AQA

Level 3 Certificate
MATHEMATICAL STUDIES

Paper 2A   Statistical techniques

Wednesday 23 May 2018   Morning   Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
- a clean copy of the Preliminary Material, Formulae Sheet and Statistical Tables (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.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- 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 or graph paper, which must be tagged securely to this answer booklet.
- The paper reference for this paper is 1350/2A.

Do not write outside the box

Answer **all** questions in the spaces provided.

1   Use **Brexit** from the Preliminary Material.

1 (a)   The UK population was 65 million in June 2016

What percentage of the population, correct to one decimal place, were eligible voters for the EU membership referendum?

Circle your answer.

[1 mark]

51.7   71.5   71.6   72.3

1 (b)   One improvement that could be made to each graph in the Preliminary Material would be to label the axes.

Suggest **two** other improvements that could be made to each graph.

[4 marks]

Graph 1: EU immigration in the UK

Improvement 1

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Improvement 2

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Graph 2: Brexit's impact on the pound

Improvement 1

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Improvement 2

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1 (c)   For 2015, the UK paid the EU £14.6 billion.

During the campaign, Vote Leave claimed that the EU costs the UK over £350 million every week.

Is Vote Leave's claim justified?

You **must** show your working.

[2 marks]

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Question 1 continues on the next page

Turn over ▶

1 (d)   Many people made comments on social media about the referendum.

Here are three of the comments.

> Nearly 20% of eligible voters didn't vote in the EU referendum.
>
> **Tim**

> The ratio of Remain votes to Leave votes is close to 12 : 13
>
> **Kelly**

> If 2 million of those who didn't vote at all had voted to remain in the EU, Remain would have won with over 51% of the votes.
>
> **Larissa**

Using the table on page 2 of the Preliminary Material, check the validity of these comments.

You **must** show your calculations.

[7 marks]

Tim's comment

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Kelly's comment

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Larissa's comment

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14

Turn over ▶

2 Maria is planning to move to Spain. She wants to buy a house which, including all associated fees, will cost €327 500

In May 2014 she opened a Spanish bank account with a deposit of £17 000
The account pays no interest.

The current exchange rate is £1 = €1.08

This is a decrease of 10% from the May 2014 rate.

Maria owns a house in England which she bought for £253 000. She has no mortgage. The house is now worth 12.5% more than she paid for it.

Advise Maria on whether the money she gets from selling her house in England, together with the money in her Spanish bank account, will be enough to buy the house in Spain.

You **must** show your working.

[6 marks]

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6

3 (a) Which of the following **cannot** be a correct value for a product moment correlation coefficient?

Circle your answer.

[1 mark]

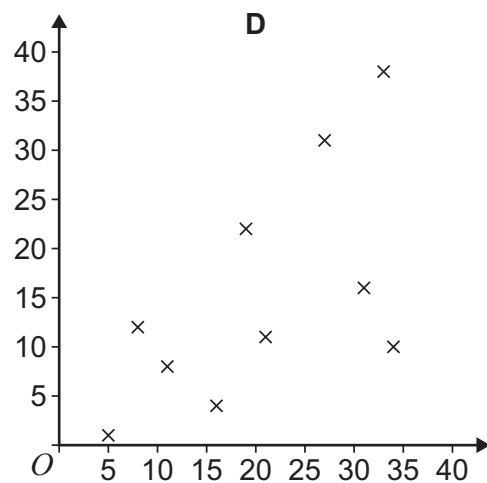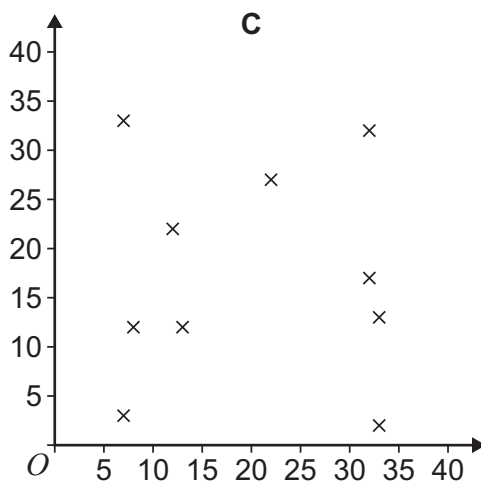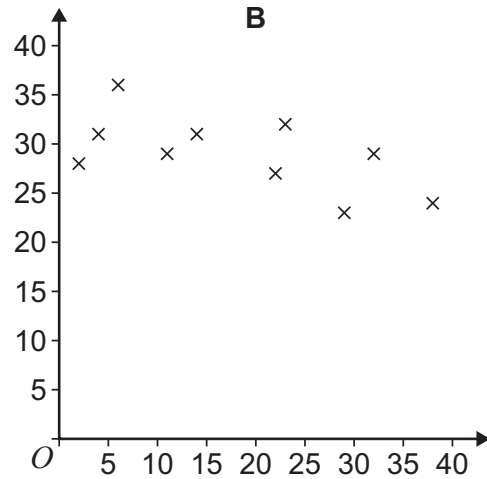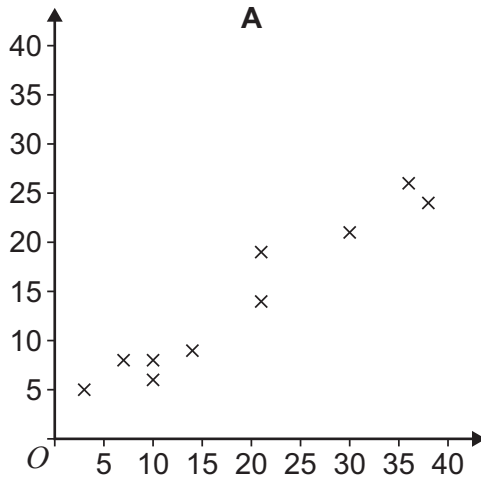$$-0.765 \qquad 0.000 \qquad \frac{13}{25} \qquad 1.379$$

3 (b) Here are four scatter diagrams, **A**, **B**, **C** and **D**.

Complete the table by matching the coefficient to the letter of the correct diagram.
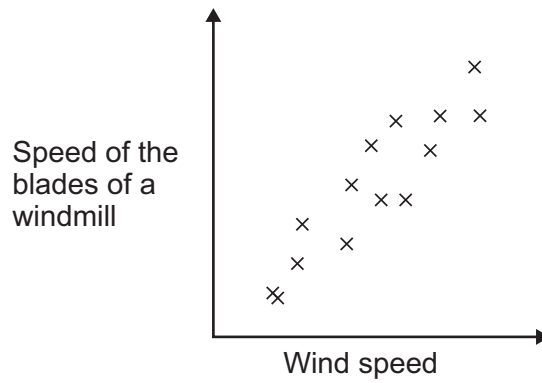You do **not** need to calculate the coefficient.

[2 marks]

Product moment correlation coefficient	0.619	0.970	−0.0153	−0.608
Scatter diagram				

Question 3 continues on the next page

Turn over ▶

3 (c) The scatter diagram shows the correlation between the speed of the blades of a windmill and wind speed.

Speed of the blades of a windmill

Wind speed

Bill looks at the diagram and says,
"Increasing the speed of the blades of the windmill causes the wind speed to increase."

Is Bill correct?
Explain your answer.

[1 mark]

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4

4 Every weekday, Alex drives from home to work.

He notices that his journey time changes depending upon the time he leaves home.

He collects this data over a 2-week period.

Leaving time, T (minutes after 7.30 am)	45	15	35	5	10	25	40	0	30	20
Journey time, J (minutes)	19	32	22	34	21	38	21	36	23	27

4 (a) Complete the scatter diagram of J against T by plotting the last two points from the table above.

[1 mark]
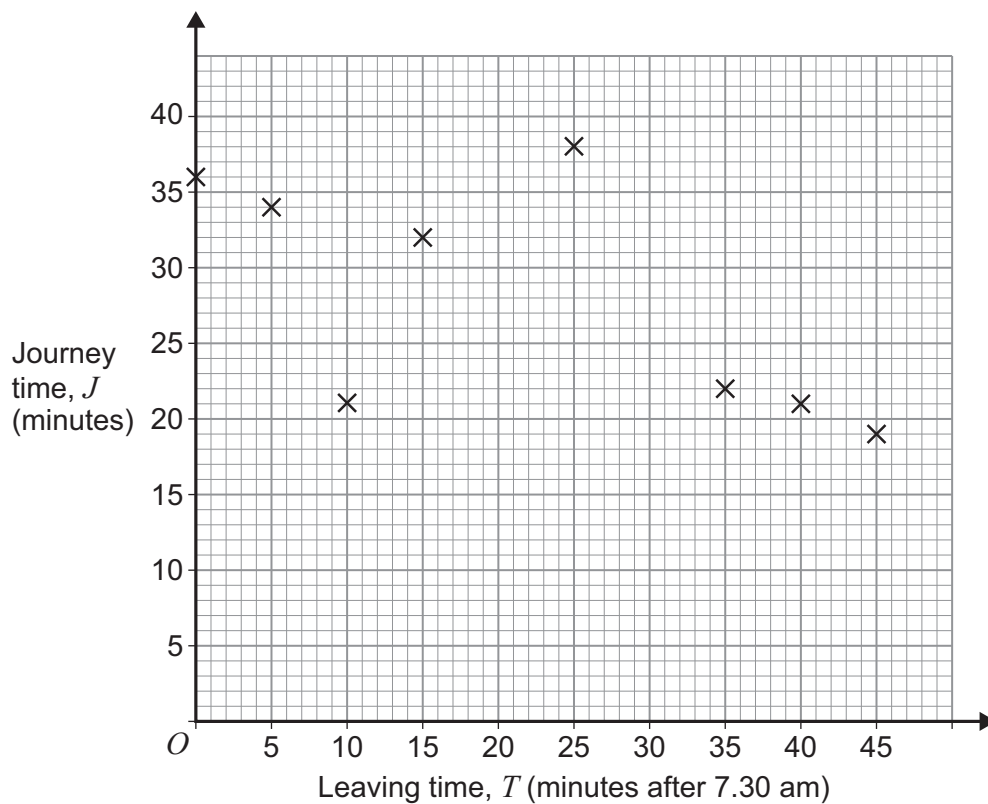
Question 4 continues on the next page

Turn over ▶

4 (b) (i) It is appropriate to exclude two of the points when calculating the equation of the regression line of J on T.

Identify the two points.

Give a reason for your answer.

[2 marks]

The points are (____ , ____) and (____ , ____)

Reason

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4 (b) (ii) Excluding the two points you identified in question **4 (b) (i)**, calculate the equation of the regression line of J on T.

[2 marks]

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Answer _____

4 (b) (iii) Draw your regression line on the scatter diagram.

[2 marks]

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4 (c) Work out the time that Alex should leave home in order to arrive at 8.30 am.

[4 marks]

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Answer _____

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Turn over ▶

5 Students on a business course are planning to set up a sweet shop in their college as part of their enterprise project.

The average weekly sales, in £, of sweet shops in similar-sized colleges are normally distributed with mean μ and variance 1750

A random sample of sweet shops in 18 similar-sized colleges had the following average weekly sales, in £.

210	308	312	195	265	251	215	224	262
294	190	233	320	196	240	271	320	245

5 (a) Construct a 95% confidence interval for μ.

[5 marks]

Answer _____

5 (b) The students on the business course claim that the mean of the average sales of sweet shops in similar-sized colleges is £250 per week.

Comment on this claim.

You do **not** need to do any additional working to answer this question.

[2 marks]

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Turn over for the next question

7

Turn over ▶

6 A person's total cholesterol level is the amount of cholesterol in their blood.

The UK government recommends that healthy adults should have a total cholesterol level below 5.0 millimoles per litre (mmol/l).

The total cholesterol level of an adult in the UK can be modelled by a normal distribution with mean 5.6 mmol/l and standard deviation 1.3 mmol/l.

6 (a) Work out the probability that a randomly chosen adult in the UK has a total cholesterol level below 5.0 mmol/l.

[3 marks]

Answer _____

6 (b)   Show that approximately one in every three adults in the UK has a total cholesterol level within 10% of the mean total cholesterol level.

[4 marks]

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Question 6 continues on the next page

Turn over ▶

6 (c)   Estimate the total cholesterol level exceeded by 75% of adults in the UK.

[3 marks]

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Answer _____

6 (d) A healthcare research company claims that adults in a small town in the UK have lower total cholesterol level than the mean for all adults in the UK.

They recorded the total cholesterol level, in mmol/l, of 10 adults in the small town.

Here are the results.

5.5   5.7   3.4   5.8   5.7   3.9   3.7   5.4   4.9   6.1

6 (d) (i) Show an appropriate calculation to justify their claim.

[1 mark]

6 (d) (ii) Suggest **one** way that the company could improve the accuracy of their claim.

[1 mark]

12

Turn over for the next question

Turn over ▶

7 (a)   Define a simple random sample.

[1 mark]

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7 (b)   Here is a list of the teachers at a secondary school.

Ms Young	Mr Burns	Mr Chan	Mr Lunn	Ms Carr
Mr Singh	Mr Davies	Ms Gibson	Ms Root	Mr Jas
Ms Amat	Ms Walton	Ms Jaleel	Ms Kang	Ms Fisher
Ms James	Mr Smith	Mrs Khan	Ms Jones	Mr Ganzert
Mr Cook	Ms Hobbs	Ms Osborne	Mr Fairly	Mr Pritchard

To check a new marking policy, the headteacher wants to look at the marking of five teachers.

She plans to choose the five teachers using simple random sampling.

To do this she uses this table of random numbers.

13962	70992	65172	28053	02190	83634	66012	70305	66761
11641	43548	30455	07686	31840	03261	89139	00504	48658
92002	63606	41078	86326	61274	57238	47267	35303	29066
96719	43753	21159	16239	50595	62509	61207	86816	29902
21636	68192	84294	38754	84755	34053	94582	29215	36807
79551	42003	58684	09271	68396	19110	55680	18792	41487
45347	88199	82615	86984	93290	87971	60022	35415	20852
05621	37293	26584	36493	63013	68181	57702	49510	75304
83025	46063	74665	12178	10741	58362	84981	60458	16194
23310	74899	87929	66354	88441	96191	04794	14714	64749
49602	94109	36460	62353	00721	66980	82554	90270	12312
70437	97803	78683	04670	70667	58912	21883	33331	51803
78984	29317	27971	16440	62843	84445	56652	91797	25842

Describe **in detail** a method she could use to choose a simple random sample of five teachers.

Showing **all** working, give the names of the five teachers she would choose by using this method.

[5 marks]

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END OF QUESTIONS