Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

2436662856

ADDITIONAL MATHEMATICS **0606/22**

Paper 2 **February/March 2021**

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.

© UCLES 2021

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

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

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

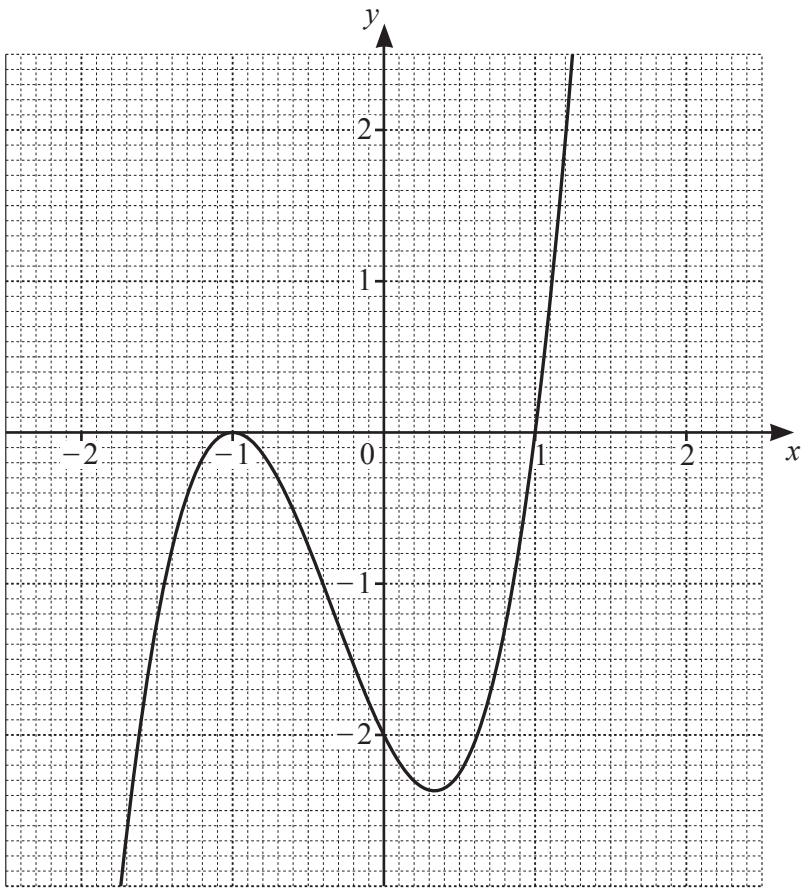
$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2021

1 Solve the equation $|4x+9| = |6-5x|$. [3]

2 Find the values of the constant k for which the equation $kx^2 - 3(k+1)x + 25 = 0$ has equal roots. [4]

3



The diagram shows the graph of $y = \mathrm{f}(x)$, where $\mathrm{f}(x) = a(x+b)^2(x+c)$ and a, b and c are integers.

(a) Find the value of each of a, b and c. [2]

(b) Hence solve the inequality $\mathrm{f}(x) \leqslant -1$. [3]

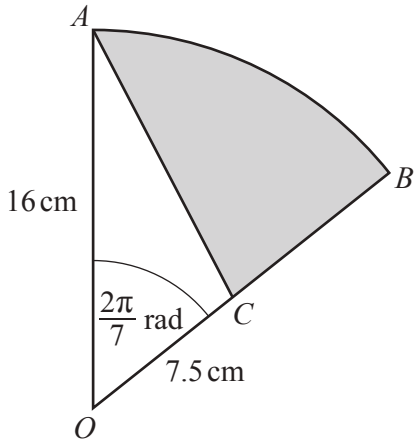
4 The curve $\frac{4}{x^2}+\frac{5}{4y^2}=1$ and the line $x+2y=0$ intersect at two points. Find the exact distance between these points. [6]

5 A cube of side x cm has surface area $S\,\text{cm}^2$. The volume, $V\,\text{cm}^3$, of the cube is increasing at a rate of $480\,\text{cm}^3\text{s}^{-1}$. Find, at the instant when $V = 512$,

(a) the rate of increase of x, [4]

(b) the rate of increase of S. [2]

6



AOB is a sector of a circle with centre *O* and radius 16 cm. Angle *AOB* is $\frac{2\pi}{7}$ radians. The point *C* lies on *OB* such that *OC* is of length 7.5 cm and *AC* is a straight line.

(a) Find the perimeter of the shaded region. [3]

(b) Find the area of the shaded region. [3]

© UCLES 2021

7 A curve has equation $y = \mathrm{p}(x)$, where $\mathrm{p}(x) = x^3 - 4x^2 + 6x - 1$.

(a) Find the equation of the tangent to the curve at the point (3, 8). Give your answer in the form $y = mx + c$. [5]

(b) **(i)** Given that p^{-1} exists, write down the gradient of the tangent to the curve $y = \mathrm{p}^{-1}(x)$ at the point (8, 3). [1]

(ii) Find the coordinates of the point of intersection of these two tangents. [2]

© UCLES 2021

8 A photographer takes 12 different photographs. There are 3 of sunsets, 4 of oceans, and 5 of mountains.

(a) The photographs are arranged in a line on a wall.

(i) How many possible arrangements are there if there are no restrictions? [1]

(ii) How many possible arrangements are there if the first photograph is of a sunset and the last photograph is of an ocean? [2]

(iii) How many possible arrangements are there if all the photographs of mountains are next to each other? [2]

(b) Three of the photographs are to be selected for a competition.

(i) Find the number of different possible selections if no photograph of a sunset is chosen. [2]

(ii) Find the number of different possible selections if one photograph of each type (sunset, ocean, mountain) is chosen. [2]

© UCLES 2021

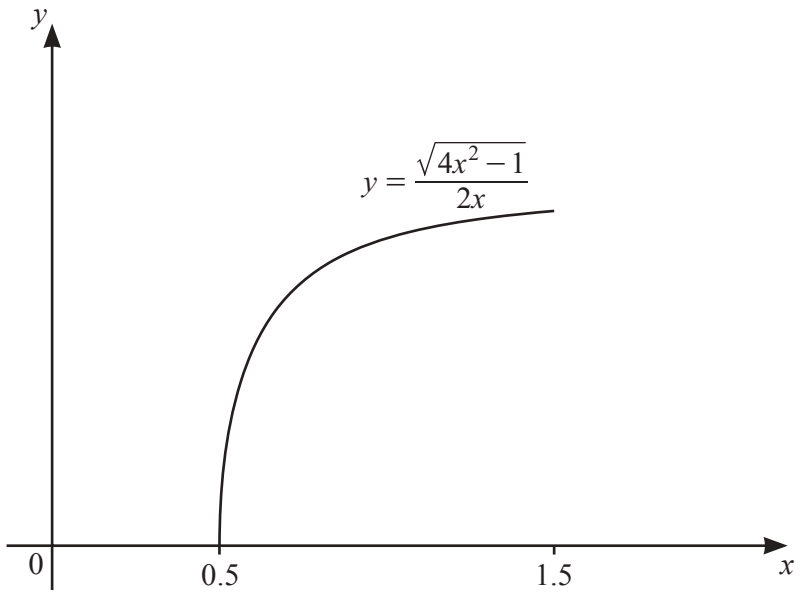
9 **(a)** In the expansion of $\left(2k-\frac{x}{k}\right)^5$, where k is a constant, the coefficient of x^2 is 160. Find the value of k. [3]

(b) **(i)** Find, in ascending powers of x, the first 3 terms in the expansion of $\left(1+3x\right)^6$, simplifying the coefficient of each term. [2]

(ii) When $(1+3x)^6(a+x)^2$ is written in ascending powers of x, the first three terms are $4+68x+bx^2$, where a and b are constants. Find the value of a and of b. [3]

10 The function f is defined by $\mathrm{f}(x) = \dfrac{\sqrt{4x^2 - 1}}{2x}$ for $0.5 \leqslant x \leqslant 1.5$.

The diagram shows a sketch of $y = \mathrm{f}(x)$.



(a) (i) It is given that f^{-1} exists. Find the domain and range of f^{-1}. [3]

(ii) Find an expression for $\mathrm{f}^{-1}(x)$. [3]

(b) The function g is defined by $\mathrm{g}(x) = \mathrm{e}^{x^2}$ for all real x. Show that $\mathrm{gf}(x) = \mathrm{e}^{\left(1-\frac{a}{bx^2}\right)}$, where a and b are integers. [2]

11 (a) (i) Find $\int \frac{1}{(10x-1)^6} \mathrm{d}x$. [2]

(ii) Find $\int \frac{(2x^3+5)^2}{x} \mathrm{d}x$. [3]

(b) (i) Differentiate $y = \tan(3x+1)$ with respect to x. [2]

(ii) Hence find $\int_{\frac{\pi}{12}}^{\frac{\pi}{10}} \left(\frac{\sec^2(3x+1)}{2} - \sin x \right) \mathrm{d}x$. [4]

Question 12 is printed on the next page.

12 A particle P travels in a straight line so that, t seconds after passing through a fixed point O, its velocity, $v\,\text{ms}^{-1}$, is given by

$$v = \frac{t}{2\text{e}} \qquad \text{for } 0 \leqslant t \leqslant 2,$$

$$v = \text{e}^{-\frac{t}{2}} \qquad \text{for } t > 2\ .$$

Given that, after leaving O, particle P is never at rest, find the distance it travels between $t = 1$ and $t = 3$. [6]

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 2021