



Cambridge International AS & A Level

CANDIDATE
NAME

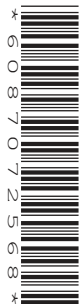
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CENTRE
NUMBER

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FURTHER MATHEMATICS

9231/13

Paper 1 Further Pure Mathematics 1

October/November 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 **16** pages. Any blank pages are indicated.

The line l passes through the point P with position vector $2\mathbf{i} + 3\mathbf{j} + \mathbf{k}$ and is parallel to the vector $\mathbf{j} + \mathbf{k}$.

- (b) Find the acute angle between l and Π . [3]

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- (c) Find the position vector of the foot of the perpendicular from P to Π . [4]

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- 6 (a) Show that the curve with Cartesian equation

$$(x^2 + y^2)^2 = 36(x^2 - y^2)$$

has polar equation $r^2 = 36 \cos 2\theta$. [3]

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The curve C has polar equation $r^2 = 36 \cos 2\theta$, for $-\frac{1}{4}\pi \leq \theta \leq \frac{1}{4}\pi$.

- (b) Sketch C and state the maximum distance of a point on C from the pole. [3]

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7 The curve C has equation $y = \frac{5x^2}{5x-2}$.

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

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(b) Find the coordinates of the stationary points on C . [4]

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(c) Sketch C .

[3]

(d) Sketch the curve with equation $y = \left| \frac{5x^2}{5x-2} \right|$ and find in exact form the set of values of x for which $\left| \frac{5x^2}{5x-2} \right| < 2$. [6]

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