OCR
Oxford Cambridge and RSA

Tuesday 20 June 2023 – Afternoon

A Level Mathematics B (MEI)

H640/03 Pure Mathematics and Comprehension

Printed Answer Booklet

Time allowed: 2 hours

AB

You must have:
- Question Paper H640/03 (inside this document)
- the Insert (inside this document)
- a scientific or graphical calculator

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

Centre number						Candidate number				

First name(s) ____________________

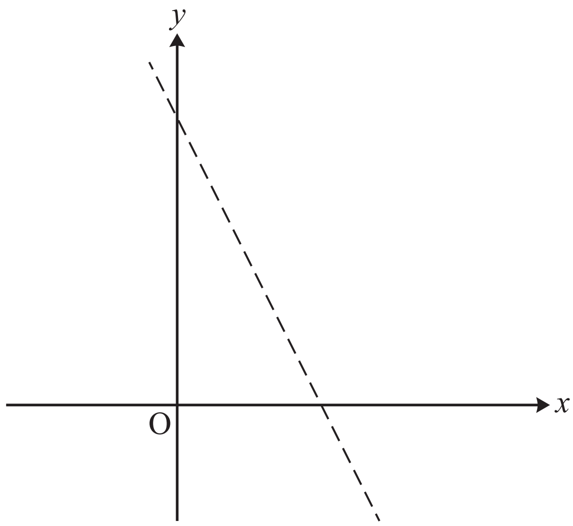
Last name ____________________

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 in the **Printed Answer Booklet**. If you need extra space use the lined pages at the end of the Printed Answer Booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.
- Give your final answers to a degree of accuracy that is appropriate to the context.

INFORMATION
- This document has **20** pages.

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

Section A (60 marks)

1	
2(a)	
2(b)	**(answer space continued on next page)**

2(b)	(continued)
3	

4

5(a)	
5(b)	
5(c)	

6(a)(i)	
6(a)(ii)	

6(b)(i)	
6(b)(ii)	
6(b)(iii)	

7

(answer space continued on next page)

7	**(continued)**

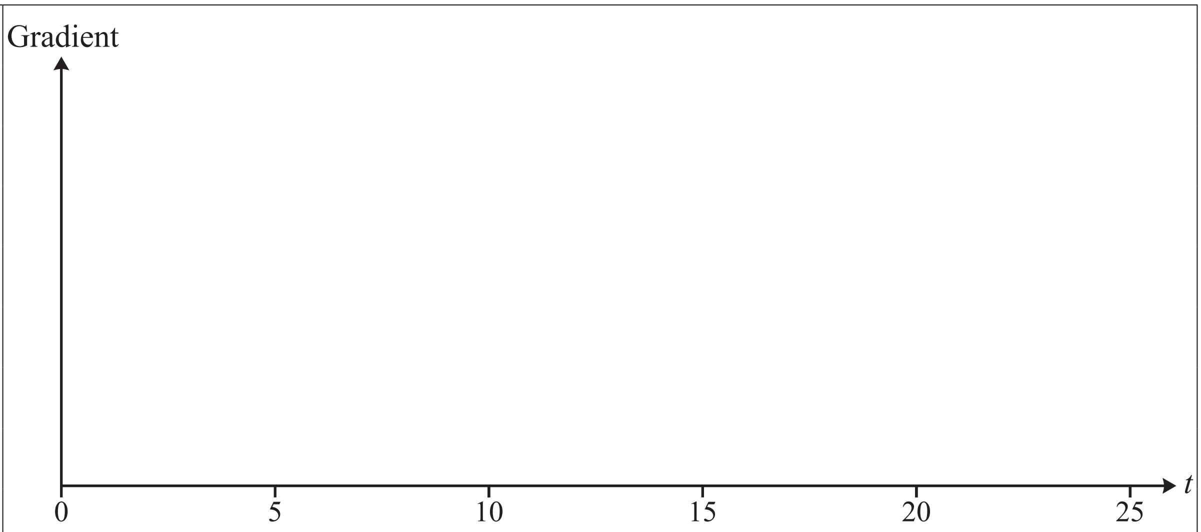
8

(answer space continued on next page)

8 **(continued)**

9(a)(i)	
9(a)(ii)	
9(b)	
9(c)	

9(d)(i)



9(d)(ii)

9(d)(iii)

9(e)

10(a)	
10(b)	

Section B (15 marks)

The questions in this section refer to the article on the Insert. You should read the article before attempting the questions.

11 **(a)** Evaluate $\sum_{r=1}^{5} r^2$. **[1]**

(b) Show that Euler's approximate formula, as given in line 13, gives the exact value of $\sum_{r=1}^{5} r^2$. **[2]**

11(a)	
11(b)	

12 With the aid of a suitable diagram, show that the three triangles referred to in line 26 have the areas given in line 27. **[3]**

12	

13 Prove that Euler's approximate formula, as given in line 13, when applied to $\sum_{r=1}^{n} r^2$ gives exactly $\frac{n(n+1)(2n+1)}{6}$. **[4]**

13	

14 Show that the expression given in line 33 simplifies to $\sum_{r=1}^{n} \frac{1}{r} \approx \ln n + \frac{13}{24} + \frac{6n+5}{12n(n+1)}$, as given in line 34. **[3]**

14	

15 The expression given in line 34 is used to calculate $\sum_{r=1}^{6} \frac{1}{r}$.

Show that the error in the result is less than 1.5% of the true value. **[2]**

15	

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).