OCR
Oxford Cambridge and RSA

Thursday 23 May 2024 – Afternoon

Level 3 Certificate Core Maths A (MEI)

H868/02 Critical Maths

Time allowed: 2 hours

You must have:
- the Insert (inside this document)

You can use:
- a scientific or graphical calculator

H868/02

Please write clearly in black ink. **Do not write in the barcodes.**

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

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working.
- Give your final answers to a degree of accuracy that is appropriate to the context.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.

1 **Fig. 1.1** shows the annual rate of inflation in the UK from 1981 to 2021.
Fig. 1.2 shows the annual rate of inflation in Slovenia from 1981 to 2021.

Fig. 1.1

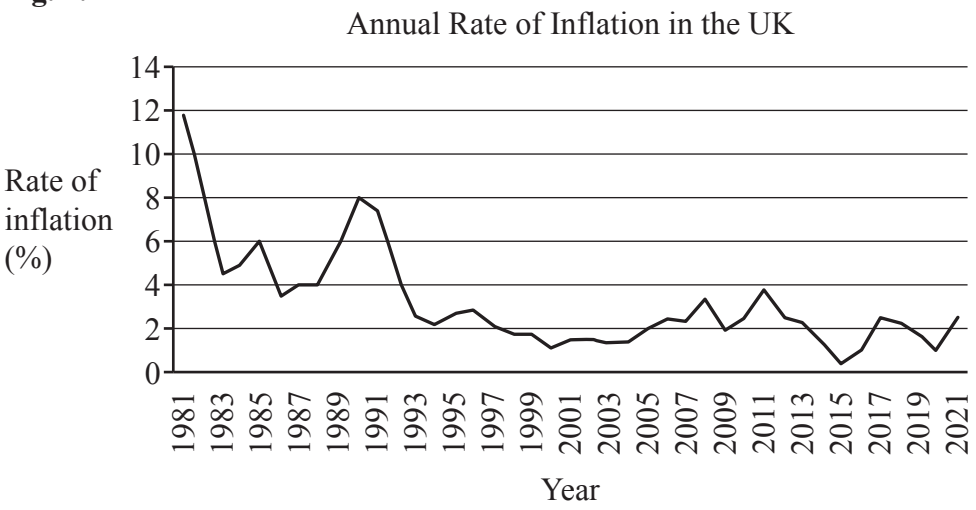
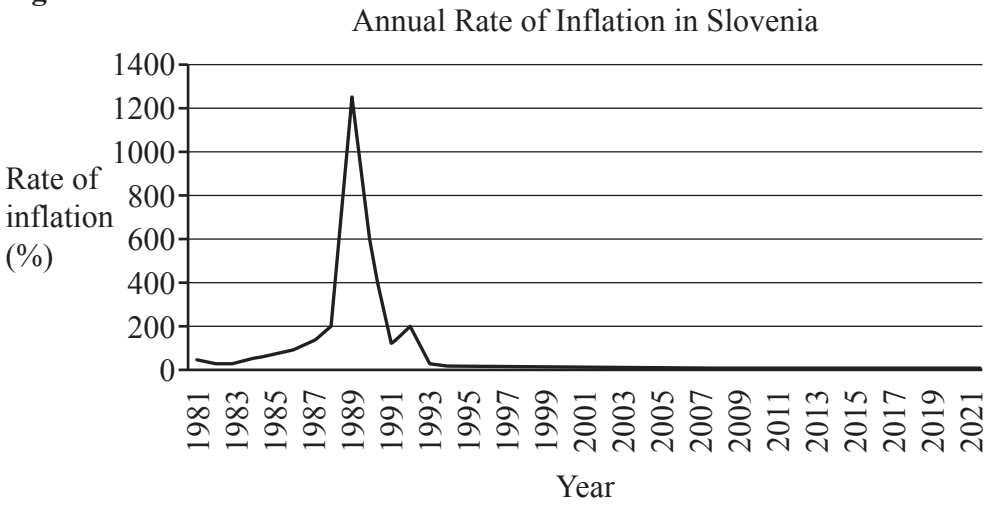


Fig. 1.2



(a) Which of the following statements are **true** and which are **false**? **[2]**

1(a) Tick **(✓) one** box in each row.

	True	**False**
Prices in the UK were going down from 1981 to 1983.		
The highest prices in Slovenia were in 1989.		
It is difficult to compare the rates of inflation in the UK and Slovenia because the vertical axes on the two graphs are different.		
It is not possible to have a rate of inflation that is over 100%.		

(b) A student says that **Fig. 1.2** shows there was no inflation in Slovenia from 2003 to 2019.

Explain why this conclusion may **not** be correct. **[1]**

1(b)	

(c) In 1989, inflation in Slovenia was just over 1200% a year.
A journalist claims that 1200% a year is equivalent to prices doubling every month.

Decide whether the journalist is correct.
Show working to support your answer. **[4]**

1(c)	

(d) **Fig. 1.3** shows the inflation rates in Slovenia and the UK in 1996 and 1997.
The percentage **point** decrease and the percentage decrease for Slovenia are also shown.

Fig. 1.3

	1996 inflation	**1997 inflation**	**Percentage point decrease**	**Percentage decrease**
Slovenia	9.9%	8.4%	1.5	15.2
UK	2.9%	2.2%		

(i) Calculate the percentage **point** decrease for the UK. **[1]**

(ii) Calculate the percentage decrease for the UK.
Give your answer to **1** decimal place. **[2]**

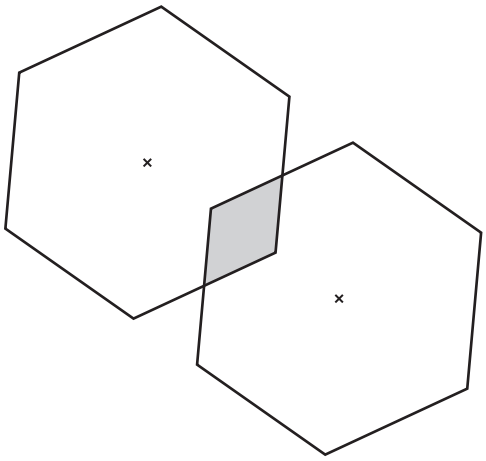
1(d)(i)	
1(d)(ii)	

2 **Fig. 2** shows two identical regular hexagons.

- The centre point of each hexagon is shown with a cross.
- The hexagons overlap at the midpoints of two adjacent sides.
- The overlap region is a rhombus. This is shaded grey in the diagram.

How many times greater is the area of **one** hexagon than the area of the grey rhombus?
You must show clearly how you have arrived at your answer. **[5]**

2 **Fig. 2**



There is a spare copy of Fig. 2 and this answer space on page 18.
If you wish to offer a second attempt, cross through the attempt that you wish to discard.

3 1% of pound coins are fake.

A machine in a car park rejects pound coins which it identifies as fake.

If a fake pound coin is inserted into the machine, there is a 99.5% chance that it will be rejected.

If a genuine pound coin is inserted into the machine, there is a 2% chance that it will be rejected.

(a) 20 000 random pound coins are tried in the machine.

Complete the table in the answer space to show the expected numbers of coins. **[4]**

(b) Calculate the percentage of rejected coins that are fake. **[2]**

3(a)

Number of coins	**Fake**	**Genuine**	**Total**
Accepted			
Rejected			
Total			20 000

3(b)

(c) The manufacturer of the machine can increase the likelihood of a fake coin being rejected, but this would also increase the likelihood of a genuine coin being rejected.

Would you advise the owners of the machine to make this change?
Explain your reasoning. **[1]**

3(c)	

4 A dance competition has 6 couples competing.
5 judges give each couple a mark out of 10.

Table 4.1 shows the marks awarded.

Table 4.1

Couple	Judge A	Judge B	Judge C	Judge D	Judge E
Amaya and Alex	6	6	6	6	6
Beth and Ben	8	9	9	8	7
Casey and Charlie	7	9	8	8	7
Darcie and Dev	8	6	7	7	6
Finley and Felix	7	7	7	5	6
Heidi and Henry	7	7	7	5	5

(a) The median mark for each couple is used to decide who is in first place.

(i) Complete **Table 4.2** to show the median scores for each couple. **[2]**

(ii) Name the couple or couples in first place. **[1]**

(iii) State **one** problem with using this method to decide who is in first place. **[1]**

4(a)(i) **Table 4.2**

Couple	Median
Amaya and Alex	
Beth and Ben	
Casey and Charlie	
Darcie and Dev	
Finley and Felix	
Heidi and Henry	

4(a)(ii)

4(a)(iii)

(b) Suggest a different rule to find an overall score for each couple from the judges' scores, which can be used to decide who is in first place.

(i) State your rule clearly. **[1]**

(ii) Complete **Table 4.3** to show the overall scores for each couple.
Use your rule and the judges' marks in **Table 4.1**. **[3]**

(iii) Name the couple or couples in first place. **[1]**

4(b)(i)

4(b)(ii)

Table 4.3

Couple	Overall score
Amaya and Alex	
Beth and Ben	
Casey and Charlie	
Darcie and Dev	
Finley and Felix	
Heidi and Henry	

4(b)(iii)

5 A researcher carries out a trial to investigate whether a new medication is effective at improving symptoms of a particular illness.

Those taking part are allocated to one of two groups:

- a group who get the new medication
- a control group who are given a placebo.

The two groups are of equal size.

To allocate the participants to a group, each person is given a random number on a spreadsheet.

The random numbers are sorted into order and the participants with smaller numbers go in one group and those with larger numbers go in the other group.

(a) Which **one** of the following terms gives the fullest description of this method of allocating the participants to each group?
Circle **one** of the options in the answer space. **[1]**

5(a)	**Blind**	**Randomised**	**Controlled**	**Experiment**

(b) The trial is a double blind trial.

Explain what this means. **[1]**

5(b)	

(c) At the end of the trial, 144 participants say that their symptoms have improved.

The researcher wants to compare the proportions of people who say their symptoms have improved after taking the medication, with the proportion who say their symptoms improved but were given the placebo.

The researcher's working hypothesis is that these proportions are the same (and so the medication has no effect).

Imagine lots of groups of 144 people who say their symptoms have improved. A Normal distribution is used to model the number of people who actually took the medication.

This is based on the researcher's working hypothesis.

Use the Normal distribution to work out:

(i) The mean number who took the medication. **[1]**

(ii) The standard deviation of the number who took the medication. **[2]**

5(c)(i)	
5(c)(ii)	

(d) 81 people out of the 144 whose symptoms improved had taken the medication.

Is this sufficient evidence that the new medication does make a difference (and so the working hypothesis in part **(c)** is **not** justified)? **[2]**

5(d)	

6 A bookcase has three shelves.
Each shelf is 90 cm long.
Each shelf is filled with one layer of paperback books, standing vertically.
A paperback book contains an average of 100 000 words.
Ivan is going to read all the books in the bookcase.

Estimate how long it will take for Ivan to read all the books.
Show your working clearly and state any assumptions you make.
Give your answer in suitable units. **[6]**

6	

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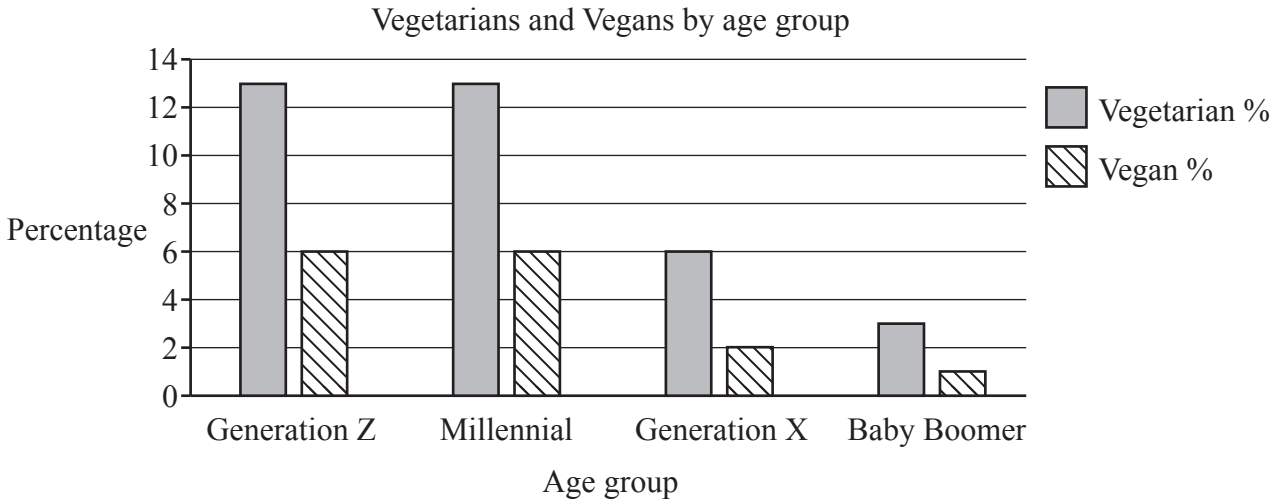
PLEASE DO NOT WRITE ON THIS PAGE

Turn over for the next question

7 This question refers to article A in the pre-release material, "Vegetarians and Vegans in the USA".
You can find the article on the Insert accompanying this paper.

The bar chart below is copied from the Insert.



(a) The youngest possible people surveyed were 18.

What **two** years were they born in? **[2]**

7(a)	

(b) Some Baby Boomers were too old to be included in the survey.
This means the survey does not include people born in all the years 1946 to 1964.

Work out the possible birth years for Baby Boomers included in the survey. **[2]**

7(b)	

(c) Vegetarians and vegans do not eat meat.
In 2022, a newspaper wrote a headline about the survey results for Generation Z and Millennials combined.

Fill in the missing numbers in the headline. **[2]**

7(c)	In the USA about 1 in _____ people aged 18 to _____ do not eat meat.

(d) A student suggests presenting the information from the bar chart as a pie chart.

Give **two** reasons why a pie chart would **not** be a suitable way to present the data. **[2]**

7(d)	First reason
	Second reason

8 This question refers to article B in the pre-release material, "Gift Aid".
You can find the article on the Insert accompanying this paper.

(a) A taxpayer gives a charity a donation of £300.
The taxpayer Gift Aids the donation.

(i) Calculate how much Gift Aid the charity claims from HMRC for this donation if the Basic Rate of income tax is 20%. **[2]**

(ii) Calculate how much Gift Aid the charity would get from HMRC for this donation if the Basic Rate of income tax was 19%.
Assume there is **no** transitional relief.
Give your answer to the nearest penny. **[2]**

(iii) How much transitional relief would the government have given to the charity for this donation if the new 19% tax policy had been implemented **with** transitional relief? **[1]**

8(a)(i)	
8(a)(ii)	
8(a)(iii)	

(b) In the tax year ending April 2022:

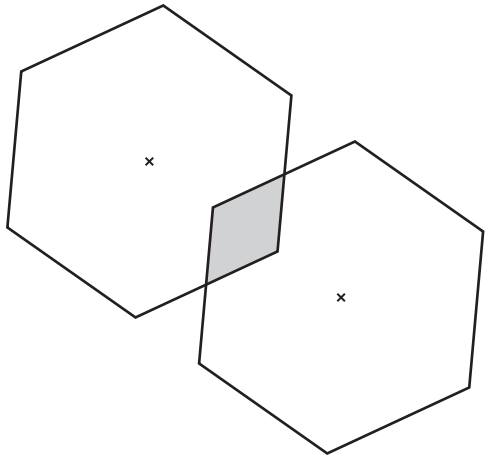
- the Basic Rate of income tax was 20%
- charities received a total of £1.34 billion in Gift Aid from HMRC
- there were 32.2 million taxpayers in the UK.

Calculate the mean amount of Gift Aided donations that each taxpayer gave that year.
(A billion is a thousand million). **[3]**

8(b)	

END OF QUESTION PAPER

2 ***This is a spare copy of Fig. 2 for question 2.***
Only write on this page if you want to offer a second solution to question 2. If you do so, cross through the attempt that you wish to discard.



EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.