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I declare this is my own work.

# Level 3 Certificate MATHEMATICAL STUDIES

## Paper 2A Statistical Techniques

Thursday 23 May 2024

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.
- 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
<b>TOTAL</b>	

### 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.



J U N 2 4 1 3 5 0 2 A 0 1

G/LM/Jun24/G4001/E6

**1350/2A**

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

**1** Use **Economics of music streaming** from the Preliminary Material.

**1 (a)** Use the information in **Graph 2** to estimate the number of premium Google (including YouTube Music) subscriptions there were in the UK in January 2020

Which is the best estimate?

Tick (✓) **one** box.

**[1 mark]**

Nine million

Nine hundred thousand

Ninety thousand

Nine thousand

**1 (b)** Suggest two improvements that could be made to the **graphs** on pages 2 and 3 of the Preliminary Material.

**[2 marks]**

Improvement 1 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Improvement 2 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



**1 (c)** Readers of the extract commented that it was difficult to follow **Diagram 1**

Give **one** reason why they might have said this.

[1 mark]

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**1 (d)** In a sports club,

20 players are daily active users of BBC Sounds

27 players are weekly active users of BBC Sounds.

Compare

the proportion of listeners at the sports club who are daily active users  
with

the proportion of all consumers who are daily active users.

Use the information in **Graph 1** to justify your comparison.

[2 marks]

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**Question 1 continues on the next page**

**Turn over ►**



1 (e) Two music websites commented on the report.

Streaming services kept more money than was given to recording artists and songwriters/composers combined.

*The Recorder*

For every 4 Amazon Music Prime subscriptions, there were about 7 Spotify subscriptions.

*Waxing Lyrical*

Using the Preliminary Material, comment on the validity of each website's claim.

You **must** show your working.

**[4 marks]**

The Recorder

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Waxing Lyrical

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1 (f) Another music website made this claim.

Only 13% of consumers do **not** use a streaming service daily.

*The Daily Fret*

Is the website's claim correct?

Use **Graph 1** to justify your answer.

[1 mark]

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11

Turn over for the next question

Turn over ►



**2** Use **Economics of music streaming** from the Preliminary Material.

Molly is researching how the income from Spotify was shared out in 2020

In 2020, the price of a Spotify premium subscription was £9.99 per month in the UK

**2 (a)** Molly disagreed with the report, saying,

“As VAT is 20%, the Government should receive almost £2 for each monthly subscription, not £1.67”

Is Molly correct?

Show working to justify your answer.

**[3 marks]**

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- 2 (b)** Molly used the following method to estimate the total amount of Spotify's UK subscription revenue that should have been received by **recording artists** in 2020

Yearly subscription cost was  $£9.99 \times 12 = £119.88$

There were  $226\,000\,000 \times 0.44 = 99\,440\,000$  subscribers in the UK

Total UK subscription revenue was  $99\,440\,000 \times £119.88 = £11\,920\,867\,200$

Recording artists received  $£11\,920\,867\,200 \times 0.0165 = £196\,694\,308.80$

So, around £200 million.

Identify **two** mistakes in Molly's calculation.

You do **not** need to carry out any calculations.

**[2 marks]**

Mistake 1

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Mistake 2

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5

**Turn over for the next question**

**Turn over ►**





4 For each statement, tick one box to say if it is true or false.

[2 marks]

	True	False
The mean of a sample is a point estimate		
A point estimate of the mean is an estimate of the population mean		
All point estimates of the mean must have the same value		

2

Turn over for the next question

Turn over ►



**5** The income tax, £ $X$ , paid last year by workers in a company can be modelled by a normal distribution with mean  $\mu$  and standard deviation  $\sigma$

**5 (a)** Draw a line from each box on the left to the box with the most appropriate percentage.

**[3 marks]**

	0%
$P(X > \mu)$	1%
$P(\mu - 2\sigma < X < \mu + 2\sigma)$	50%
$P(X = \mu)$	67%
	95%
	100%

**5 (b)** Three quarters of the workers paid less than £15 000 income tax last year.

Circle the correct statement about the gradient of the normal bell-shaped curve at  $X = 15000$

**[1 mark]**

It is negative

It is 0

It is positive

4



**6** Roshi is doing a study on the electricity use in houses across a town.  
Roshi selects a random sample of 16 houses for the study.

**6 (a)** State the population of the study.

**[1 mark]**

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**6 (b)** Give **one** reason why Roshi uses a sample.

**[1 mark]**

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**Question 6 continues on the next page**

**Turn over ►**



**6 (c)** The average electricity use per day, in kWh, is normally distributed with mean  $\mu$  and variance 1.7

Here is the average electricity use per day, in kWh, recorded by Roshi at the 16 houses.

8.5	9.7	11.0	8.6	6.3	9.3	7.5	7.2
7.8	8.5	9.2	8.7	11.0	10.0	9.1	8.6

**6 (c) (i)** Use these values to construct a 95% confidence interval for  $\mu$

**[5 marks]**

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Answer \_\_\_\_\_



- 6 (c) (ii)** Roshi realises he has made a mistake.  
Each value recorded is 0.5 kWh less than the actual value.

State the correct 95% confidence interval for  $\mu$

[1 mark]

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Answer \_\_\_\_\_

- 6 (d)** Roshi decides to use a larger sample of houses in the town.  
The sample now contains 50 houses.

What effect should the larger sample have on the **width** of the 95% confidence interval?

Circle your answer.

[1 mark]

Decrease

Stay the same

Increase

9

**Turn over for the next question**

**Turn over ►**



- 7 A manufacturer selected nine wooden letters in order to compare their height, width and mass.

Not drawn to scale

**ELTAKSCP**

Here is the data for eight of the letters.

Letter	Height (cm)	Width (cm)	Mass (g)
A	0.8	2.0	22
C	0.9	1.3	12
E	1.2	2.2	37
K	0.8	1.5	18
L	1.3	2.3	40
P	1.1	1.6	19
S	0.9	1.7	25
T	1.3	1.9	31



The letter V has height 1.7 cm and width 3.0 cm but its mass is unknown.

**7 (a)** Which value should the manufacturer use to predict the mass of the letter V, its height or its width?

Use a statistical measure to explain your decision.

**[4 marks]**

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**7 (b)** By comparing the height and width of V with the other letters, comment on the reliability of the predicted mass of V.

**[1 mark]**

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5

**Turn over for the next question**

**Turn over ►**



**8** One day, the time spent on social media by the students in a school is normally distributed with mean 140 minutes and standard deviation 25 minutes.  
A student at the school is chosen at random.

**8 (a)** Calculate the probability that the time the student spent on social media

**8 (a) (i)** was under 175 minutes.

**[2 marks]**

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Answer \_\_\_\_\_

**8 (a) (ii)** was above 130 minutes.

**[2 marks]**

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Answer \_\_\_\_\_

**8 (a) (iii)** did not exceed 50% of the mean time.

**[2 marks]**

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Answer \_\_\_\_\_



- 8 (b)** The probability that the student spent between  $t$  minutes and 170 minutes on social media is 0.3

Work out the value of  $t$

**[4 marks]**

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$t =$  \_\_\_\_\_

10

**Turn over for the next question**

**Turn over ►**



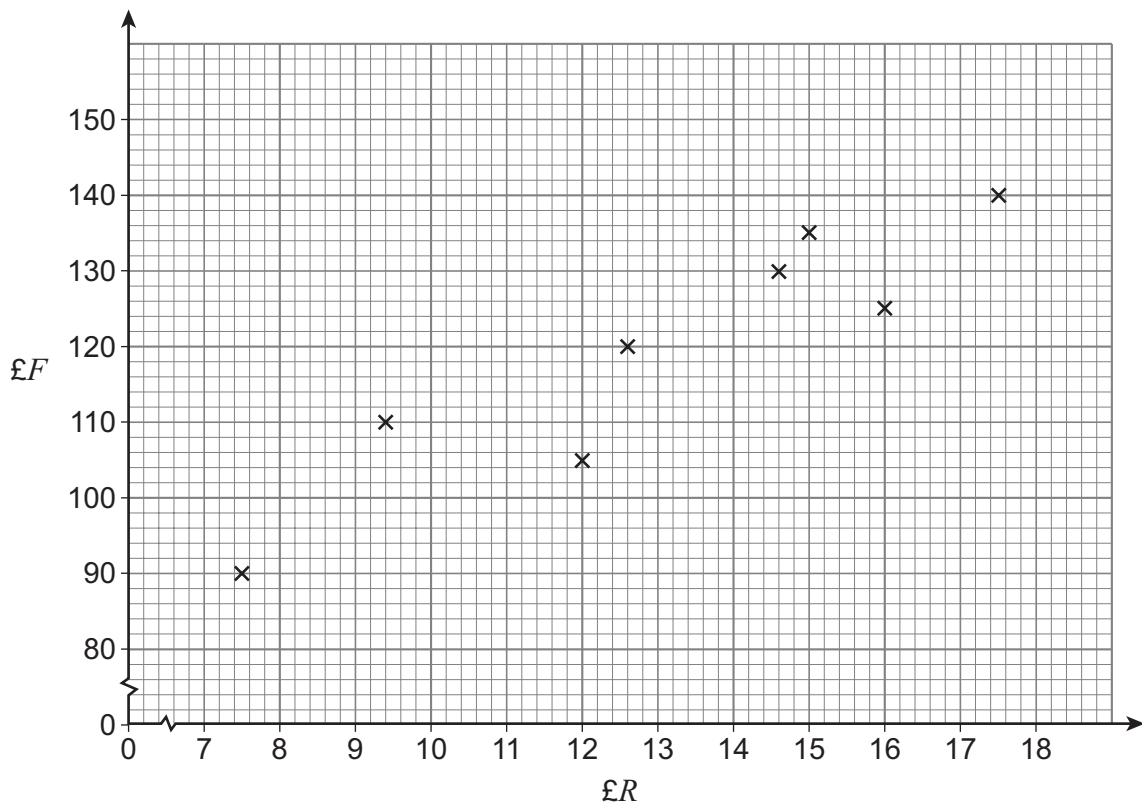
- 9 For eight workers, their hourly pay,  $\pounds R$ , and the average amount they spend per week on food,  $\pounds F$ , is recorded.

Hourly pay, $\pounds R$	7.50	9.40	12.00	12.60	14.60	15.00	16.00	17.50
Amount spent on food, $\pounds F$	90	110	105	120	130	135	125	140

The data is plotted on the following scatter diagram.

- 9 (a) Calculate and plot the mean point.

[2 marks]




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- 9 (b) Give **one** reason why a regression line of  $F$  on  $R$  is likely to be a good fit for the data.

[1 mark]

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**9 (c) (i)** Calculate the equation of the regression line of  $F$  on  $R$

**[2 marks]**

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Answer \_\_\_\_\_

**9 (c) (ii)** Draw the regression line on the scatter diagram.

**[2 marks]**

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**9 (d)** A worker has an hourly pay of £11.00

Estimate the average amount this worker spends per week on food.

**[2 marks]**

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£ \_\_\_\_\_

**9 (e)** A different worker spends on average £115 per week on food.

Give **one** reason why the regression line should not be used to predict the hourly pay for this worker.

**[1 mark]**

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10

**END OF QUESTIONS**



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2 4



2 4 6 A 1 3 5 0 / 2 A

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