Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

L2290902811

ADDITIONAL MATHEMATICS **4037/22**

Paper 2 **May/June 2020**

2 hours

You must answer on the question paper.

No additional materials are needed.

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.
- 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 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Blank pages are indicated.

© UCLES 2020

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series

$$u_n = a + (n-1)d$$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series

$$u_n = ar^{n-1}$$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2020

1 Variables x and y are such that $y = \sin x + e^{-x}$. Use differentiation to find the approximate change in y as x increases from $\frac{\pi}{4}$ to $\frac{\pi}{4} + h$, where h is small. [4]

2 DO NOT USE A CALCULATOR IN THIS QUESTION.

The point $\left(1 - \sqrt{5}, p\right)$ lies on the curve $y = \frac{10 + 2\sqrt{5}}{x^2}$. Find the exact value of p, simplifying your answer. [5]

3 Find the values of k for which the line $y = x - 3$ intersects the curve $y = k^2x^2 + 5kx + 1$ at two distinct points. [6]

4 The three roots of $\mathrm{p}(x) = 0$, where $\mathrm{p}(x) = 2x^3 + ax^2 + bx + c$ are $x = \frac{1}{2}$, $x = n$ and $x = -n$, where a, b, c and n are integers. The y-intercept of the graph of $y = \mathrm{p}(x)$ is 4. Find $\mathrm{p}(x)$, simplifying your coefficients. [5]

© UCLES 2020

5 Solutions to this question by accurate drawing will not be accepted.

The points A and B are (4, 3) and (12, −7) respectively.

(a) Find the equation of the line L, the perpendicular bisector of the line AB. [4]

(b) The line parallel to AB which passes through the point (5, 12) intersects L at the point C. Find the coordinates of C. [4]

6 **(a)** Find the equation of the tangent to the curve $2y = \tan 2x + 7$ at the point where $x = \frac{\pi}{8}$.

Give your answer in the form $ax - y = \frac{\pi}{b} + c$, where a, b and c are integers. [5]

(b) This tangent intersects the x-axis at P and the y-axis at Q. Find the length of PQ. [2]

© UCLES 2020

7 Giving your answer in its simplest form, find the exact value of

(a) $\int_0^4 \frac{10}{5x+2}\,\mathrm{d}x$, [4]

(b) $\int_0^{\ln 2} \left(\mathrm{e}^{4x+2}\right)^2 \mathrm{d}x$. [5]

8 **(a)** Solve $3\cot^2 x - 14\operatorname{cosec} x - 2 = 0$ for $0° < x < 360°$. [5]

(b) Show that $\dfrac{\sin^4 y - \cos^4 y}{\cot y} = \tan y - 2\cos y \sin y$. [4]

9 **(a)** Solve the equation $\dfrac{9^{5x}}{27^{x-2}} = 243$. [3]

(b) $\log_a \sqrt{b} - \dfrac{1}{2} = \log_b a$, where $a > 0$ and $b > 0$.

Solve this equation for b, giving your answers in terms of a. [5]

10 **(a)** The first 5 terms of a sequence are given below.

$$4 \qquad -2 \qquad 1 \qquad -0.5 \qquad 0.25$$

(i) Find the 20th term of the sequence. [2]

(ii) Explain why the sum to infinity exists for this sequence and find the value of this sum. [2]

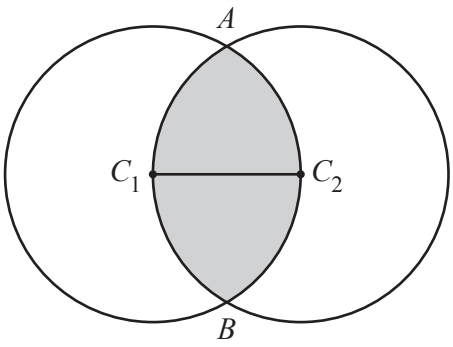
(b) The tenth term of an arithmetic progression is 15 times the second term. The sum of the first 6 terms of the progression is 87.

(i) Find the common difference of the progression. [4]

(ii) For this progression, the nth term is 6990. Find the value of n. [3]

Question 11 is printed on the next page.

11



The circles with centres C_1 and C_2 have equal radii of length r cm. The line C_1C_2 is a radius of both circles. The two circles intersect at A and B.

(a) Given that the perimeter of the shaded region is 4π cm, find the value of r. [4]

(b) Find the exact area of the shaded region. [4]

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.

© UCLES 2020