

# 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**

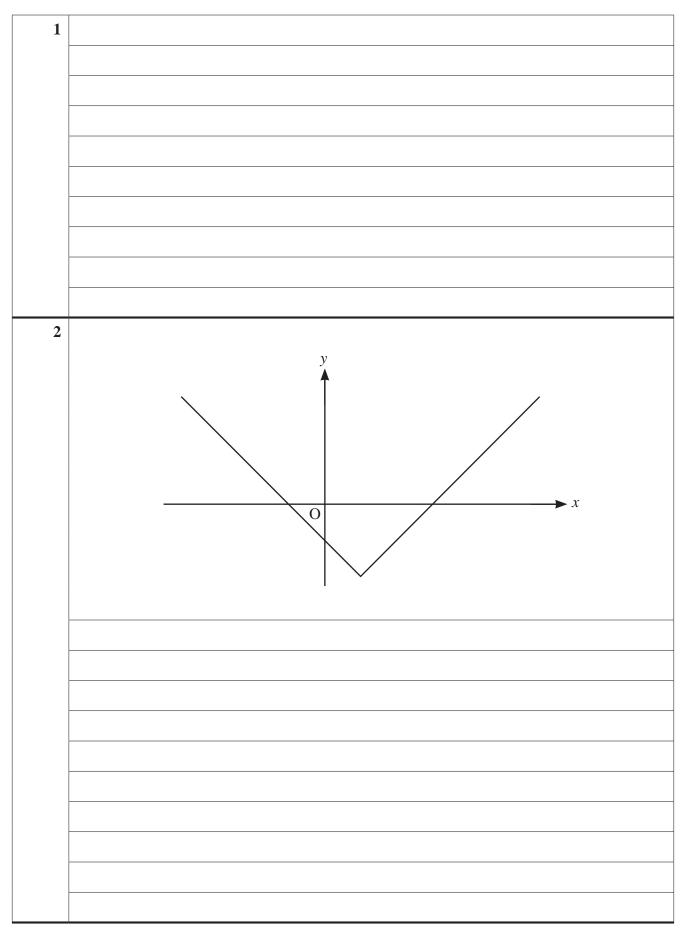
• This document has **16** pages.

#### **ADVICE**

• Read each question carefully before you start your answer.

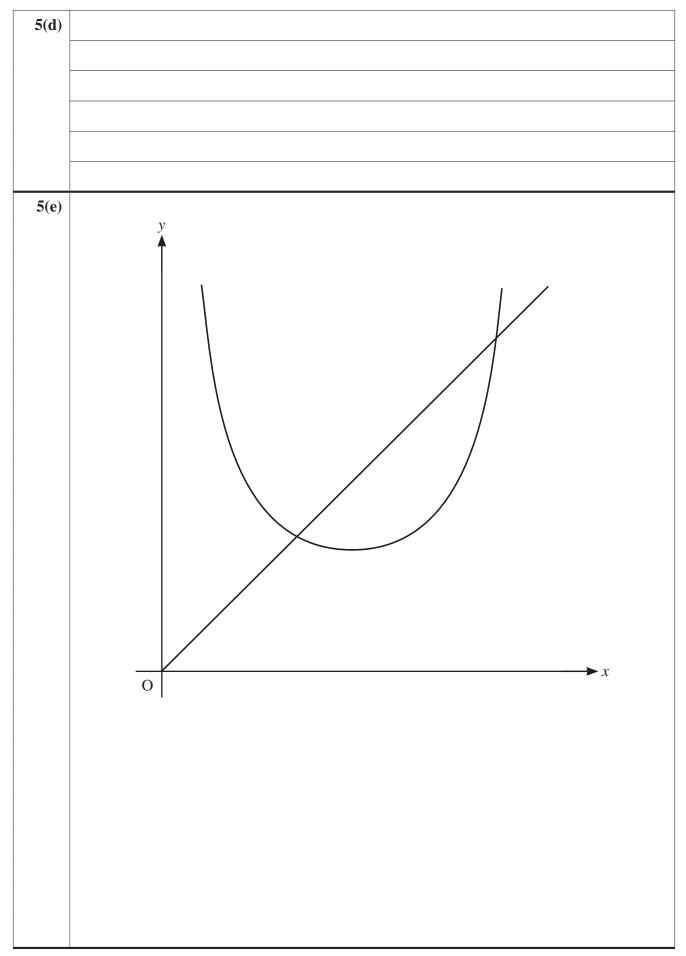
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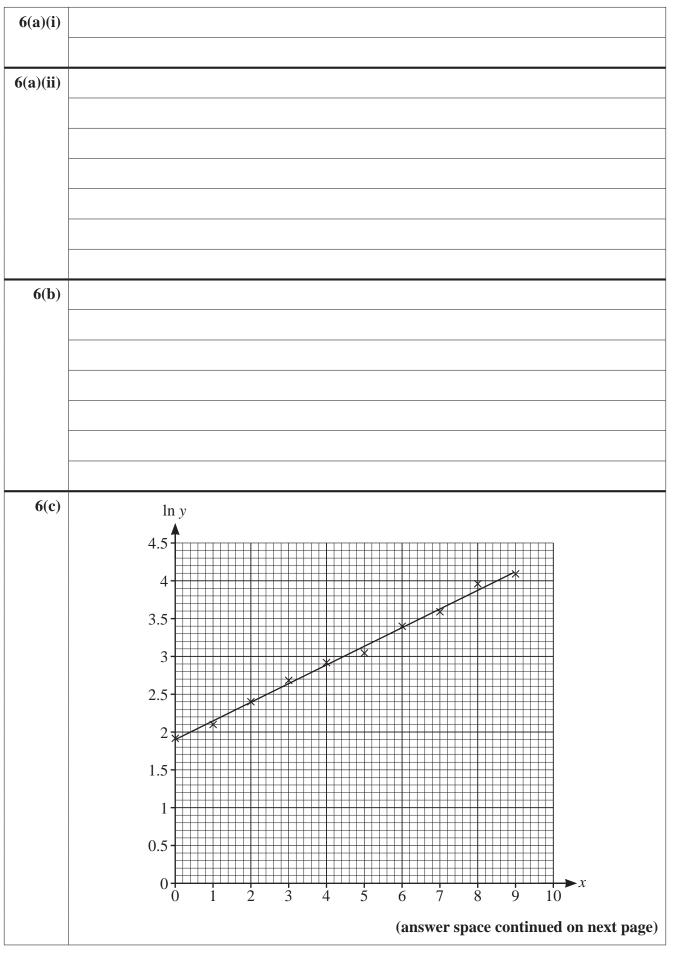
Section A (60 marks)



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





<b>6(c)</b>	(continued)
6(d)	
6(e)	

8

7(a)	
<b>7(b)</b>	
	(answer space continued on next page)

9

<b>7(b)</b>	(continued)

8(a)(i)	

8(a)(ii)	
9(1)	
<b>8(b)</b>	
	(answer space continued on next page)

<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  $a^b < b^a$ . [2]
  - (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]

[3]

[2]

## 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. [2]

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

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.
  - (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)	
12(b) 12(c)	

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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