

**Modified Enlarged 24pt**  
**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Friday 12 June 2020 – Afternoon**

**A Level Mathematics B (MEI)**

**H640/03 Pure Mathematics and  
Comprehension**

**Printed Answer Booklet**

**Time allowed: 2 hours  
plus your additional time allowance**

**YOU MUST HAVE:**

**Question Paper H640/03 (with this  
document)**

**the Insert (with this document)**

**a scientific or graphical calculator**

**Please write clearly in black ink.**

**Centre number**

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**Candidate number**

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**First name(s)** \_\_\_\_\_

**Last name** \_\_\_\_\_

**READ INSTRUCTIONS OVERLEAF**



## **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.**

## **ADVICE**

**Read each question carefully before you start your answer.**

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**SECTION A (60 marks)**

**1**

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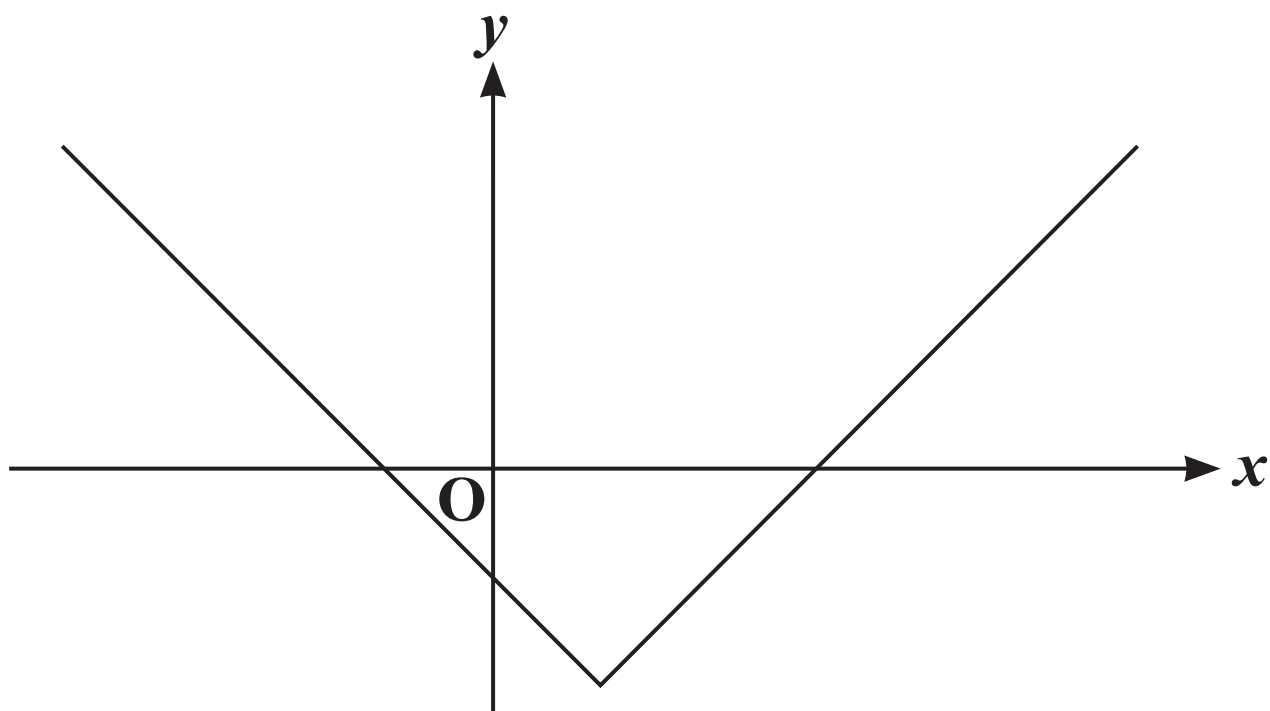
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**5 (a) (i)** \_\_\_\_\_

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**5 (a) (ii)** \_\_\_\_\_

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**5 (b)** \_\_\_\_\_

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**5 (c) (i)** \_\_\_\_\_

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5 (c) (ii) \_\_\_\_\_

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5 (d) \_\_\_\_\_

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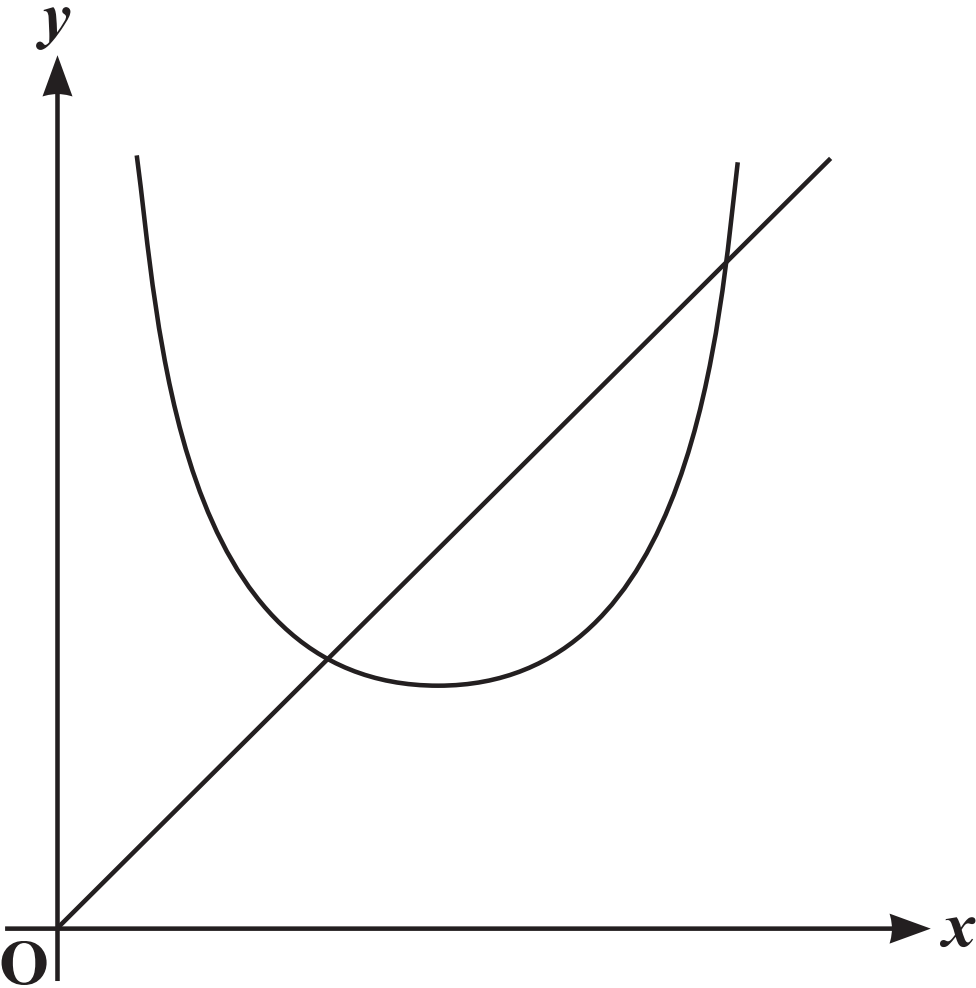
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5 (e)



**6 (a) (i)** \_\_\_\_\_  
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**6 (a) (ii)** \_\_\_\_\_  
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**6 (b)** \_\_\_\_\_  
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6 (b) (continued) \_\_\_\_\_

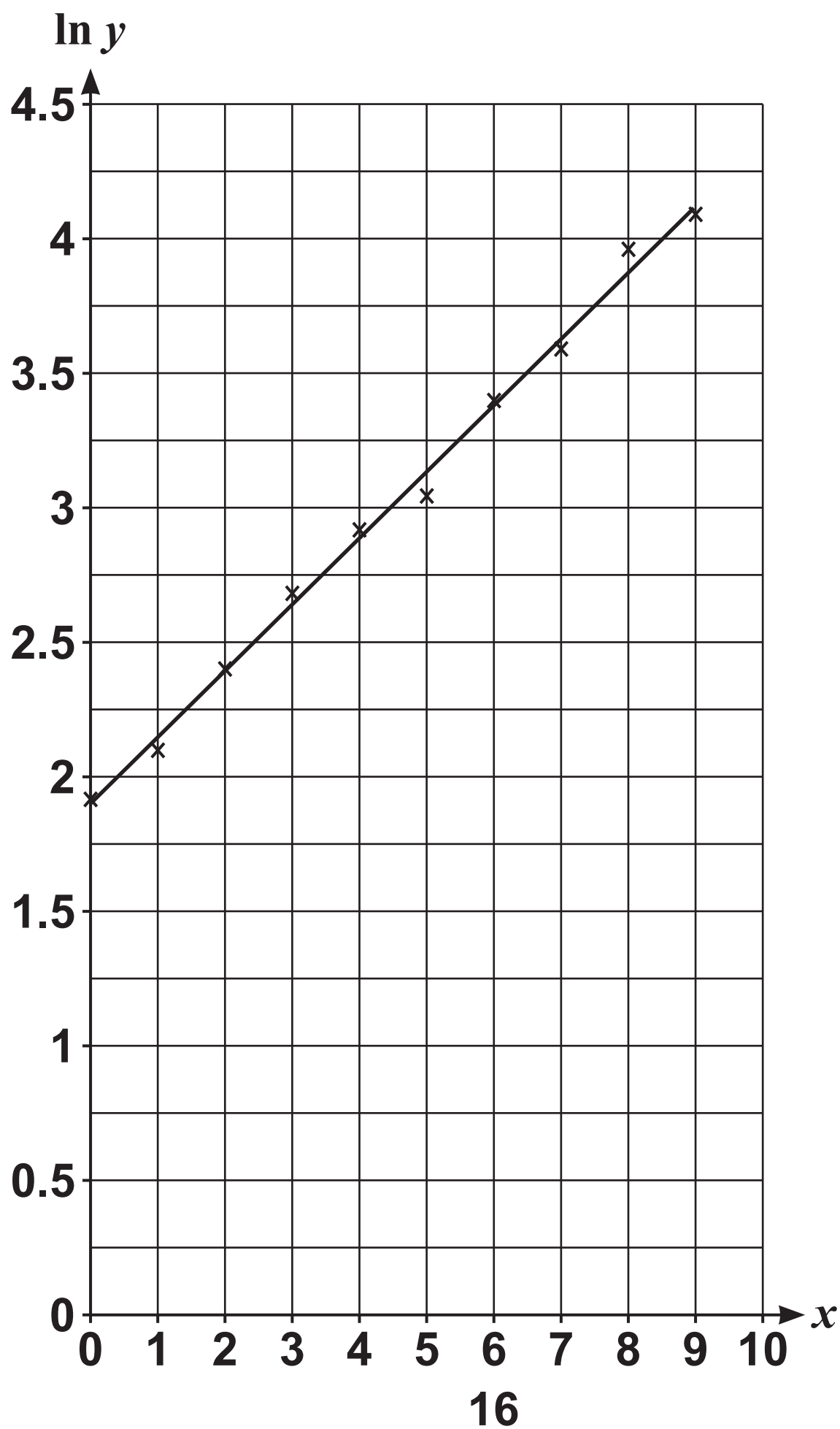
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6 (c)





6 (c) \_\_\_\_\_

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6 (e) \_\_\_\_\_

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**7 (a)** \_\_\_\_\_  
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**7 (b)** \_\_\_\_\_  
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[illegible]

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[illegible]

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**7 (b) (continued)** \_\_\_\_\_

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**8 (a) (i)** \_\_\_\_\_

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[illegible]

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8 (a) (i) (continued) \_\_\_\_\_

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[illegible]

[illegible]

**(answer space continued on next page)**

[illegible]

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[illegible]

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8 (b) (continued) \_\_\_\_\_

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## 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 15–17). [1]

9 (a) \_\_\_\_\_

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**9 (a) (continued)** \_\_\_\_\_

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**9 (b)** \_\_\_\_\_

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**9 (b) (continued)** \_\_\_\_\_

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**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 70. [2]**

**10** \_\_\_\_\_

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**10 (continued)** \_\_\_\_\_

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**11 Show that  $e^x$  is an increasing function for all values of  $x$ , as stated in lines 72–73. [2]**

**11** \_\_\_\_\_

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**11 (continued)** \_\_\_\_\_

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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 lines 85–87. [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) \_\_\_\_\_

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12 (b) \_\_\_\_\_

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12 (c) \_\_\_\_\_

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**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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