



## Cambridge International AS & A Level

CANDIDATE  
NAME

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NUMBER

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### FURTHER MATHEMATICS

9231/13

Paper 1 Further Pure Mathematics 1

May/June 2022

2 hours

You must answer on the question paper.

You will need: List of formulae (MF19)

### INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

### INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

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- 1 (a) Sketch the curve with equation  $y = \frac{x+1}{x-1}$ . [2]

- (b) Sketch the curve with equation  $y = \frac{|x|+1}{|x|-1}$  and find the set of values of  $x$  for which  $\frac{|x|+1}{|x|-1} < -2$ . [4]

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3 A curve  $C$  has equation  $y = \frac{ax^2 + x - 1}{x - 1}$ , where  $a$  is a positive constant.

(a) Find the equations of the asymptotes of  $C$ . [3]

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(b) Show that there is no point on  $C$  for which  $1 < y < 1 + 4a$ . [4]

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(c) Sketch *C*. You do not need to find the coordinates of the intersections with the axes. [3]











6 The curve  $C$  has Cartesian equation  $x^2 + xy + y^2 = a$ , where  $a$  is a positive constant.

(a) Show that the polar equation of  $C$  is  $r^2 = \frac{2a}{2 + \sin 2\theta}$ . [3]

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(b) Sketch the part of  $C$  for  $0 \leq \theta \leq \frac{1}{4}\pi$ . [2]

















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