AQA

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 24 May 2017 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.

For Examiner's Use	
Pages	Mark
2 – 3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 - 17	
18 - 19	
TOTAL	

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.

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

1 Oliver is researching costs for a new smartphone he is planning to buy.
He collects information from **five** mobile network operators.

The network operators offer the phone on a rental contract or on pay-as-you-go.
Users must also make a one-off payment for the phone.

He produces the table below.

Operator	One-off payment for the phone	Rental cost
A	£189.99p	£25
B	£129.99p	£36
C	£99.99p	£49
D	£9999p	£0 (pay-as-you-go)

1 (a) Analyse Oliver's table, identifying **two** errors.

Then suggest **two** improvements he could make to his table.

[4 marks]

Error 1

Error 2

Improvement 1

Improvement 2

1 (b) Sam works for a different mobile network operator.

She can take out a 24-month contract which costs, before staff discount,

£109.99 one-off payment for the phone

£37.49 per month rental cost.

She receives a 30% staff discount on the monthly rental cost only.

Sam does **not** want to spend more than £700 on the phone over the 24 months.

Should she take out the contract?

You **must** show your working.

[4 marks]

8

2 Use **Youth Unemployment** from the Preliminary Material.

2 (a) Work out the decrease, between September–November 2014 and June–August 2015, in the number of people aged 16–24 who were unemployed.

Circle your answer.

[1 mark]

56 000 80 000 136 000 192 000

2 (b) Two newsletters contained articles about the unemployment rate of the economically active population aged 16–24 in September–November 2015

Here are the two headlines.

Unemployment rate for 16–24 year olds declines by one fifth in one year!

Always Young newsletter

For economically active 16–24 year olds, the ratio of men to women is about 11 : 10

Dynamic Youth newsletter

Using the data given, comment on the validity of these headlines.

[8 marks]

Always Young

Dynamic Youth

9

Question 2 continues on the next page

2 (c) An independent body overseeing the quality of government reports suggested that the briefing paper could have been improved.

Suggest **three improvements** for future briefing papers.

[3 marks]

Improvement 1

Improvement 2

Improvement 3

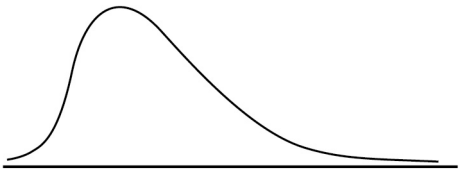
3 William teaches English.

His class sat an exam.

The marks of the students can be modelled by a normal distribution.

3 (a) Which of the following diagrams shows a normal distribution?
Tick **one** box.

[1 mark]



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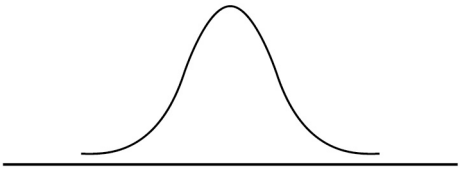

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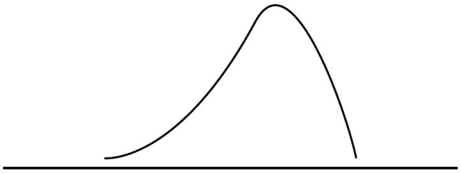

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4

Question 3 continues on the next page

3 (b) The marks have mean 65 and standard deviation 11

According to the model, 40% of his students scored more than M marks.

Work out the value of M

[3 marks]

Answer _____

3 (c) There are 30 students in William's class.

Students who scored more than the mean mark in the exam will each receive a voucher worth £5 as a reward.

William uses the normal distribution model to conclude that it will **not** cost more than £70 to reward these students.

Is William correct?
You **must** show your working.

[2 marks]

5

Question 3 continues on the next page

3 (d) Other students in the same year group will sit the same exam.

The pass mark for the exam is 60

If the distribution of their marks matches that of William's class, with mean 65 and standard deviation 11, approximately 140 of these students are expected to pass.

How many students are there **in total** in the year group?

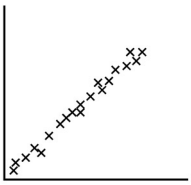
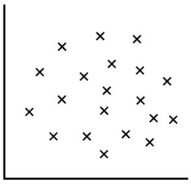
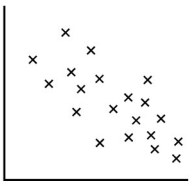
[4 marks]

Answer _____

4 Jamir and Lily are investigating different types of correlation between two sets of data.

4 (a) Match each scatter diagram below to the most appropriate type of correlation.

[2 marks]

Scatter diagram	Type of correlation
	Weak negative correlation
	Weak positive correlation
	Strong negative correlation
	Strong positive correlation
	No correlation

6

Question 4 continues on the next page

Jamir and Lily each wear a special band that measures

the number of steps walked each day (S)

the number of calories burned each day (C)

The tables below show Jamir's data and Lily's data for the last eight days.

Jamir

S	5900	7400	8300	8600	9700	9900	11 600	12 500
C	2560	2680	2810	2700	2970	2940	3070	3290

Lily

S	14 000	4600	3300	4600	3900	12 200	16 300	5400
C	2320	2400	1980	2000	1960	2420	2780	2200

4 (b) Jamir and Lily want to know if it is justified to use S to estimate C

By calculating the product moment correlation coefficient between S and C, show that this is justified for Jamir's data.

[2 marks]

4 (c) Calculate the product moment correlation coefficient between S and C for Lily's data.

Hence explain why Jamir's estimate of C is likely to be more accurate than Lily's estimate of C for any given value of S

[2 marks]

4

Question 4 continues on the next page

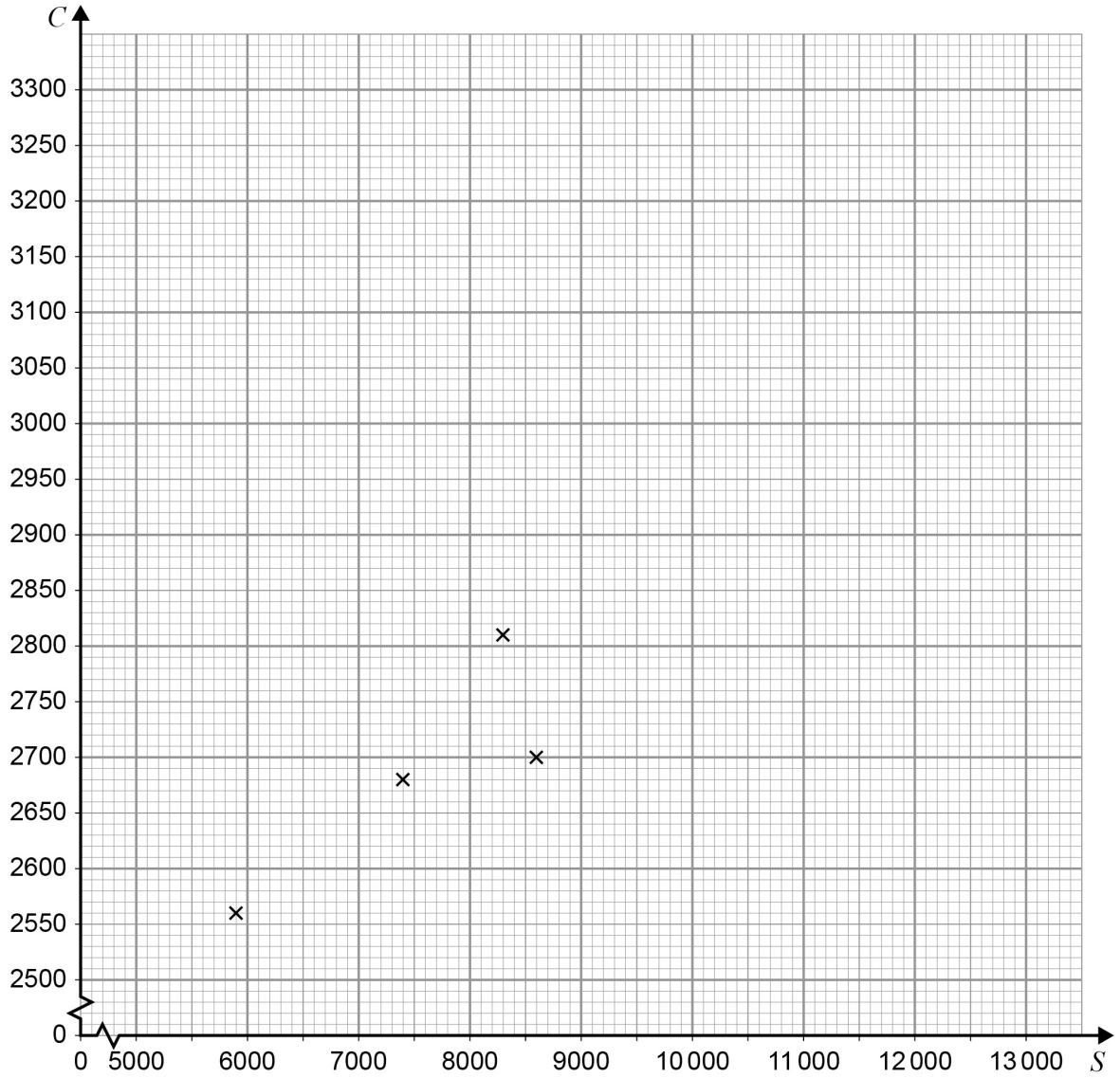
4 (d) (i) Complete the scatter diagram of C against S for **Jamir's** data on the grid below.

The table with Jamir's data is repeated below.

Jamir

S	5900	7400	8300	8600	9700	9900	11 600	12 500
C	2560	2680	2810	2700	2970	2940	3070	3290

[2 marks]



4 (d) (ii) Calculate the equation of the regression line of C on S for Jamir's data.

Draw your regression line on the scatter diagram for values of S from 6000 to 12 000

[4 marks]

4 (d) (iii) Jamir wants to burn at least 20 000 calories each **week**.

Work out the minimum number of steps he should aim to walk each **day**.

[3 marks]

Answer _____

9

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5 Sophie is a 400-metre runner.

She records her training times in seconds.

Her training times can be modelled by the distribution $N(59.6, 1.5^2)$.

5 (a) Write down the standard deviation of Sophie's training times.

[1 mark]

Answer _____ seconds

5 (b) Work out the probability that Sophie's next training time will be between 59.0 seconds and 59.8 seconds.

[4 marks]

Answer _____

5

6 Human body temperature, in °C, may be modelled by a normal distribution with mean μ and variance σ^2

Emily, a medical student, measured the body temperature of a random sample of 20 patients in a hospital.

She calculated a 90% confidence interval for the mean body temperature of patients in the hospital to be (35.2, 41.8).

6 (a) Calculate a 99% confidence interval for μ

[8 marks]

Answer _____

6 (b) Emily claims that the mean body temperature of patients in the hospital is above 37°C.

Comment on her claim.

[2 marks]

10

END OF QUESTIONS

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