

# 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)

- the Insert (inside this document)
- · a scientific or graphical calculator



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

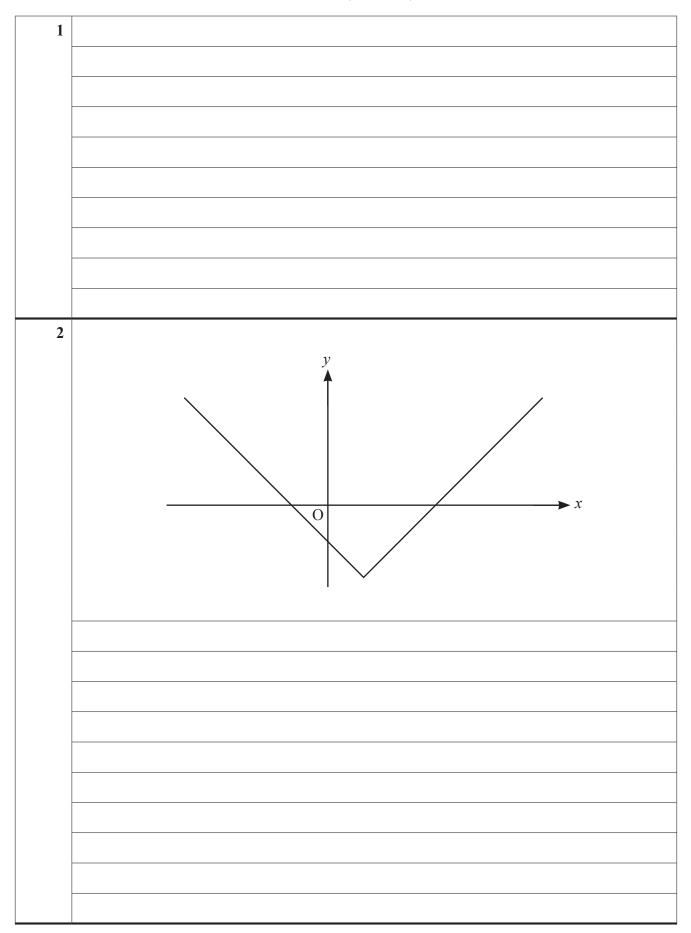
#### INFORMATION

• This document has 16 pages.

#### ADVICE

• Read each question carefully before you start your answer.

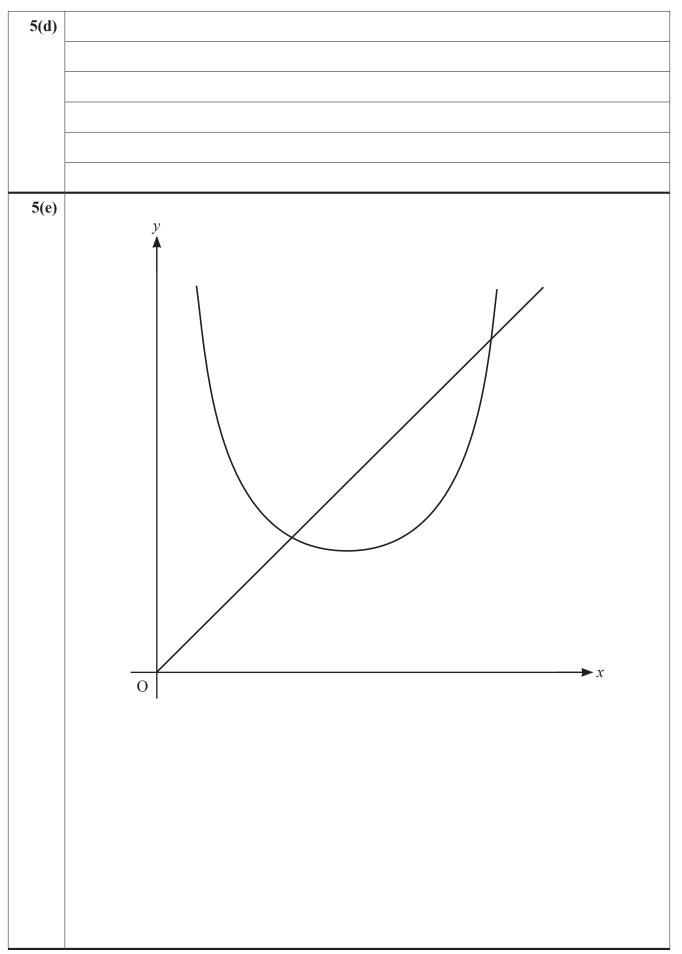
Section A (60 marks)

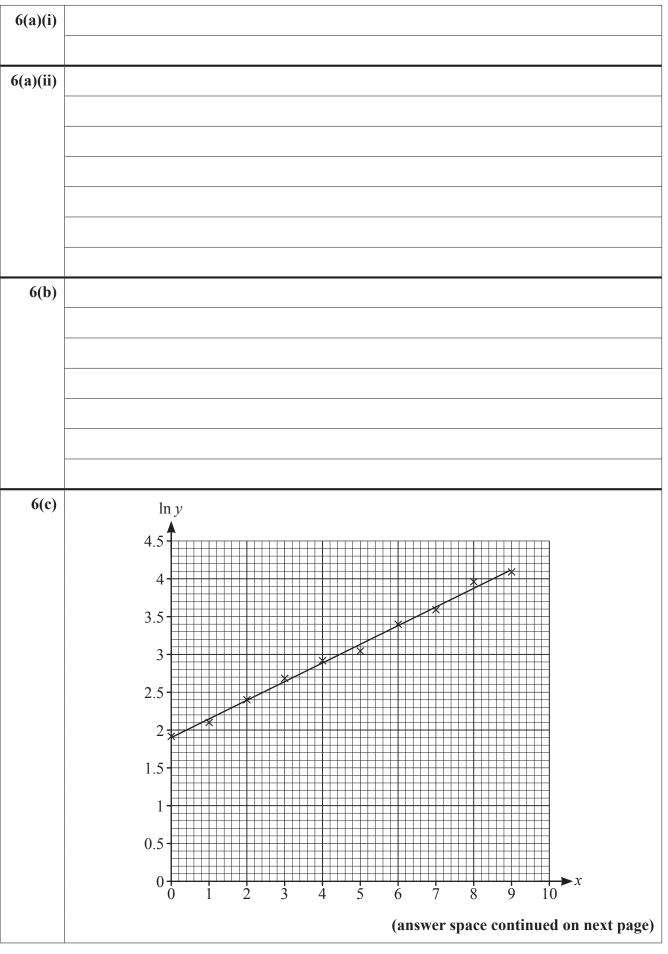


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5(a)(ii)	
5(b)	
5(c)(i)	
5(c)(ii)	





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

7(a)	
7(b)	
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'(b)	(continued)

8(a)(i)	

8(a)(ii)	
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<b>8(b)</b>	(continued)

### 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.

- 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]



[2]

## 10 In this question you must show detailed reasoning.

Show that 
$$\int_{e}^{u} \frac{1}{x} dx = \ln \pi - 1$$
 as given in line 37. [2]

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

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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]

[3]

[2]

- (b) Show that the stationary point is a maximum.
- (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  $e^a > a^e$ .

12(a)	
12(b)	
12(c)	
(•)	

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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