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Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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I declare this is my own work.

# AS

## FURTHER MATHEMATICS

### Paper 1

Monday 11 May 2020

Afternoon

Time allowed: 1 hour 30 minutes

#### Materials

- You must have the AQA formulae and statistical tables booklet for A-level Mathematics and A-level Further Mathematics.
- You should have a scientific calculator that meets the requirements of the specification. (You may use a graphical calculator.)

#### Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer each question in the space provided for that question. If you require extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do **not** write outside the box around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work you do not want to be marked.

#### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.

#### Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- You do not necessarily need to use all the space provided.

For Examiner's Use	
Question	Mark
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<b>TOTAL</b>	



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Answer **all** questions in the spaces provided.

**1** Express the complex number  $1 - i\sqrt{3}$  in modulus-argument form.

Tick (✓) **one** box.

[1 mark]

$$2\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right) \quad \square$$

$$2\left(\cos\frac{2\pi}{3} + i\sin\frac{2\pi}{3}\right) \quad \square$$

$$2\left(\cos\left(-\frac{\pi}{3}\right) + i\sin\left(-\frac{\pi}{3}\right)\right) \quad \square$$

$$2\left(\cos\left(-\frac{2\pi}{3}\right) + i\sin\left(-\frac{2\pi}{3}\right)\right) \quad \square$$

**2** Given that  $1 - i$  is a root of the equation  $z^3 - 3z^2 + 4z - 2 = 0$ , find the other two roots.

Tick (✓) **one** box.

[1 mark]

$$-1 + i \text{ and } -1 \quad \square$$

$$1 + i \text{ and } 1 \quad \square$$

$$-1 + i \text{ and } 1 \quad \square$$

$$1 + i \text{ and } -1 \quad \square$$



**3** Given  $(x - 1)(x - 2)(x - a) < 0$  and  $a > 2$

Find the set of possible values of  $x$ .

Tick (✓) **one** box.

**[1 mark]**

$$\{x : x < 1\} \cup \{x : 2 < x < a\}$$

$$\{x : 1 < x < 2\} \cup \{x : x > a\}$$

$$\{x : x < -a\} \cup \{x : -2 < x < -1\}$$

$$\{x : -a < x < -2\} \cup \{x : x > -1\}$$

**Turn over for the next question**

**Turn over ►**



4 The matrices **A** and **B** are such that

$$\mathbf{A} = \begin{bmatrix} 2 & a & 3 \\ 0 & -2 & 1 \end{bmatrix} \quad \text{and} \quad \mathbf{B} = \begin{bmatrix} 1 & -3 \\ -2 & 4a \\ 0 & 5 \end{bmatrix}$$

4 (a) Find the product **AB** in terms of  $a$ .

[2 marks]

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4 (b) Find the determinant of **AB** in terms of  $a$ .

[1 mark]

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**10 (a)** Show that the equation

$$y = \frac{3x - 5}{2x + 4}$$

can be written in the form

$$(x + a)(y + b) = c$$

where  $a$ ,  $b$  and  $c$  are integers to be found.

**[3 marks]**

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**10 (b)** Write down the equations of the asymptotes of the graph of

$$y = \frac{3x - 5}{2x + 4}$$

**[2 marks]**

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**10 (c)** Sketch, on the axes provided, the graph of

$$y = \frac{3x - 5}{2x + 4}$$

**[3 marks]**

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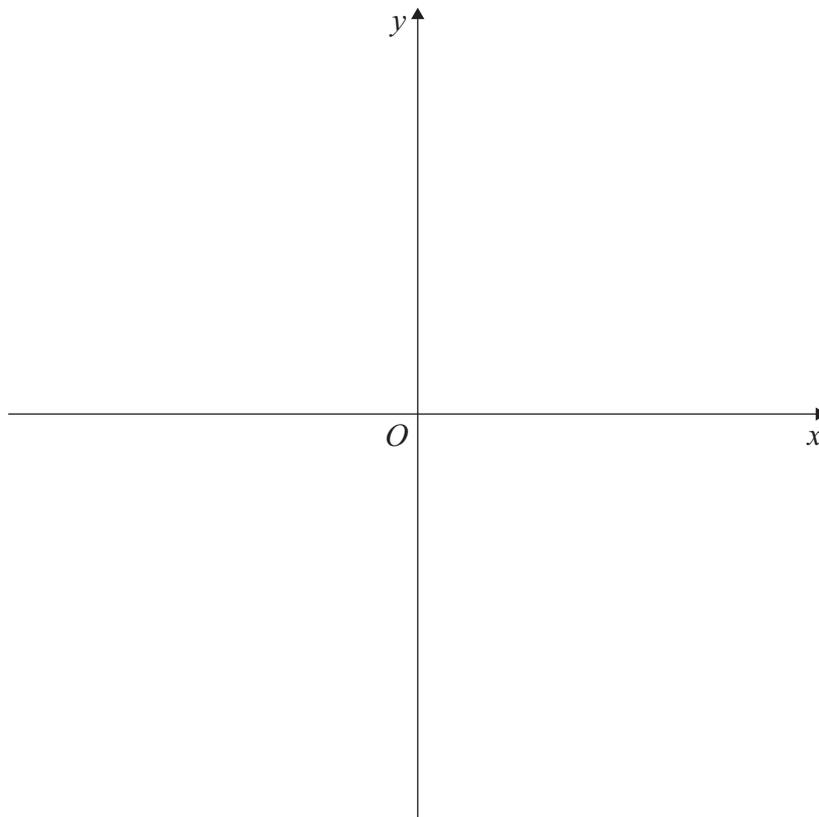
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**Turn over ►**



11 Sketch the polar graph of

$$r = \sinh \theta + \cosh \theta$$

for  $0 \leq \theta \leq 2\pi$

[3 marks]

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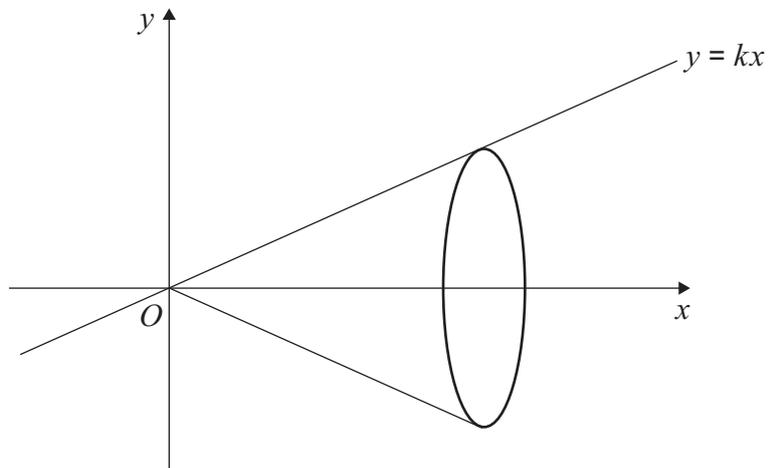




**15** A segment of the line  $y = kx$  is rotated about the  $x$ -axis to generate a cone with vertex  $O$ .

The distance of  $O$  from the centre of the base of the cone is  $h$ .

The radius of the base of the cone is  $r$ .



**15 (a)** Find  $k$  in terms of  $r$  and  $h$ .

**[1 mark]**

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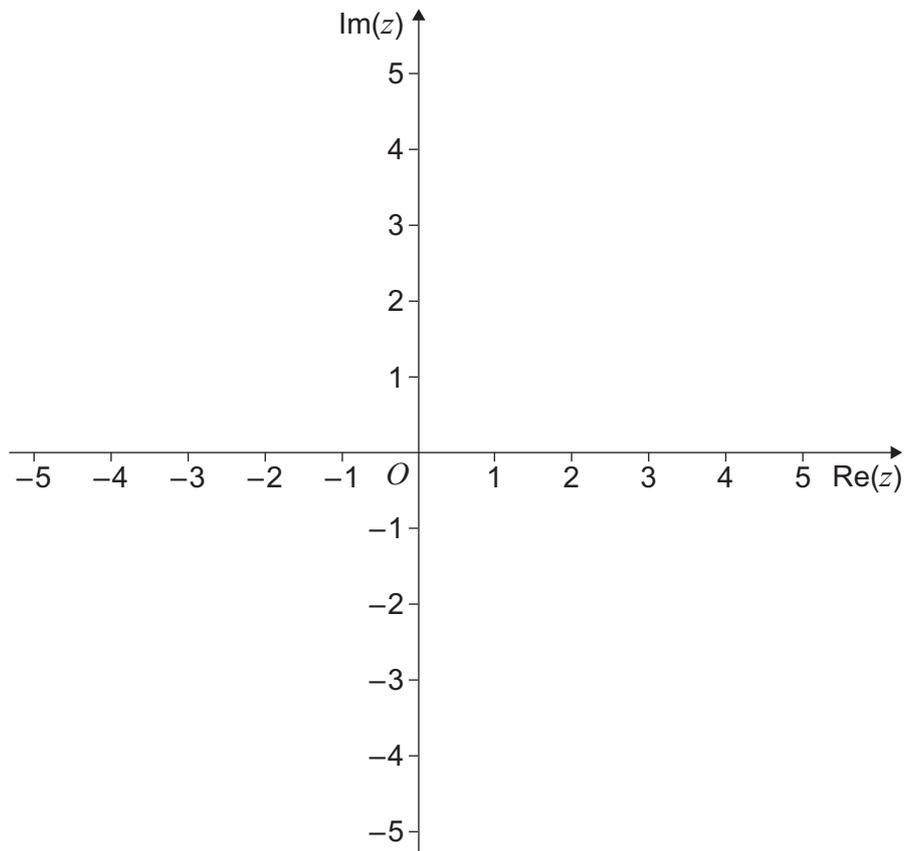


**18** The locus of points  $L_1$  satisfies the equation  $|z| = 2$

The locus of points  $L_2$  satisfies the equation  $\arg(z + 4) = \frac{\pi}{4}$

**18 (a)** Sketch  $L_1$  on the Argand diagram below.

[1 mark]



**18 (b)** Sketch  $L_2$  on the Argand diagram above.

[1 mark]





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ANSWER IN THE SPACES PROVIDED**



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