

Please write clearly in block capitals.

Centre number

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Candidate number

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Forename(s)

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Candidate signature

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I declare this is my own work.

# Level 3 Certificate

# MATHEMATICAL STUDIES

## Paper 1

Time allowed: 1 hour 30 minutes

### Materials

For this paper you must have:

- a clean copy of the Preliminary Material and Formulae Sheet (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 each question in the space 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.

### 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.

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



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

**1 (a)** Rasheed is collecting data about cars in a car park.

Draw a line from each variable on the left to the type of data it is.

**[3 marks]**

The amount of time each car is in the car park	Qualitative and discrete
The make of each car	Qualitative and continuous
The number of people in each car when it arrives	Quantitative and discrete
	Quantitative and continuous



- 1 (b)** Rob wants to find out what students and staff think about the parking at his college. The table shows information about the students and staff.

	Students aged 16 to 18	Students aged 19+	Staff
Male	345	129	56
Female	406	162	42

Rob decides to take a stratified sample of 80 from these groups of students and staff.

Work out the number of **male students aged 19+** that should be in the sample.

**[2 marks]**

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Answer \_\_\_\_\_

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**Turn over for the next question**

**Turn over ►**



**2** Peter took out a mortgage for £150 000 at the end of December 2021

The **annual** interest is 3.6%, charged **monthly**.

His monthly payment is £920

At the end of each month, the interest is added then the payment is deducted.

The spreadsheet shows some information about the amount he still owes at the end of each month.

	A	B
1	Month	Balance
2	Initial borrowing	150 000.00
3	January	149 530.00
4	February	149 058.59
5	March	
6	April	
7	May	147 635.86
8	June	147 158.77

**2 (a)** Complete the spreadsheet.

Give each value to the nearest penny.

**[2 marks]**

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**2 (b)** Work out the total amount of interest that Peter pays in the first six months.

**[3 marks]**

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Answer £ \_\_\_\_\_

**2 (c)** Peter wants to know what percentage of his original mortgage he has still to pay after these six months.

Circle the spreadsheet formula he can use to work this out.

**[1 mark]**

$$=(B2 - B8)/B2$$

$$=(B2 - B8)/B8$$

$$=B2/B8*100$$

$$=B8/B2*100$$

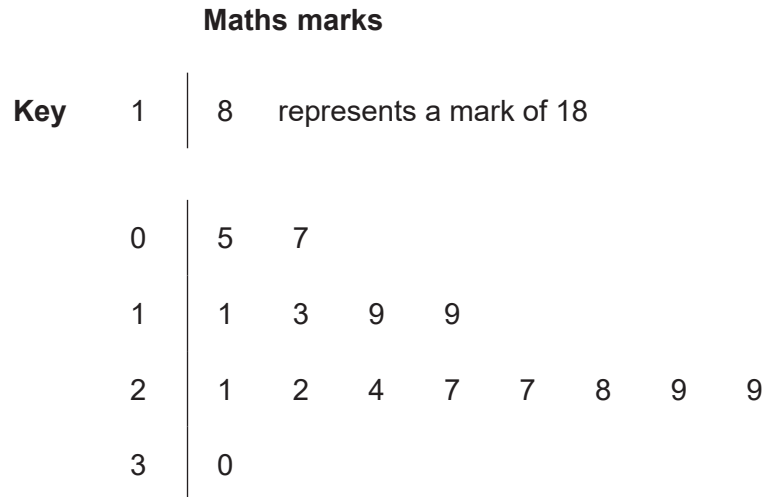
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**Turn over for the next question**

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- 3** 15 students sat a Maths exam and an English exam.  
Both exams were marked out of 30  
The stem-and-leaf diagram shows their Maths marks.



- 3 (a)** The table shows information about their English marks.

	Lowest value	Lower quartile	Median	Upper quartile	Highest value
<b>English marks</b>	3	17	19	26	28
<b>Maths marks</b>					

Complete the table to show the information for the Maths exam.

**[3 marks]**

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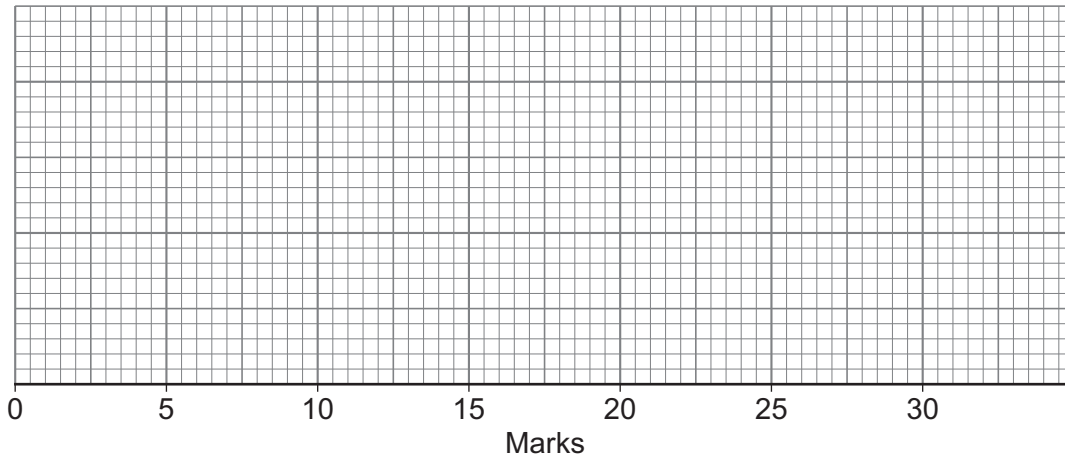


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**3 (b)** Draw box and whisker plots to represent the data for the English and Maths exams.

**[3 marks]**



**3 (c)** Compare the average marks for the English and Maths exams.

**[1 mark]**

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**3 (d)** Which marks were more consistent, English or Maths?

Give a reason for your answer.

**[1 mark]**

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- 4 (a)** Some years ago, Kelly invested £2000 in a savings account.  
Since then, she has not withdrawn money from the account but interest has been added.

The total in the account is now £2319, correct to the nearest pound.

Complete the error interval for the total amount of interest, £ $I$ , that has been added to the account.

**[2 marks]**

Answer \_\_\_\_\_  $\leq I \leq$  \_\_\_\_\_

- 4 (b)** Jessica invests an amount in a variable rate savings account.

The account receives compound interest at

2.4% per year for the first 2 years

then

3.1% per year for the next 5 years.

Jessica says,

“My investment will increase by 20.3%, because  $2 \times 2.4 + 5 \times 3.1 = 20.3$ ”

By calculating the correct percentage increase, show that she is wrong.

**[4 marks]**

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**5** Estimate the number of hours in a year that a washing machine is in use in an **average** household.

State any assumptions you make.

You **must** show your working.

**[4 marks]**

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Answer \_\_\_\_\_ hours

4

**Turn over for the next question**

**Turn over ►**



**6 Use Income Tax and National Insurance 2021–2022** in the Preliminary Material.

John has a gross income of £49 000 per year.

8% of his gross income is deducted and paid into his company pension.

He pays Income Tax and National Insurance, but has no further deductions.

He has the standard personal allowance.

The pension amount is deducted before Income Tax and National Insurance are calculated.

John wants to move to a new flat, which will cost £1050 per month to rent.

He says,

“I will only be able to afford the rent if it is less than  $\frac{2}{5}$  of my net monthly income.”

Can John afford the rent?

You **must** show your working.

**[8 marks]**

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- 7 (a)** Linda grows and sells potatoes.  
The mean mass of her potatoes in last year's crop was 193 grams.  
She sees this advert for a new fertiliser for potatoes.



**Potato fertiliser**  
Increase the average mass  
of your crop by at least 15%

Linda uses the fertiliser on her next crop of potatoes.  
The table shows the mass of these 130 potatoes when she picks them.

Mass, $m$ grams	Number of potatoes
$120 \leq m < 160$	12
$160 \leq m < 200$	23
$200 \leq m < 240$	45
$240 \leq m < 280$	32
$280 \leq m < 320$	18

Based on these two crops of potatoes, is the claim in the advert justified?  
You **must** show your working.

**[4 marks]**

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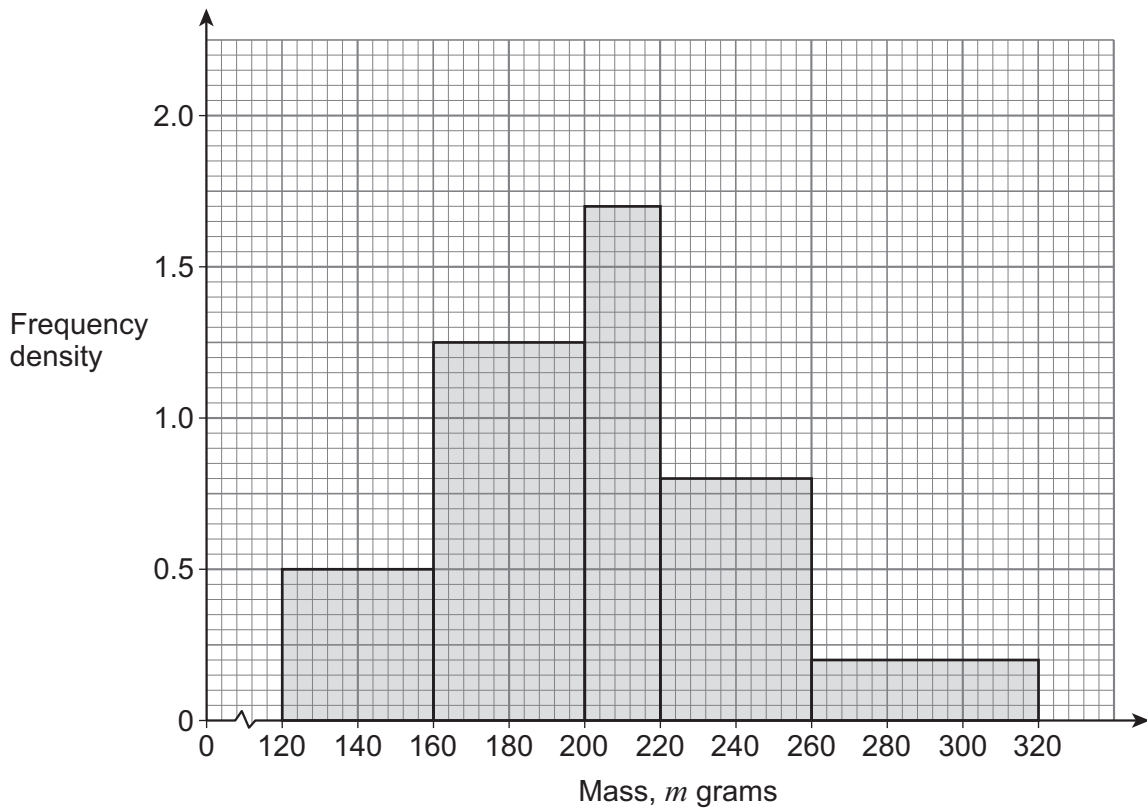


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7 (b) Dan also grows and sells potatoes.

The histogram shows the distribution of the masses of his potatoes this year.



The potatoes are classed as small, medium and large.

Medium potatoes have a mass between 188grams and 260grams.

Estimate the number of Dan's potatoes that are classed as medium.

**[4 marks]**

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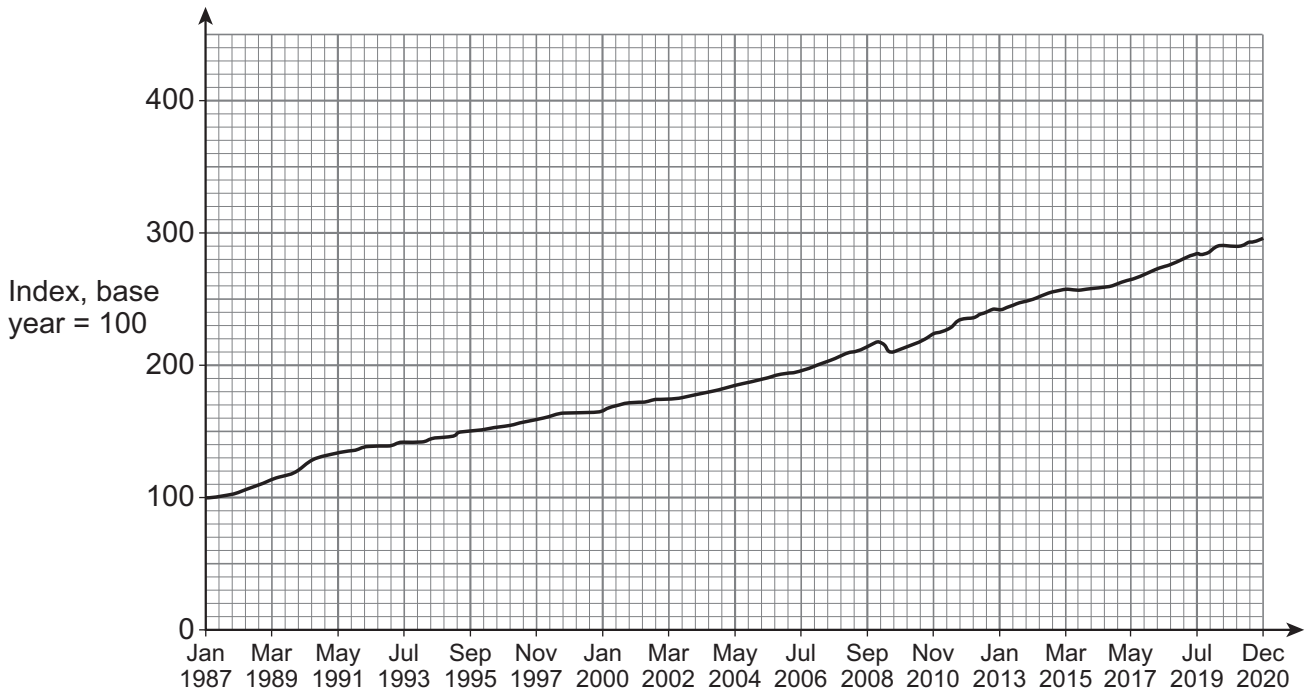
Answer \_\_\_\_\_

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Turn over ►



**8** The chart shows information about the change in the UK Retail Price Index (RPI) between January 1987 and December 2020



**8 (a)** A food item cost £1.90 in January 1987

Use the chart to estimate the cost of this food item in September 1995

**[3 marks]**

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Answer £ \_\_\_\_\_



**8 (b)** An electrical item cost £129 in December 2020

Use the chart to estimate the cost of this item in July 2006

You **must** show your working.

**[2 marks]**

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Answer £ \_\_\_\_\_

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**Turn over for the next question**

**Turn over ►**



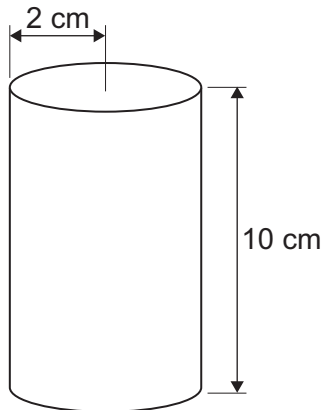
**9 (a)** Use **Sweet Factory** in the Preliminary Material.

You may also use the Formulae Sheet.

The factory is making a new sweet.

The sweet will be a **sphere** of radius 0.8 cm

The sweets will be packaged into cylindrical tubes of radius 2 cm and height 10 cm



One machine will be used for these new sweets.

It will take an hour and a half before the first sweets are produced and packaged.

Once the first sweets come off the production line in their tubes the production is continuous until the end of the day.

Estimate how many tubes of sweets can be filled in one working day.

Give your answer to a suitable degree of accuracy.

State any assumptions you make.

You **must** show your working.

**[9 marks]**

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Answer \_\_\_\_\_

**9 (b)** Explain **how** your answer may have been affected by one assumption you made.

**[1 mark]**

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**END OF QUESTIONS**



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