Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **May/June 2022**

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 **16** pages. Any blank pages are indicated.

© UCLES 2022

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 2022

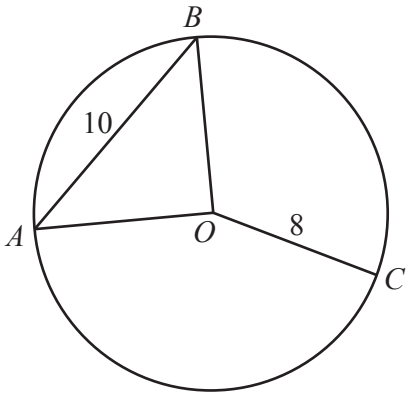
1 **(a)** Find the rational numbers a, b and c, such that the first three terms, in descending powers of x, in the expansion of $\left(3x^2 - \frac{1}{9x}\right)^5$ can be written in the form $ax^{10} + bx^7 + cx^4$. [3]

View solution

(b) Hence find the coefficient of x^4 in the expansion of $\left(3x^2 - \frac{1}{9x}\right)^5\left(1 + \frac{1}{x^3}\right)^2$. [3]

View solution

2 In this question, all lengths are in centimetres and all angles are in radians.



The diagram shows a circle, centre O, radius 8. The points A, B and C lie on the circumference of the circle. The chord AB has length 10.

(a) Show that angle BOA is 1.35 correct to 2 decimal places. [2]

View solution

(b) Given that the minor arc BC has a length of 18, find angle BOC. [2]

View solution

(c) Find the area of the minor sector AOC. [3]

View solution

3 **(a)** Find the exact solution of the equation $2e^{6x} - 3e^{3x} - 5 = 0$. [3]

View solution

(b) Solve the following simultaneous equations.

View solution

$$e^{4x-7} \div e^{5x+7y} = \frac{1}{e^2}$$

$$xy + 18 = 0$$ [5]

© UCLES 2022

4 Variables x and y are such that when e^{4y} is plotted against x, a straight line of gradient $\frac{2}{5}$, passing through (10, 2), is obtained.

(a) Find y in terms of x. [3]

View solution

(b) Find the value of y when $x = 45$, giving your answer in the form $\ln p$. [2]

View solution

(c) Find the values of x for which y can be defined. [1]

View solution

© UCLES 2022

5 The velocity, $v\,\text{ms}^{-1}$, of a particle moving in a straight line, t seconds after passing through a fixed point O, is given by $v = 6\sin 3t$.

(a) Find the time at which the acceleration of the particle is first equal to $-9\,\text{ms}^{-2}$. [4]

View solution

(b) Find the displacement of the particle from O when $t = 5.6$. [4]

View solution

6 **(a)** It is given that $\mathrm{f} : x \to 2x^2$ for $x \geqslant 0$,

$\mathrm{g} : x \to 2x + 1$ for $x \geqslant 0$.

View solution

Each of the expressions in the table can be written as one of the following.

f' f'' g' g'' fg gf f^2 g^2 f^{-1} g^{-1}

Complete the table. The first row has been completed for you. [5]

Expression	Function notation
2	g'
0	
$4x$	
$8x^2 + 8x + 2$	
$4x + 3$	
$\frac{x-1}{2}$	

© UCLES 2022

(b) It is given that $\mathrm{h}(x) = (x-1)^2 + 3$ for $x \geqslant a$. The value of a is as small as possible such that h^{-1} exists.

(i) Write down the value of a. [1]

View solution

(ii) Write down the range of h. [1]

View solution

(iii) Find $\mathrm{h}^{-1}(x)$ and state its domain. [3]

View solution

© UCLES 2022

7 A curve has equation $y = \dfrac{(2x+1)^{\frac{3}{2}}}{x+5}$ for $x \geqslant 0$.

(a) Show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{(2x+1)^{\frac{1}{2}}}{(x+5)^2}(Ax+B)$, where A and B are integers to be found. [4]

View solution

(b) Show that there are no stationary points on this curve. [1]

View solution

(c) Find the approximate change in y when x increases from 1 to $1 + p$, where p is small. [2]

View solution

(d) Given that when $x = 1$ the rate of change in x is 2.5 units per second, find the corresponding rate of change in y. [2]

View solution

8 **(a)** A 6-digit number is formed from the digits 0, 1, 2, 5, 6, 7, 8, 9. A number cannot start with 0 and each digit can be used at most once in any 6-digit number.

(i) Find how many 6-digit numbers can be formed if there are no further restrictions. [1]

View solution

(ii) Find how many of these 6-digit numbers are divisible by 5. [3]

View solution

(iii) Find how many of these 6-digit numbers are greater than 850 000. [3]

View solution

(b) A team of 8 people is to be chosen from 12 people. Three of the people are brothers who must not be separated. Find the number of different teams that can be chosen. [3]

View solution

9 **(a)** Solve the equation $3\,\text{cosec}^2\left(2\phi - \frac{\pi}{3}\right) = 4$, for $0 < \phi < \pi$. Give your solutions in terms of π. [4]

View solution

(b) Given that $2x - 1 = \text{cosec}^2\theta$ and $y + 1 = \tan^2\theta$, find y in terms of x. [4]

View solution

10 **(a)** Show that $\frac{6}{2+3x}+\frac{4}{(x+1)^2}-\frac{2}{x+1}$ can be written as $\frac{14x+10}{(2+3x)(x+1)^2}$. [2]

View solution

(b) Hence find the exact value of $\int_0^2 \frac{14x+10}{(2+3x)(x+1)^2}\,\mathrm{d}x$. Give your answer in the form $p+\ln q$, where p and q are rational numbers. [6]

View solution

© UCLES 2022

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 Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

© UCLES 2022