OCR
Oxford Cambridge and RSA

Monday 19 October 2020 – Afternoon

A Level Mathematics B (MEI)

H640/03 Pure Mathematics and Comprehension

Printed Answer Booklet

Time allowed: 2 hours

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 **16** pages.

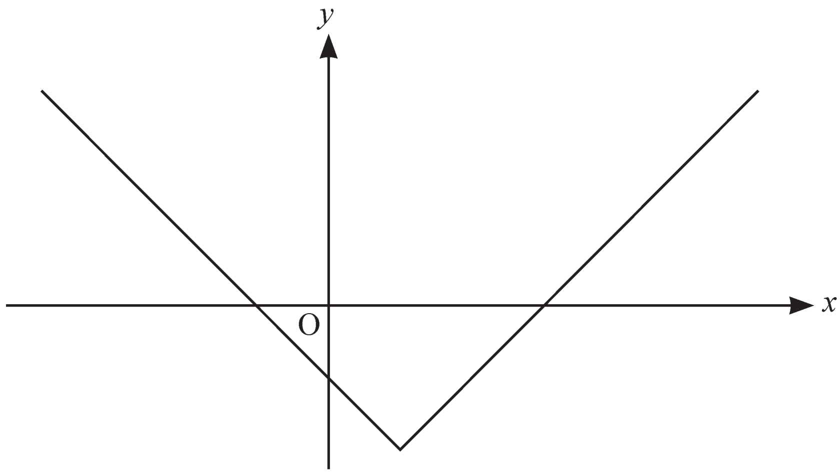
ADVICE
- Read each question carefully before you start your answer.

OCR is an exempt Charity

Section A (60 marks)

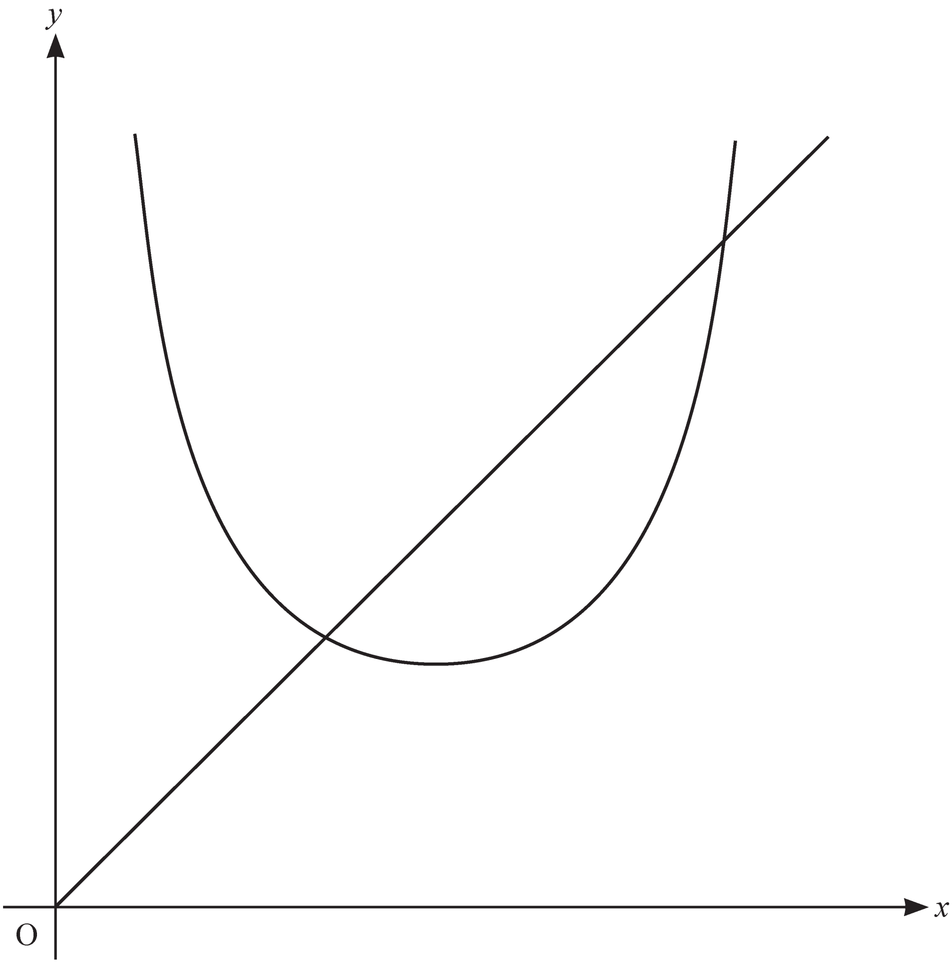
1

2



3	
4	

5(a)(i)	
5(a)(ii)	
5(b)	
5(c)(i)	
5(c)(ii)	

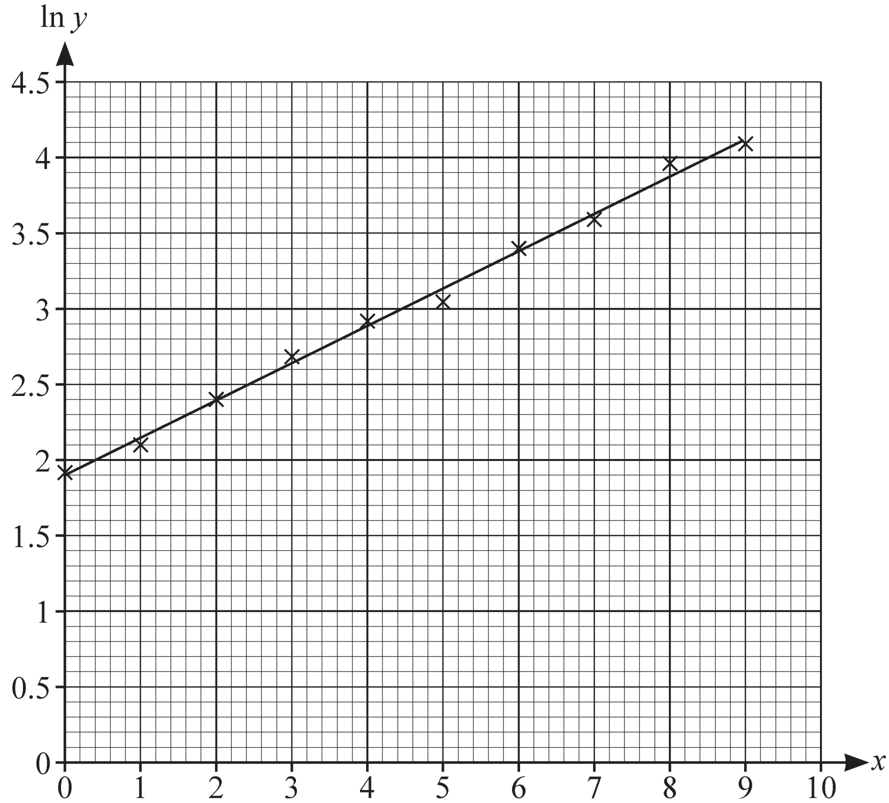
5(d)	
5(e)	

6(a)(i)

6(a)(ii)

6(b)

6(c)



(answer space continued on next page)

6(c)	(continued)
6(d)	
6(e)	

7(a)	
7(b)	
	(answer space continued on next page)

7(b) (continued)

8(a)(i)	

8(a)(ii)

8(b)

(answer space continued on next page)

8(b)	**(continued)**

Section B (15 marks)

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

9 **(a)** Show that if $a = 1$ and $b > 1$ then $a^b < b^a$.

(b) Find integer values of a and b with $b > a > 1$ and a^b not greater than b^a (a counter example to the conjecture given in lines 7–8). **[1]**

9(a)	
9(b)	

10 In this question you must show detailed reasoning.

Show that $\int_{e}^{\pi} \frac{1}{x} \, dx = \ln \pi - 1$ as given in line 37.

10	

11 Show that e^x is an increasing function for all values of x, as stated in line 39. **[2]**

11	

12 (a) Show that the only stationary point on the curve $y = \frac{\ln x}{x}$ occurs where $x = e$, as given in line 45. **[3]**

(b) Show that the stationary point is a maximum. **[3]**

(c) It follows from part **(b)** that, for any positive number a with $a \neq e$,

$$\frac{\ln e}{e} > \frac{\ln a}{a}.$$

Use this fact to show that $e^a > a^e$. **[2]**

12(a)	
12(b)	
12(c)	

ADDITIONAL ANSWER SPACE

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