



Cambridge International AS & A Level

CANDIDATE
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FURTHER MATHEMATICS

9231/13

Paper 1 Further Pure Mathematics 1

May/June 2021

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.

2 The cubic equation $2x^3 - 4x^2 + 3 = 0$ has roots α, β, γ . Let $S_n = \alpha^n + \beta^n + \gamma^n$.

(a) State the value of S_1 and find the value of S_2 . [3]

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(b) (i) Express S_{n+3} in terms of S_{n+2} and S_n . [1]

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(ii) Hence, or otherwise, find the value of S_4 . [2]

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7 The curve C has equation $y = \frac{x^2 - x - 3}{1 + x - x^2}$.

(a) Find the equations of the asymptotes of C . [2]

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(b) Find the coordinates of any stationary points on C . [3]

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- (c) Sketch C , stating the coordinates of the intersections with the axes. [3]

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- (d) Sketch the curve with equation $y = \left| \frac{x^2 - x - 3}{1 + x - x^2} \right|$ and find in exact form the set of values of x for which $\left| \frac{x^2 - x - 3}{1 + x - x^2} \right| < 3$. [6]

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