Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

Level 3 Certificate
MATHEMATICAL STUDIES

Paper 2A Statistical techniques

Wednesday 25 May 2016 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 questions in the space 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 that 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 **Facebook Facts** on page 2 of the Preliminary Material.

1 (a) According to the article, Facebook had 1230 million monthly active users worldwide by the end of 2013

Circle 1230 million written in standard form.

[1 mark]

1230×10^6 1.23×10^7 1.23×10^8 1.23×10^9

1 (b) Suggest **two** improvements that could be made to the presentation of the bar chart in the article.

[2 marks]

Improvement 1

Improvement 2

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1 (c) Joe has just started working for Survey Hunt, a social media research company.

Joe calculates the mean increase in the number of active Facebook users per year from the beginning of 2008 to the end of 2013

His calculation is as follows.

$$\frac{(145 - 58) + (360 - 145) + (680 - 360) + (845 - 608) + (1056 - 845) + (1230 - 1056)}{5}$$

Critically analyse Joe's calculation, stating any corrections or improvements that could be made.

[3 marks]

Do not write outside the box

1 (d) Just before Facebook bought Instagram, Facebook had 900 million users.

As part of the purchase, each Instagram user was automatically given a Facebook account.

On 10 April 2012, Survey Hunt carried out a survey about the public's opinion of social media.

A sample of 350 people with Facebook accounts took part in this survey.

Of these 350 people, 25 were Instagram users who had just been given a Facebook account.

Survey Hunt claimed that its survey fairly represented the Instagram users who had just been given a Facebook account.

Does the data support the claim?
You **must** show your working.

[4 marks]

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1 (e) On 4 February 2014, Lena had 50 shares in Facebook.

The exchange rate that day was £1 = $1.60

She said,

"My shares in Facebook are worth more than £2000"

Was she correct?
You **must** show your working.

[2 marks]

Turn over for the next question

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2 Use **Global Adult Literacy** on page 3 of the Preliminary Material.

2 (a) Some members of UNESCO suggested that the data had not been presented well.

2 (a) (i) Give one reason why they might suggest this with regard to **Figure 1**

[1 mark]

2 (a) (ii) Give one reason why they might suggest this with regard to **Table 1**

[1 mark]

2 (b) The two statements below were made on an online forum discussing adult literacy rates.

'The number of literate adults in the world in 2012 reached nearly 4.2 billion.'

(Paul)

'Central Asia has made the greatest progress in improving adult literacy over the past two decades.'

(Rena)

Critically analyse these two statements.
Show working to justify your comments.

[6 marks]

Paul's statement

Do not write outside the box

Rena's statement

Do not write outside the box

3 Debbie is the principal of a sports college.

She states,

> *"On average the students at our college are taller than the athletes in the 2012 Olympics."*

The mean height of athletes in the 2012 Olympics was 176.9 cm

Assume the heights, in centimetres, of the students at the college are normally distributed with mean μ and variance 40

A random sample of 10 students from the sports college had the following heights, in centimetres.

173	186	176	185	186	175	179	184	188	173

Calculate a 90% confidence interval for μ
Hence comment on Debbie's statement.

[6 marks]

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4 For a piece of coursework, Tom and Amy decided to investigate cars passing their school between 3 pm and 4 pm

4 (a) Describe the population in their investigation.

[2 marks]

Do not write outside the box

4 (b) Tom and Amy each used a speed gun to measure the speeds of a sample of cars.

	Number of cars	**Mean speed (mph)**
Tom	10	24.1
Amy	20	23.1

Using the information in the table, calculate, to one decimal place, the point estimate for the population mean.

[3 marks]

Answer _____ mph

Turn over for the next question

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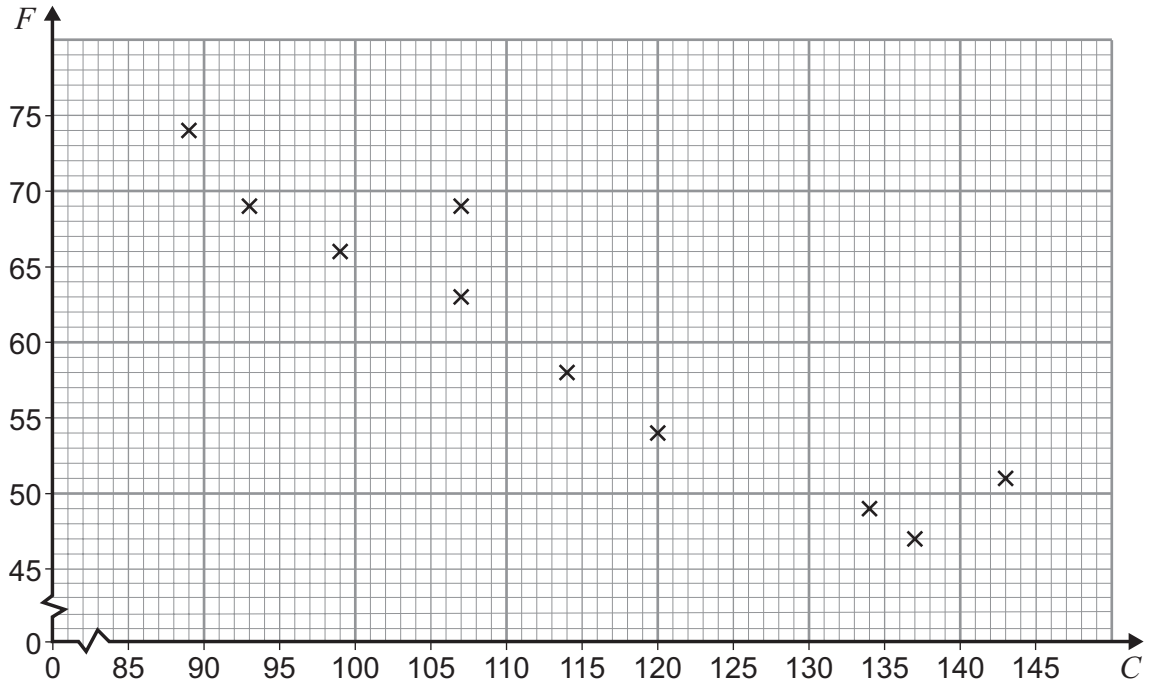
4 (c) Tom also recorded the make and model of each car in his sample.

For each car, he found the figures for
the fuel economy in miles per gallon (F)
the CO_2 emissions in grams per kilometre (C)

He plotted F against C on this scatter diagram.



Calculate the equation of the regression line of F on C.

Draw the regression line on the scatter diagram.

You may use the table below if you wish.

[6 marks]

C										
F										

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4 (d) You have to pay vehicle tax if you own a car.

The vehicle tax you pay depends on the CO_2 emissions of your car, as shown in the table.

Band	**A**	**B**	**C**	**D**	**E**	**F**
CO_2 emissions (g per km)	Up to 100	101–110	111–120	121–130	131–140	141–150
Vehicle tax per year	£0	£20	£30	£110	£130	£145

You want to buy a car for which the vehicle tax is not more than £30 per year.

Using your graph or the equation of the regression line of F on C, estimate the minimum fuel economy of a car you might buy.

[3 marks]

Answer _____ mpg

Turn over for the next question

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5 Ten students are selected to take a Maths test, an English test and a Science test.

Kenny is absent for the Science test.

Here are the test scores.

	Maths	**English**	**Science**
Cathy	14	50	28
Seema	30	42	26
Olena	39	68	30
Joanne	45	45	37
Kenny	95	65	*absent*
Beth	50	35	45
Shazia	57	85	39
John	67	50	58
Harry	79	44	59
Abdul	63	72	74

A teacher wants to estimate Kenny's score in the Science test.

Using statistical analysis and reasoning, advise the teacher whether she should use scores from the Maths test or the English test to help her.

You must comment on the validity of the score the teacher will award Kenny in the Science test if she follows your advice.

You **do not** need to estimate Kenny's score in the Science test.

[5 marks]

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6 Charles travels to work by bus.

The time he leaves home depends on which of two buses, A and B, he decides to travel on.

Bus A

Time he leaves home	8.30 am
The mean time he takes to get to work	26 minutes
The standard deviation of the time to get to work	4 minutes

Bus B

He leaves home at 8.35 am

Here are the times, in minutes, he takes to get to work on 10 randomly selected days using bus B.

23	22	26	20	20
23	27	20	23	26

6 (a) Compare the times he arrives at work using bus A and bus B.

[6 marks]

Do not write outside the box

Turn over ▶

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6 (b) Charles aims to get to work between 8.55 am and 9.00 am

Which bus should he travel on to have a better chance of doing this?

You **must** show your working, using a suitable probability distribution.

State **one** assumption you make.

[9 marks]

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END OF QUESTIONS

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