



Oxford Cambridge and RSA

**Thursday 19 June 2025 – 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.**

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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 page 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.

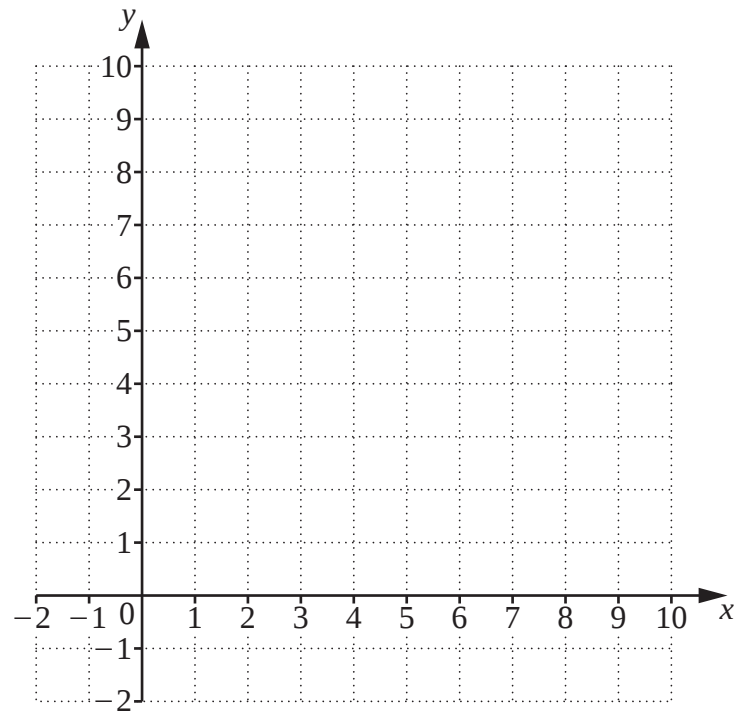
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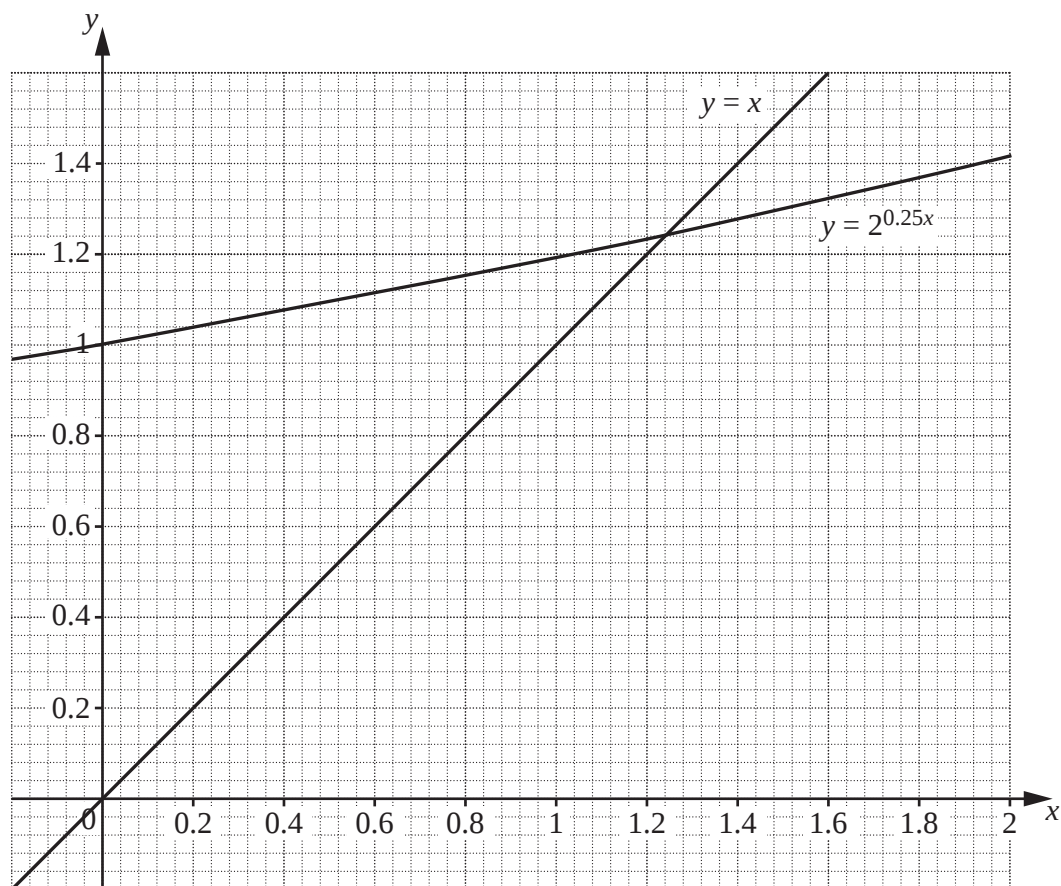
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## 14

## 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.

- 12 (a) Show that for the point on the curve where  $x = 0$ ,  $\frac{3a-x}{a+x} \geq 0$ , as given in line 10. [1]
- (b) Use the equation of the curve given in line 8 to show that for all points on the curve where  $x \neq 0$ ,  $\frac{3a-x}{a+x} \geq 0$  as given in line 10. [1]
- (c) Show that it follows that  $3a - x \geq 0$  and  $a + x > 0$ , as given in lines 10 and 11, for values of  $a > 0$ . [3]
- (d) Hence find, in terms of  $a$  where  $a > 0$ , the range of values of  $x$  for points on the curve  $y^2 = \frac{x^2(3a-x)}{a+x}$ . [1]
- (e) Find the equation of the asymptote to the curve. [1]

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13 Use  $\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$ , with suitable choices for  $A$  and  $B$ , to show that

$$\tan 3\theta = \frac{t(3 - t^2)}{1 - 3t^2}, \text{ where } t = \tan \theta, \text{ as given in line 25.}$$

[3]

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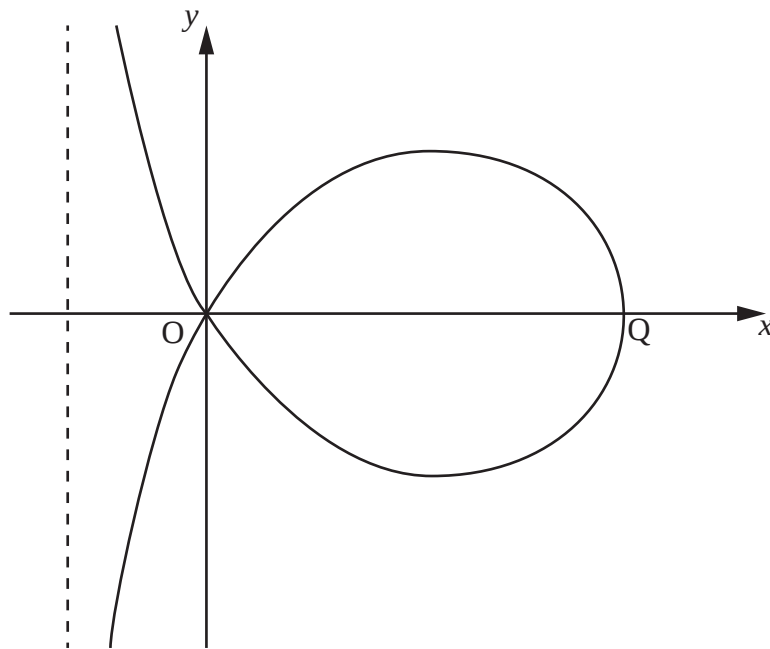
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- 14 (a) Draw and label a suitable triangle on the diagram in the **Printed Answer Booklet** to show that  $\tan \theta = \frac{y}{x}$ , as given in line 30. [1]
- (b) Subtract  $x = \frac{a(3-t^2)}{1+t^2}$  from  $3a$  to show that  $3a - x = \frac{4at^2}{1+t^2}$ . [1]
- (c) Find an expression, in terms of  $a$  and  $t$ , for  $a + x$ . [1]
- (d) Hence, or otherwise, show that the parametric equations given in lines 29 and 31 are equivalent to  $y^2 = \frac{x^2(3a-x)}{a+x}$ , as claimed in lines 8 and 33. [2]

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