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.

DC (CE/SW) 202023/5

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

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

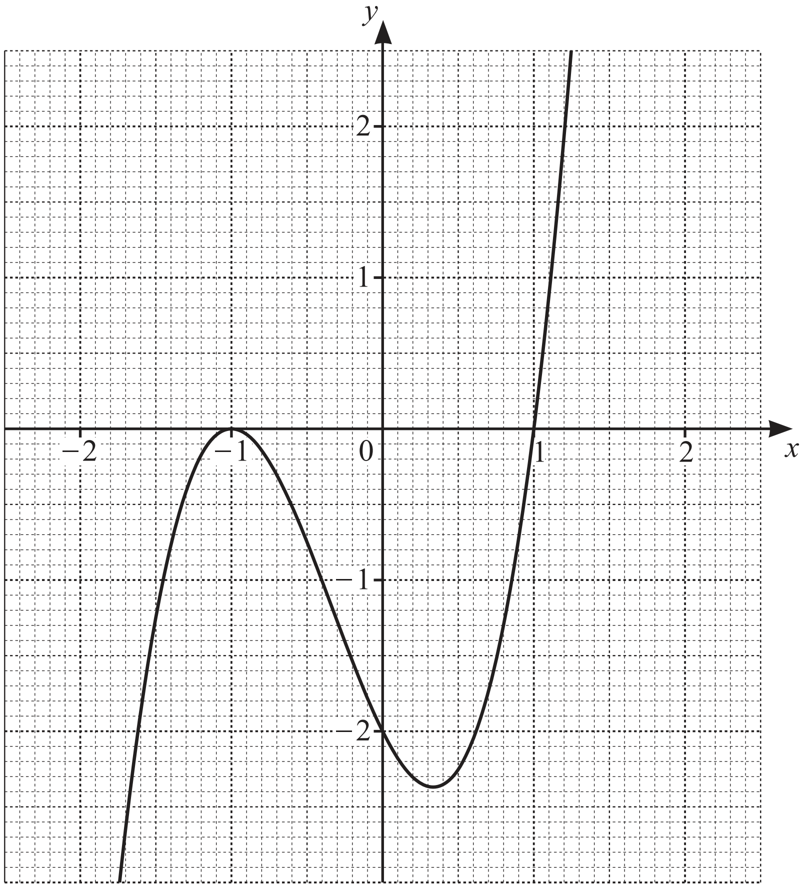
$$a^2 = b^2 + c^2 - 2bc\cos A$$

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

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]

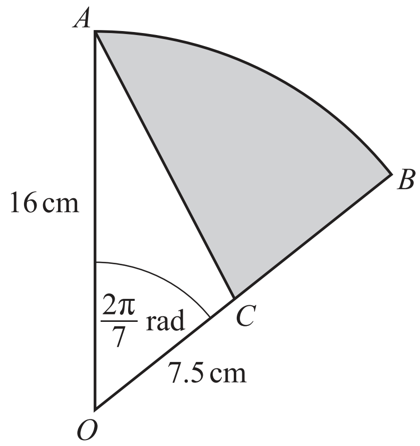
4 The curve $\frac{4}{x^2} + \frac{5}{4y^2} = 1$ and the line $x + 2y = 0$ intersect at two points. Find the exact distance between these points. [6]

5 A cube of side x cm has surface area S cm^2. The volume, V cm^3, of the cube is increasing at a rate of 480 cm^{3}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]

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]

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]

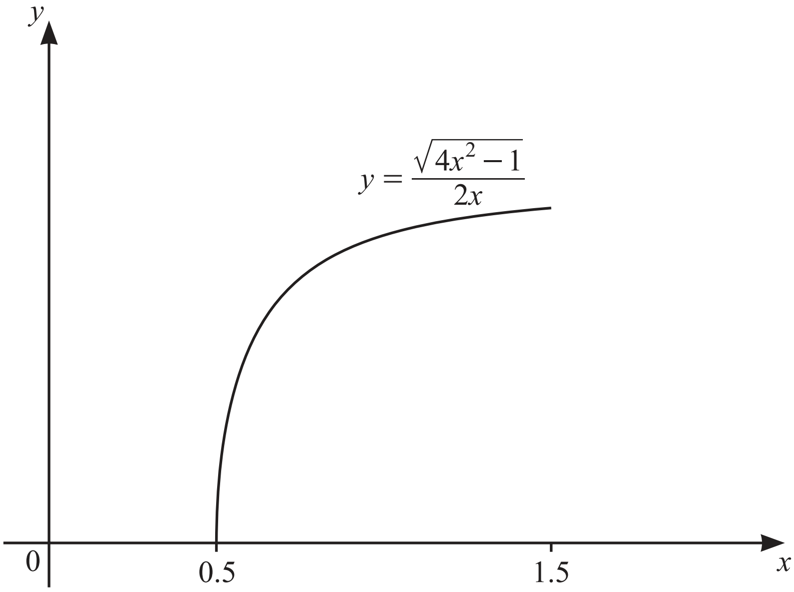
9 **(a)** In the expansion of $\left(2k - \frac{x}{k}\right)^5$, where k is a constant, the coefficient of x^2 is 160. Find the value of k. [3]

(b) **(i)** Find, in ascending powers of x, the first 3 terms in the expansion of $(1+3x)^6$, 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 $f^{-1}(x)$. [3]

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

11 **(a)** **(i)** Find $\displaystyle\int \frac{1}{(10x-1)^6}\,dx$. [2]

(ii) Find $\displaystyle\int \frac{(2x^3+5)^2}{x}\,dx$. [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]