



Cambridge International AS & A Level

CANDIDATE
NAME
CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

**FURTHER MATHEMATICS****9231/13**

Paper 1 Further Pure Mathematics 1

October/November 2020**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. Blank pages are indicated.

- State the type of each transformation, and make clear the order in which they are applied. [2]

.....

.....

.....

.....

.....

(b) Find, in terms of a and b , the matrix which transforms parallelogram $OPQR$ onto the unit square. [2]

[illegible]

It is given that the area of $OPQR$ is 2 cm^2 and that the line $x+3y=0$ is invariant under the transformation represented by $\mathbf{M}$.

(c) Find the values of a and b . [5]

[illegible]

where a , b and c are constants to be determined. [3]

[illegible]

[illegible]

(c) Deduce the value of $\sum_{r=1}^{\infty} \frac{1}{(7r+1)(7r+8)}$. [1]

[illegible]

3 The cubic equation $x^3 + cx + 1 = 0$, where c is a constant, has roots α, β, γ .

(a) Find a cubic equation whose roots are $\alpha^3, \beta^3, \gamma^3$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) Show that $\alpha^6 + \beta^6 + \gamma^6 = 3 - 2c^3$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

respectively, relative to the origin O .

- (a) Find the equation of the plane ABC , giving your answer in the form $ax + by + cz = d$. [5]

This image shows a full page of a handwriting practice worksheet. It consists of multiple rows of horizontal dotted lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.

.....

.....

.....

.....

(c) Find the acute angle between the planes OAB and ABC . [4]

[illegible]

$$\frac{d^{2n-1}}{dx^{2n-1}}(x \sin x) = (-1)^{n-1} (x \cos x + (2n-1) \sin x). \quad [7]$$

This image shows a full page of a document template designed for handwriting practice or general note-taking. It consists of approximately 20 evenly spaced horizontal dotted lines across the entire width of the page. The background is plain white, and there are no margins, headers, footers, or other markings present.

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

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) Show that there is no point on C for which $1 < y < 5$. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

13

(c) Find the coordinates of the intersections of C with the axes, and sketch C . [3]

.....

.....

.....

.....

.....

(d) Sketch the curve with equation $y = \left| \frac{x^2 + x - 1}{x - 1} \right|$. [2]

7 (a) Show that the curve with Cartesian equation

$$(x^2 + y^2)^{\frac{5}{2}} = 4xy(x^2 - y^2)$$

has polar equation $r = \sin 4\theta$.

[4]

[illegible]

The curve C has polar equation $r = \sin 4\theta$, for $0 \leq \theta \leq \frac{1}{4}\pi$.

- (b)** Sketch C and state the equation of the line of symmetry. [3]

- (c) Find the exact value of the area of the region enclosed by C . [4]

[illegible]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting or typing. There are no margins, text, or other markings on the page.

BLANK PAGE

BLANK PAGE

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.