



Cambridge International AS & A Level

CANDIDATE
NAME
CENTRE
NUMBER

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CANDIDATE
NUMBER

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FURTHER MATHEMATICS

9231/13

Paper 1 Further Pure Mathematics 1

October/November 2024

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.

- (a) Show that $\mathbf{M} = \begin{pmatrix} k & k \\ 0 & 1 \end{pmatrix}$. [4]



- Find, in terms of k , the equation of this line. [3]

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5

- [illegible]

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- 4Uadmission

$$\frac{d^n}{dx^n}(\tan^{-1}x) = P_n(x)(1+x^2)^{-n},$$

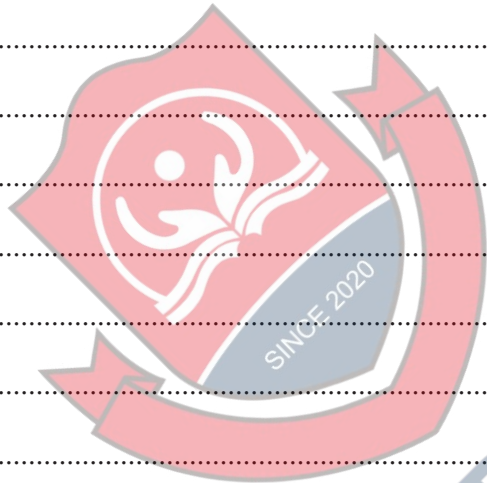
[6]



4Uadmission



(a) Find a quartic equation whose roots are $\alpha^4, \beta^4, \gamma^4, \delta^4$ and state the value of $\alpha^4 + \beta^4 + \gamma^4 + \delta^4$. [5]



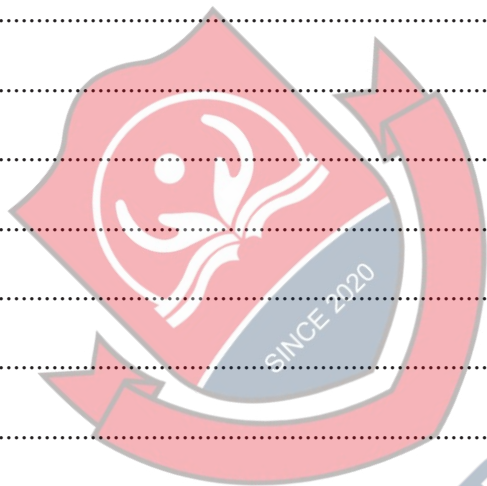
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[3]

[2]

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[2]

A pink decorative graphic at the bottom of the page, featuring a stylized flower or leaf shape with a white outline and a small pink arrow pointing upwards.

[2]

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

$$(x^2 + y^2)^2 = 6xy$$

has polar equation $r^2 = 3 \sin 2\theta$.

[2]

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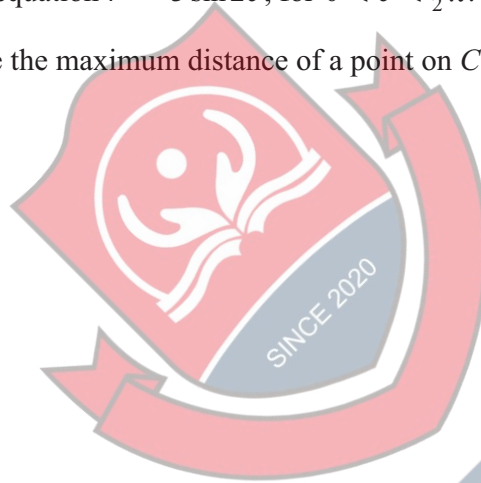
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The curve C has polar equation $r^2 = 3 \sin 2\theta$, for $0 \leq \theta \leq \frac{1}{2}\pi$.

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

[3]



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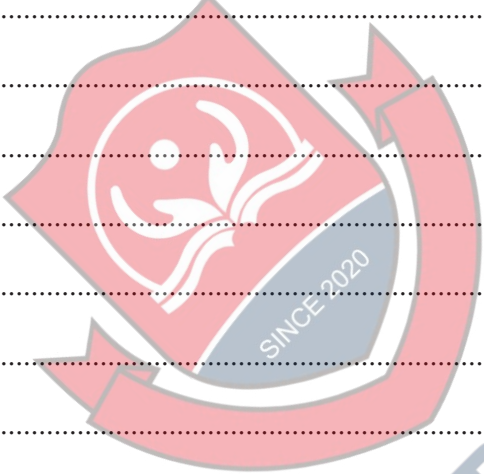
[2]

[6]



[2]

[4]



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- (c) Sketch C , stating the coordinates of any intersections with the axes.

[5]



- (d) Sketch the curve with equation $y = \left| \frac{4x^2 + x + 1}{2x^2 - 7x + 3} \right|$ and state the set of values of k for which $\left| \frac{4x^2 + x + 1}{2x^2 - 7x + 3} \right| = k$ has 4 distinct real solutions.

[2]



[illegible]



[7]



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