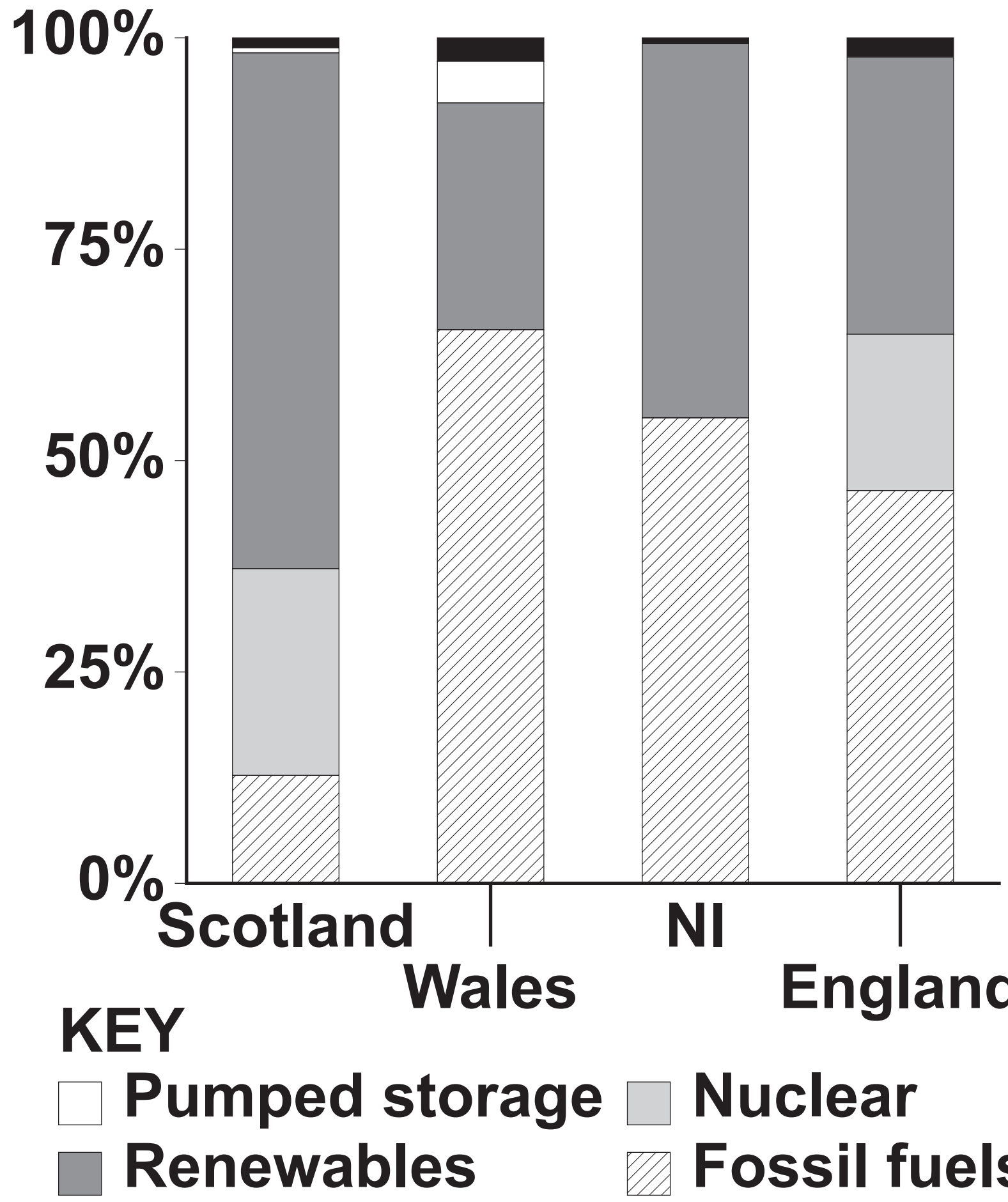
11

7

[Turn over]

1 1

2 **Use ELECTRICITY GENERATION from the Preliminary Material.**



2 (a) **The bar chart, on page 12, shows how each of the four nations of the United Kingdom generated electricity in 2019.**

Suggest TWO improvements that could be made to the bar chart. [2 marks]

Improvement 1

Improvement 2

2 (b) **Two newspapers reported on electricity generation in England in 2019.**

Electricity generated by renewables reached more than 70% of that generated from fossil fuels.

‘Morning Record’

The ratio of wind to other renewables is about 13 : 17

‘Daily Bulletin Review’

Using TABLE 1 in the Preliminary Material, comment on the validity of each newspaper’s claim.

You MUST show your working.
[5 marks]

Morning Record

Daily Bulletin Review

2 (c) In 2019, Northern Ireland generated 4189 GWh of electricity by renewables.

The average cost of electricity was 14.4p per kWh

1 GWh = 1 000 000 kWh

Anna says,

“In 2019, Northern Ireland generated electricity by renewables worth over 600 million pounds.”

Is she correct?

You MUST show your working.
[3 marks]

2 (d) In 2019, Wales generated 7700 GWh of electricity by renewables.

Work out the total amount of electricity generated in Wales from all fuels. [2 marks]

Answer _____ **GWh**

[Turn over]

2 (e) **Bobby wants to work out the mean percentage of electricity generated by renewables in the UK.**

Here is his calculation, which uses the values from CHART 1 in the Preliminary Material.

61.1 + 44.6 + 33.0 + 26.9 = 165.6

165.6 ÷ 4 = 41.4

So 41.4% of energy generated in the UK in 2019 was by renewables.

The article states that 37.1% of energy generated in the UK in 2019 was by renewables.

Critically analyse Bobby's method, explaining why his percentage does not agree with the article.

You do NOT need to carry out any calculations. [1 mark]

[Turn over]

3 **The normal distribution is one of the most important probability distributions in statistics.**

Draw a line from each box on the left to the correct value on the right. [2 marks]

Mean of the standardised normal distribution	**0**
	0.5
	0.67
Standard deviation of the standardised normal distribution	**1**

2

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[Turn over]

4 The Intelligence Quotient (IQ) of staff in an office is normally distributed with mean μ and variance 340

A random sample of 20 staff have their IQ measured.

The mean of their results was 103

The office manager wants to construct a 90% confidence interval for μ

4 (a) Circle the z-value, correct to two decimal places, needed to construct a 90% confidence interval. [1 mark]

0.90 **1.28** **1.64** **2.58**

4 (b) Calculate a 90% confidence interval for μ [3 marks]

Answer _____

[Turn over]

4 (c) **The manager claims that the mean IQ of staff in the office is 120**

Use your answer to Question 4(b) to comment on this claim. [2 marks]

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[Turn over]

5 **An ordinary 6-sided dice is thrown 150 times.**

The scores are shown below.

4	5	2	4	3	3	4	6	6	3	5	1	4	4	5
6	5	3	2	6	3	6	2	6	5	3	6	1	5	4
2	6	2	4	2	1	3	6	1	2	6	6	5	2	2
5	4	4	5	5	5	3	1	1	2	1	1	3	5	6
6	6	1	6	1	3	5	5	5	6	4	5	5	3	2
3	6	1	5	5	6	5	1	3	1	6	3	3	2	6
3	1	3	4	5	2	4	1	2	2	5	2	5	2	5
2	1	2	5	6	6	6	3	2	1	4	5	4	6	4
1	3	6	5	6	6	5	3	3	3	4	3	4	4	4
6	4	1	4	5	5	5	5	6	4	2	5	4	2	5

5 (a) A random number generator is used to choose a random sample of three scores.

The numbers generated are 98, 147 and 6

State their corresponding dice scores. [2 marks]

98 → _____

147 → _____

6 → _____

5 (b) Ali, Becky and Carly choose random samples from the 150 dice scores.

They each calculate a point estimate of the mean score using their sample.

	SAMPLE SIZE	POINT ESTIMATE
Ali	10	3.6
Becky	10	4.3
Carly	25	3.8

Whose point estimate is likely to be closest to the mean score of all 150 throws?

Give a reason for your answer. [1 mark]

5 (c) Use your scores in Question 5(a) and the point estimates from the table in Question 5(b) to calculate a more representative point estimate of the mean.

You may assume that each score is in at most one sample.
[4 marks]

Answer _____

5 (d) Is the dice fair?

Give a reason for your answer.
[2 marks]

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[Turn over]

6 (a) State the value of perfect negative correlation. [1 mark]

Answer _____

6 (b) The table gives the time spent running and distance travelled for 8 members of a running club.

TIME (MINUTES)	DISTANCE (KM)
28	3.4
31	4.7
35	6.2
40	9.1
45	8.0
49	4.3
52	6.1
57	7.7

Using the product moment correlation coefficient, state the TYPE and STRENGTH of the correlation between time and distance. [2 marks]

7 The heights, X metres, of yucca plants at a garden centre are normally distributed with mean 1.58 and standard deviation 0.31

7 (a) Write the distribution in notation form. [1 mark]

Answer _____

7 (b) Calculate P($X < 2$) [2 marks]

_____

_____

_____

_____

_____

_____

Answer _____

7 (c) Calculate P($X < 1.3$) [2 marks]

Answer _____

7 (d) 60% of the yucca plants have a height of MORE THAN k metres.

Work out the value of k. [3 marks]

k = _____

8

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[Turn over]

8 **12 students in a class were due to sit two tests.**

One student was absent for test 1

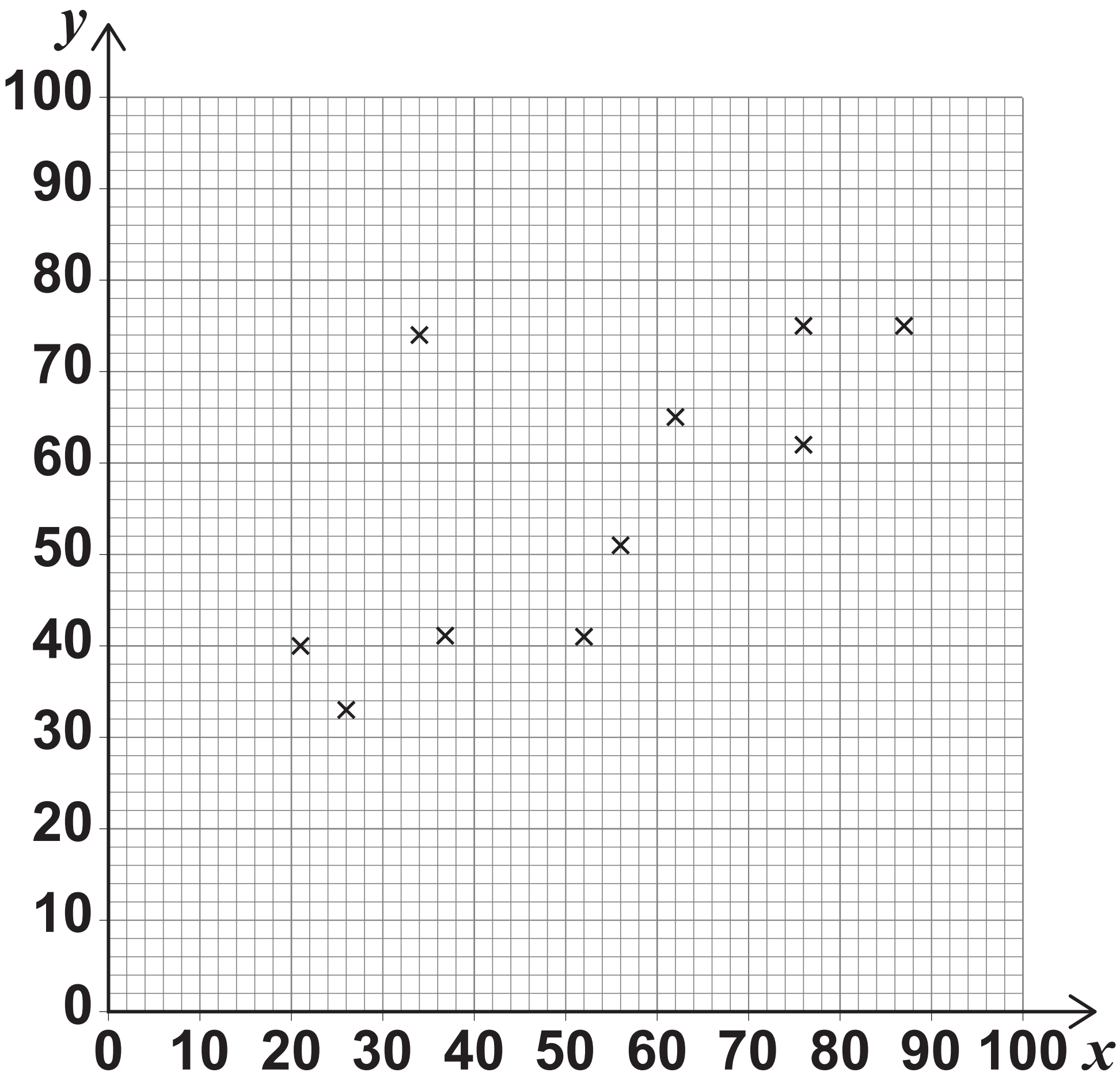
A different student was absent for test 2

The marks are shown in _____ x is the mark for test 1

y is the mark for test 2

STUDENT	A	B	C	D	E	F	G	H	I	J	K	L
x	21	87	52	76	34	56	76	27	26	37	62	abs
y	40	75	41	75	74	51	62	abs	33	41	65	49

The marks of the 10 students that sat both tests are shown on the scatter diagram.



[Turn over]

8 (a) The class teacher says that one student's pair of marks could be an outlier.

Which student is this? [1 mark]

Answer _____

8 (b) Calculate the equation of the regression line of y on x

Do not include the outlier.
[2 marks]

Answer _____

8 (c) Use your equation of the regression line to estimate the missing marks. [3 marks]

[Turn over]

Test 2 mark for student H

Test 1 mark for student L

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[Turn over]

8 (d) **Each student was awarded an overall grade based on the total mark, t, of their two tests.**

m is the mean of the values of t, including the outlier and the two estimated marks.

GRADE 5	$t \geqslant 1.4m$
GRADE 4	$1.1m \leqslant t < 1.4m$
GRADE 3	$0.8m \leqslant t < 1.1m$
GRADE 2	$0.6m \leqslant t < 0.8m$
GRADE 1	$t < 0.6m$

Which students were awarded GRADE 3?

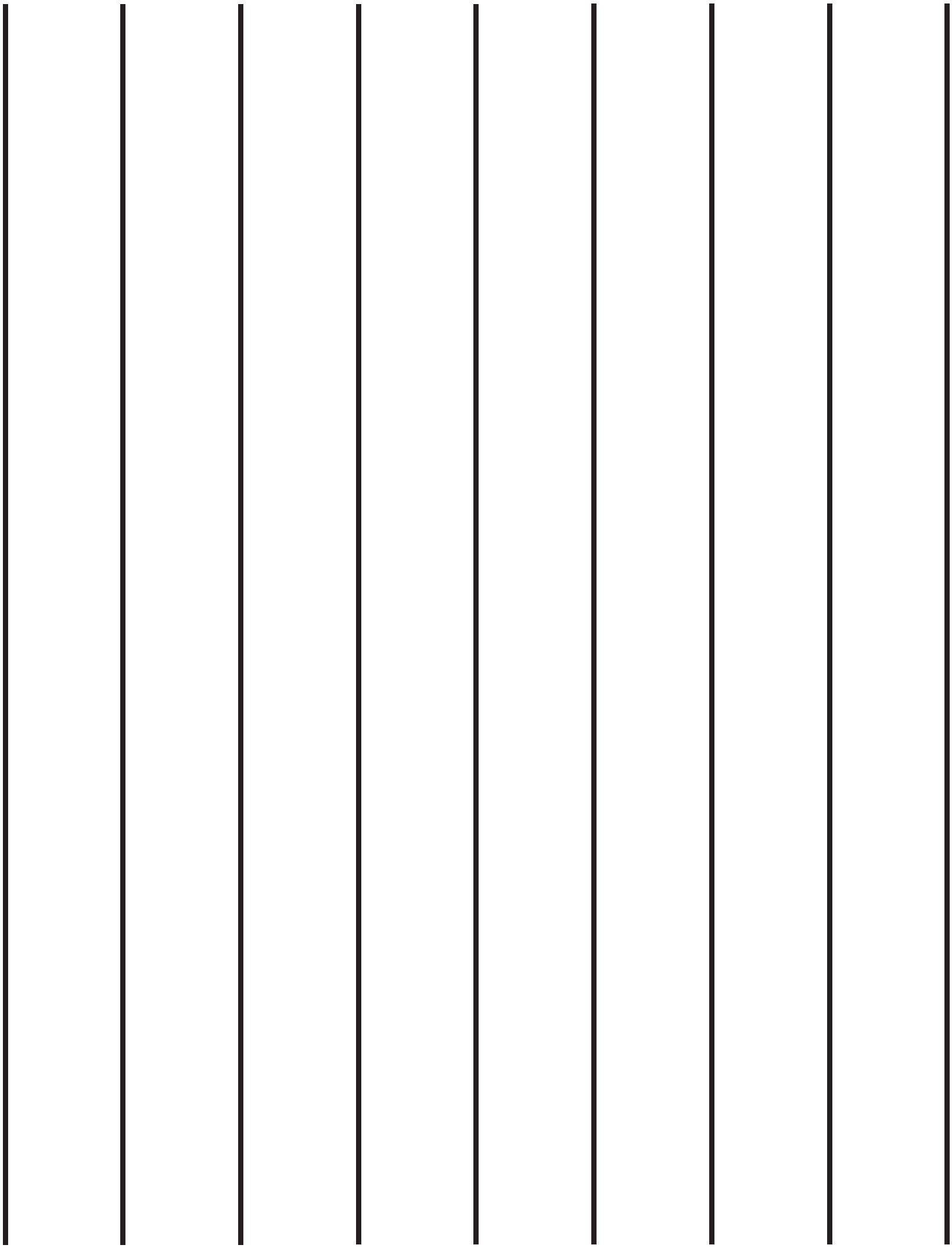
You MUST show your working.

You may use the table below.

STUDENT	A	B	C	D	E	F	G	H	I	J	K	L
x	21	87	52	76	34	56	76	27	26	37	62	
y	40	75	41	75	74	51	62		33	41	65	49

[6 marks]

48



4 8

Answer _____

12

END OF QUESTIONS

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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	