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

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)

Morning

- a scientific calculator or a graphics calculator
- a ruler.

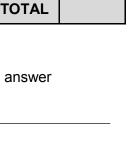
Instructions

- 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.





For Examiner's Use

Mark

Pages

2 - 3

4 – 5

6 - 7

8 – 9

10 – 11

12 - 13

14 – 15

16 - 17

18 - 19



Do not write outside the

box

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
В	£129.99p	£36
С	£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



	•	•	
1	-	5	
•		,	

	3	Do not write outside the box
	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	1
		_
		-
		-
		-
		_
		-
		8



Turn over ►

Do not write outside the

box

2	1

Use Youth Unemployment from the Preliminary Material.

		etween September d 16–24 who were	-November 2014 ar unemployed.	nd June–August 20	15, in
Circle you	ur answer.			[1]	mark]
				[
	56 000	80 000	136 000	192 000	
		d articles about the –24 in September-	unemployment rate -November 2015	e of the economical	ly
Here are	the two headline	S.			
Unemplo	yment rate for	16–24 year olds de	eclines by one fifth	in one year!	
			A	ways Young news	letter
					- │

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



2

2 (a)

2 (b)

-	۰.	
	,	
	2	נ

Do not write outside the box

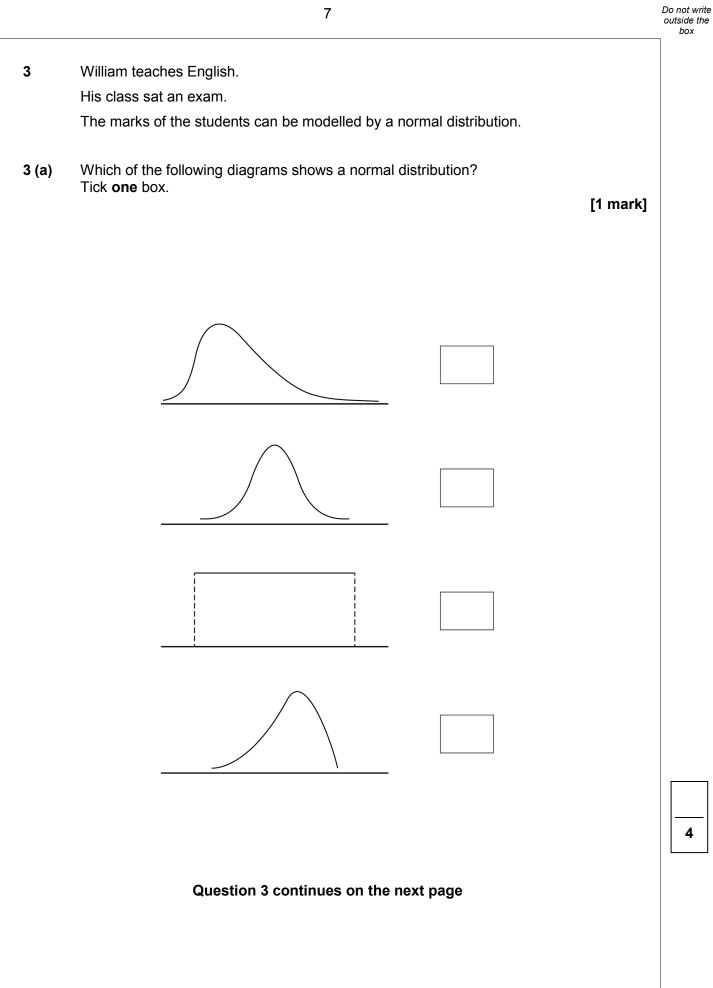
Dynamic Youth				
	Question 2 cont	inues on the ne	ext page	



www.xtrapa	pers.com
6	Do not write outside the box
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	1
Improvement 1	
	_
	_
	_
Improvement 2	-
	_
	_
	-
	_
Improvement 3	
	-
	_
	_
	_



2 (c)





Turn over ►

Do not write outside the box

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				



	9	Do not write outside the box
3 (c)	There are 30 students in William's class.	
0(0)	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	



Turn over 🕨

Do not write
outside the
box

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



	WW	w.xtra	papers.	com
--	----	--------	---------	-----

Do not write

outside the box

11

4 Jamir and Lily are investigating different types of correlation between two sets of data. Match each scatter diagram below to the most appropriate type of correlation. 4 (a) [2 marks] Scatter diagram Type of correlation Weak negative correlation ×××××, Weak positive correlation Strong negative correlation Strong positive correlation No correlation Question 4 continues on the next page Turn over ►



Do not write outside the box

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	11600	12500
С	2560	2680	2810	2700	2970	2940	3070	3290

Lily

S	14 000	4600	3300	4600	3900	12200	16 300	5400
С	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]



13

Do not write outside the box

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 mail	rks]				
	Question 4 continues on the next page					
	Turn ov	er				

[2 marks]

Do not write outside the box

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	11600	12500
С	2560	2680	2810	2700	2970	2940	3070	3290

 $C \blacklozenge$ × × × 0] 11 000 Ś



Do not write outside the box

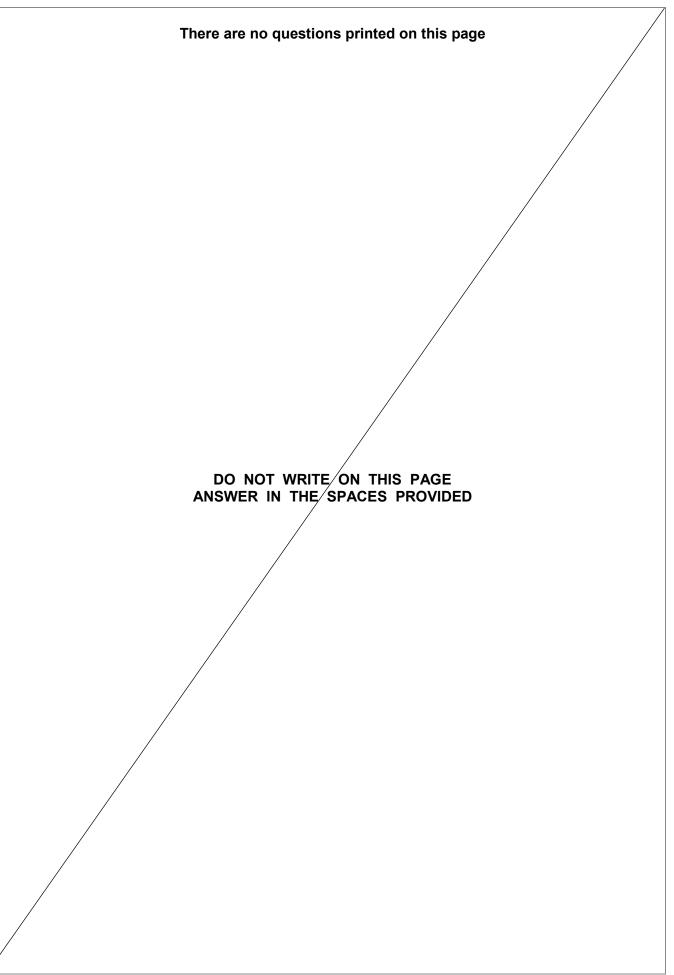
	Draw your regression line on the scatter diagram for values of \boldsymbol{S} from 6000 to	12 000 [4 marks]
(-1) (!!!)	landia wanta ta huma at la ast 00.000 as lania a sa huma la	
(a) (III)	Jamir wants to burn at least 20 000 calories each week .	
	Work out the minimum number of steps he should aim to walk each day .	[3 marks]
	Work out the minimum number of steps he should aim to walk each day .	[3 marks]
	Work out the minimum number of steps he should aim to walk each day .	[3 marks]
	Work out the minimum number of steps he should aim to walk each day .	[3 marks]
	Work out the minimum number of steps he should aim to walk each day .	[3 marks]
	Work out the minimum number of steps he should aim to walk each day .	[3 marks]
	Work out the minimum number of steps he should aim to walk each day.	[3 marks]
	Work out the minimum number of steps he should aim to walk each day.	[3 marks]
	Work out the minimum number of steps he should aim to walk each day .	[3 marks]
	Work out the minimum number of steps he should aim to walk each day.	[3 marks]
	Work out the minimum number of steps he should aim to walk each day.	[3 marks]
	Work out the minimum number of steps he should aim to walk each day.	[3 marks]
	Work out the minimum number of steps he should aim to walk each day.	

1 5

Turn over ►



Do not write outside the box





	17		Do not write outside the box
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 5	9.0 seconds	
	and 59.8 seconds.	[4 marks]	
			_
			-
			_
			-
			_
			-
			_
			-
			_
			-
			5
			-
	Answer		
			-



Turn over 🕨

Do not write outside the box

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).								
Calculate a 99% confidence interval for μ [8 marks]								

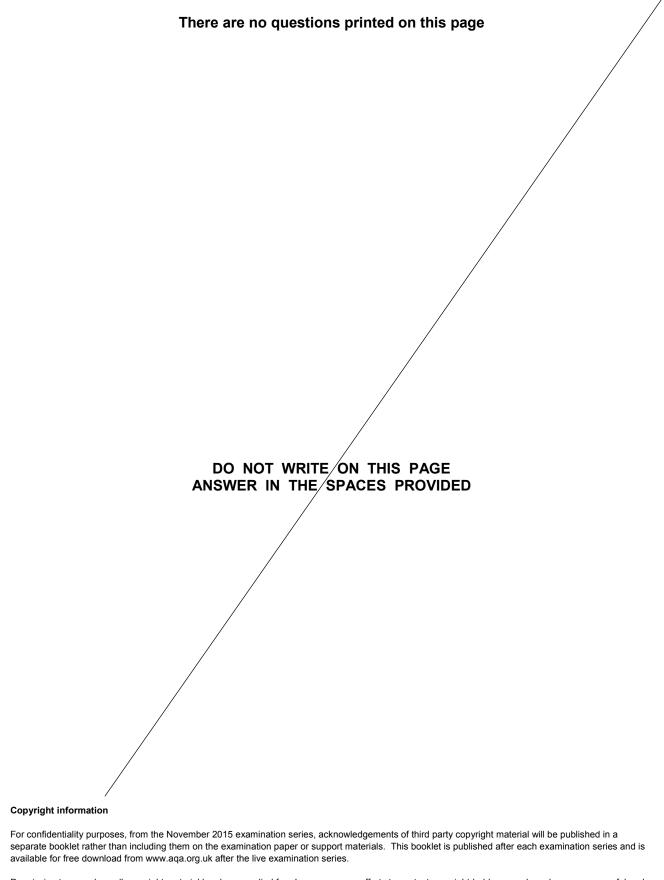


	19	Do not write outside the box
		_
		_
		_
		_
		_
		_
		_
		_
	Answer	
6 (b)	Emily claims that the mean body temperature of patients in the hospital is above 37°C.	
. ,	Comment on her claim.	
	[2 marks]	
		_
		_
		_
		_
		10
		_
	END OF QUESTIONS	
	END OF QUESTIONS	





Do not write outside the box



Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team, AQA, Stag Hill House, Guildford, GU2 7XJ.

Copyright © 2017 AQA and its licensors. All rights reserved.

