OCR
Oxford Cambridge and RSA

Wednesday 13 October 2021 – 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

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 **16** pages.

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

Turn over

Answer **all** the questions.

1 A shopping website offers two different discounts, shown below.
   Shoppers can only use one of the two discounts.

Discount 1	Discount 2
£15 off orders over £50 plus free postage.	25% off your order. Postage is £4 per order. No reduction on cost of postage.

   (a) A shopper orders goods costing £52 before discount.
   Calculate the cost of the order, including postage, for each discount. **[3]**

1(a)	**Discount 1**
	Discount 2

   (b) Another shopper is ordering goods.
   For what order costs is it better to use Discount 1?
   Justify your answer. **[4]**

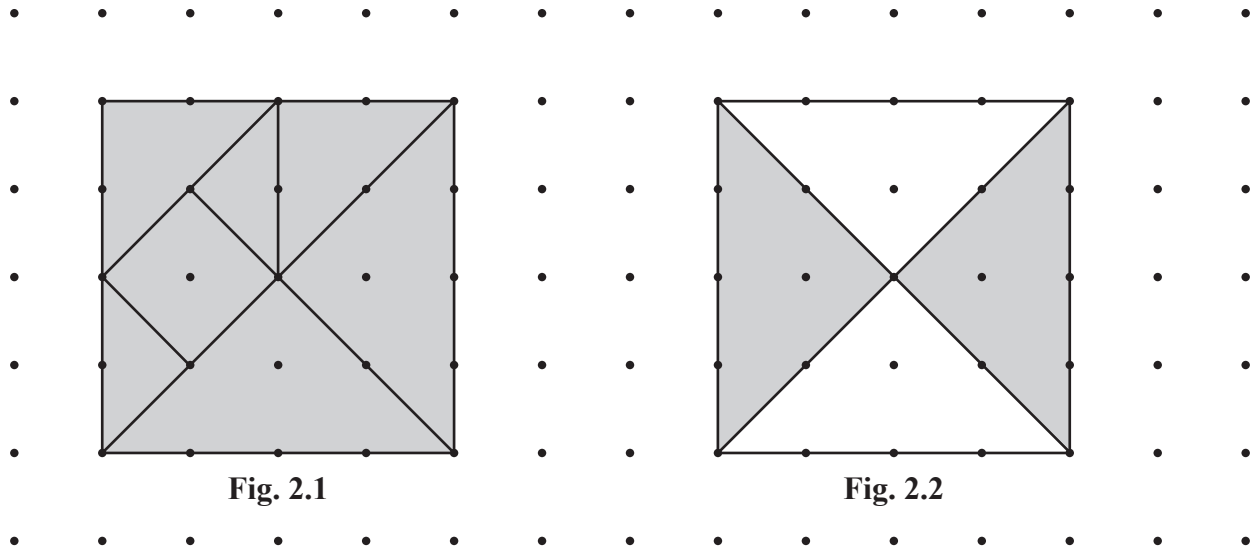| 1(b)	

2   **Fig. 2.1** shows a puzzle made by cutting a cardboard square into 7 pieces.

Fig. 2.2 shows the start of a different arrangement of the 7 pieces, with the two large triangles opposite each other.

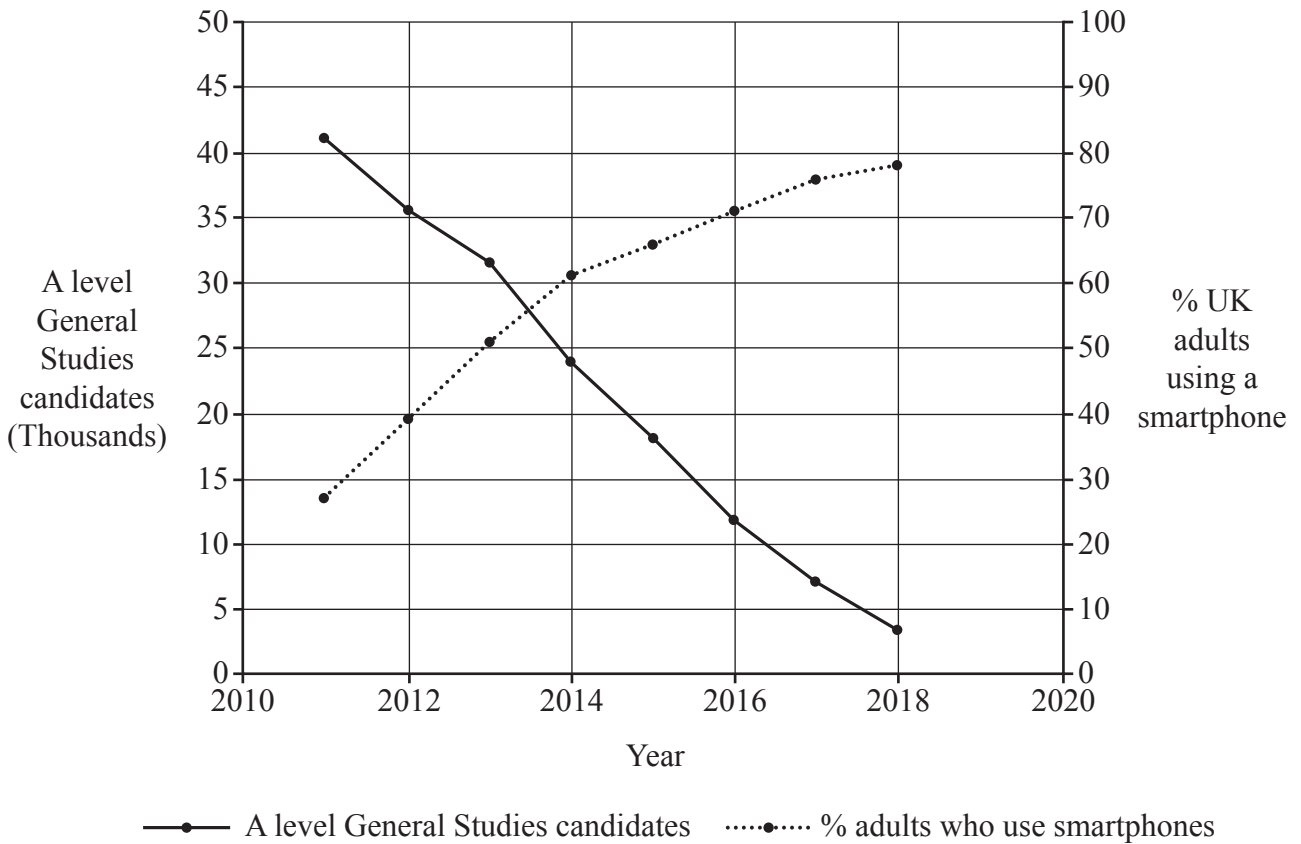Draw the remaining pieces in **Fig. 2.2**.   **[2]**

Fig. 2.1   Fig. 2.2

If you need to draw a copy of **Fig. 2.2**, use the grid below.

Turn over

3   The chart below shows two time series for 2011–2018.
It shows the trends in:
- The number of candidates for A level General Studies in the UK.
- The percentage of UK adults who use smartphones.

——•—— A level General Studies candidates   ·····•····· % adults who use smartphones

(a)   How many candidates were there for A level General Studies in 2012?   **[1]**

(b)   The chart has two vertical axes.
Give **one** advantage and **one** disadvantage of presenting the data in this way.   **[2]**

(c)   Jack says that the increasing availability of smartphones has made General Studies less popular and that is why there has been a drop in candidates.

Comment on Jack's claim.   **[1]**

3(a)	

3(b)	**Advantage**
	Disadvantage
3(c)	

4 (a) (i) Write down the approximate population of the UK. **[1]**

    (ii) Write down the approximate average lifespan in the UK. **[1]**

    (iii) Estimate the number of births each year in the UK.
You should make the following assumptions:
- The population of the UK is constant.
- Migration can be ignored.

Show your reasoning and give your answer to a sensible degree of accuracy. **[3]**

4(a)(i)	
4(a)(ii)	
4(a)(iii)	

(b) The NHS website gives the following information.

> In 2016, around 12 000 sets of twins were born in the UK.
> There were also about 190 other multiple births resulting in triplets or more.

Show that the probability of a birth resulting in twins is between 1% and 2%. **[3]**

4(b)	
	(answer space continued on next page)

4(b)	**(continued)**

(c) A magazine website gives the following information.

> In 2016 there was a 15.9% chance of having multiple babies, while in 2015 the likelihood was 16.1%.

This information is incorrect.
Show that the error can be explained by a misplaced decimal point. **[1]**

4(c)	

(d) (i) What percentage of the UK population has a twin brother or twin sister? **[1]**

(ii) Anika has a twin sister.
On her first day at work, Anika texts her twin:

> Person at the next desk is a twin too. How amazing is that?

Is this an amazing coincidence? Explain your reasoning. **[1]**

4(d)(i)	
4(d)(ii)	

5 **This question refers to the article "B: The 2016 European Union (EU) membership referendum". This was given out as pre-release material and is available as an insert.**

   (a) **(i)** Alex says the **number** voting for Leave is 8% more than the number voting for Remain so 8% more people voted for Leave than for Remain.

          Show that increasing 16 141 241 by 8% gives approximately 17.4 million. **[2]**

      (ii) Taylor says the **percentage** voting for Leave is 4 percentage points more than those voting for Remain so 4% more people voted for Leave than for Remain.

          Show how Taylor could work out the 4% figure from the data in the insert. **[3]**

     (iii) Give a reason why Taylor's 4% figure better represents the size of the majority. **[1]**

5(a)(i)	

5(a)(ii)	

5(a)(iii)	

(b) A journalist was writing an article in late 2016.
He thought that a particular town had voted 50% Leave and 50% Remain in the EU referendum in June 2016.
The journalist asked a random sample of 400 voters in the town how they had voted.

Imagine a large number of random samples of size 400 are taken from a population with equal numbers of Leave and Remain voters.

   (i)   What is the mean number of Leave voters per sample? **[1]**

   (ii) What is the standard deviation of the number of Leave voters per sample? **[2]**

5(b)(i)	

5(b)(ii)	

(c) The journalist's random sample had 184 Leave voters.
Does this provide convincing evidence that the town did **not** vote 50% Leave?
Justify your answer fully. **[2]**

5(c)	

6 A biscuit factory is testing a new automated quality control process.
The new process classifies each biscuit as either broken or acceptable.

Most of the biscuits are acceptable, but some are broken.

The new process correctly identifies 90% of the broken biscuits, but only correctly identifies 70% of the acceptable biscuits.

(a) Past experience shows that 1% of biscuits produced at the factory are broken.

   (i) 1000 biscuits, chosen at random from the production line, are checked by the automated quality control process.
      Complete the table below to show the expected results. **[2]**

   (ii) Calculate the proportion of biscuits correctly assessed by the automated quality control process. **[2]**

6(a)(i)

Expected numbers	Broken biscuits	Acceptable biscuits	Total
Automatic process shows broken biscuits	9		
Automatic process shows acceptable biscuits		693	
Total	10		1000

6(a)(ii)

(b) Biscuit production at the factory once went badly wrong.
20% of the biscuits manufactured that day were broken.

Calculate the proportion of biscuits that would be correctly assessed by the automated quality control process if 20% of biscuits were actually broken. **[5]**

(c) Comment on the effectiveness of the automated quality control process. **[1]**

6(b)	
6(c)	

7 **This question refers to the article "A: The gender pay gap".**
This was given out as pre-release material and is available as an insert.

(a) An employer is working out the gender pay gap for their employees.
They have the following data.

	Male hourly pay (£)	Female hourly pay (£)
Mean	21.75	18.75
Median	19.20	18.50

Calculate the following gender pay gaps.
Give your answers to **one** decimal place.

(i) Mean gender pay gap.

(ii) Median gender pay gap. **[4]**

7(a)(i)	Mean gender pay gap

7(a)(ii)	Median gender pay gap

(b) **Fig. A.1**, in the pre-release material is reproduced below.
It shows that the national gender pay gap for part-time workers has often been negative.

Explain clearly what this tells you about the pay of part-time workers. **[2]**

Gender pay gap for median gross hourly earnings (excluding overtime),
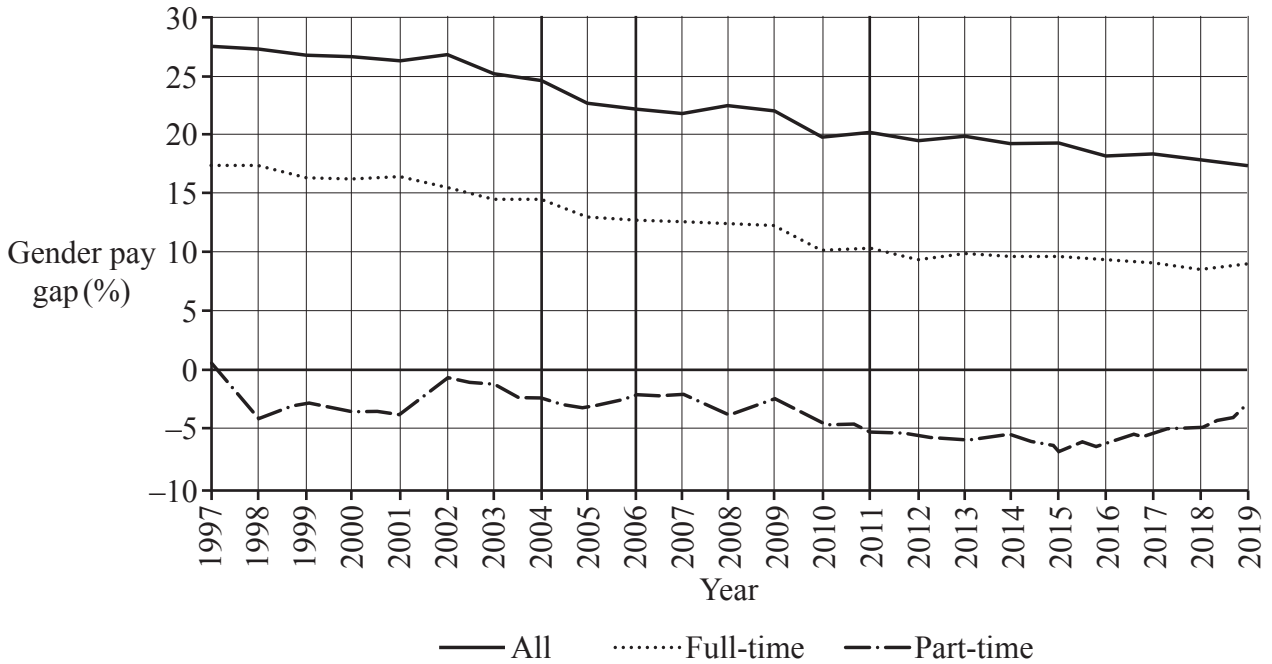UK, April 1997 to 2019

Fig. A.1

7(b)	

Turn over

(c) An employer has five female employees and five male employees.
All the employees earn at least £12 an hour.
The mean gender pay gap is 50% and the median gender pay gap is zero.

Suggest possible hourly pay rates for each of the employees. **[4]**

7(c)						
	Male (£)					
	Female (£)					

(d) A company has 200 employees.
The percentages of male and female employees in each pay quartile is shown in the following table.

	Q1	Q2	Q3	Q4
Male (%)	76	74	60	100
Female (%)	24	26	40	0

Calculate the number of male employees and female employees in the company. **[3]**

7(d)	
Male	
Female	

(e) An employer reports that it has a mean gender pay gap of 100%.
What can you conclude? **[2]**

7(e)	

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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