Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME					
CENTRE NUMBER					
CANDIDATE NUMBER					

0156641698

ADDITIONAL MATHEMATICS **4037/11**

Paper 1 **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 **16** pages. Blank pages are indicated.

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

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

Geometric series $\quad u_n = ar^{n-1}$

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

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

2. TRIGONOMETRY

Identities

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

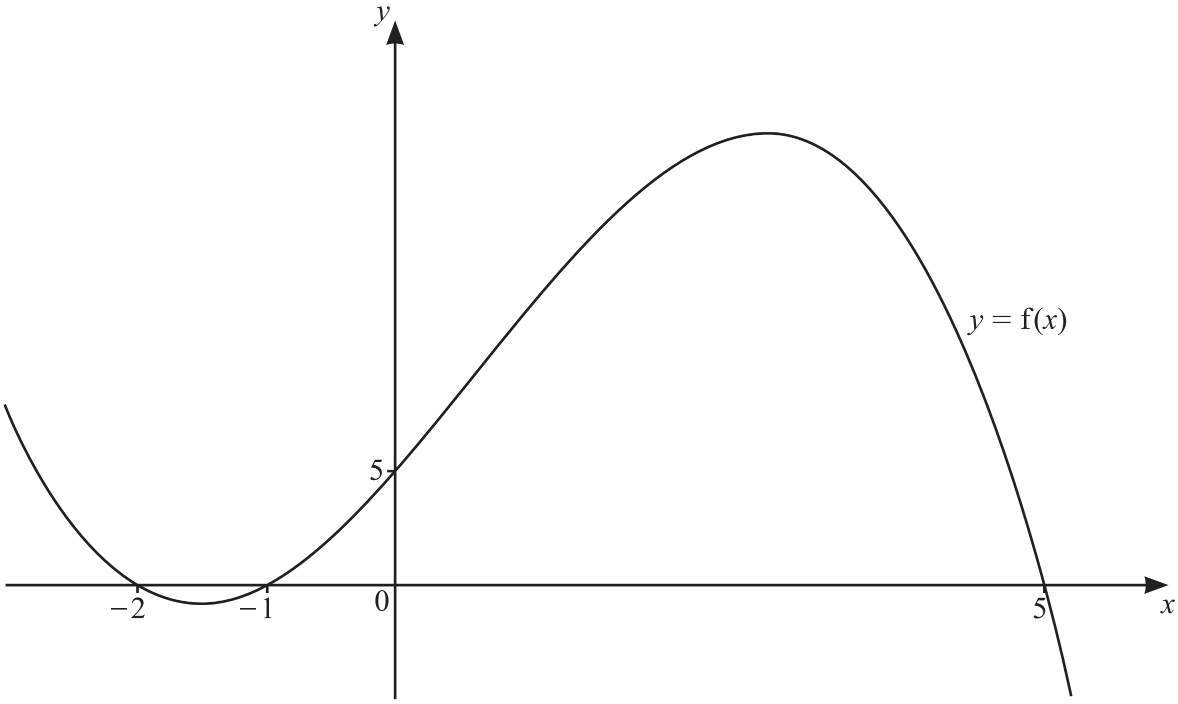
Formulae for ΔABC

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

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

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

1 The diagram shows the graph of a cubic curve $y = \mathrm{f}(x)$.

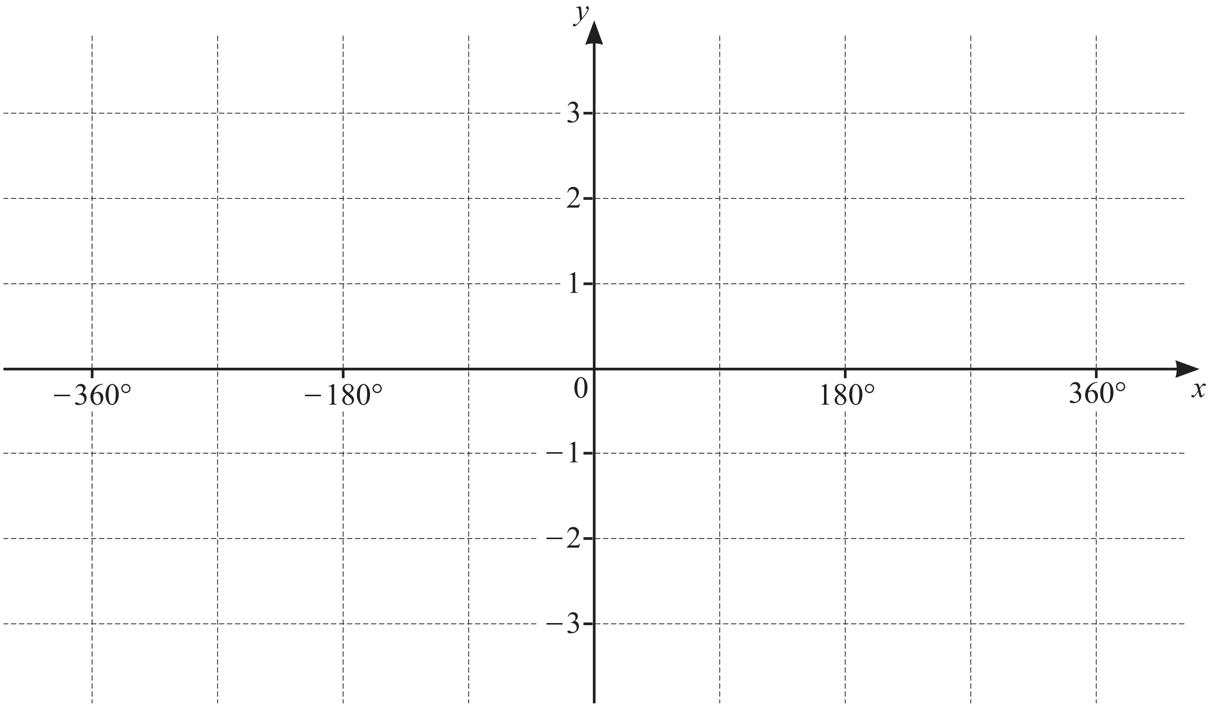


(a) Find an expression for $\mathrm{f}(x)$. [2]

(b) Solve $\mathrm{f}(x) \leqslant 0$. [2]

2 **(a)** Write down the period of $2\cos\frac{x}{3} - 1$. [1]

(b) On the axes below, sketch the graph of $y = 2\cos\frac{x}{3} - 1$ for $-360° \leqslant x \leqslant 360°$. [3]



3 The radius, r cm, of a circle is increasing at the rate of $5\,\text{cm s}^{-1}$. Find, in terms of π, the rate at which the area of the circle is increasing when $r = 3$. [4]

4 **DO NOT USE A CALCULATOR IN THIS QUESTION.**

Find the positive solution of the equation $\left(5+4\sqrt{7}\right)x^2+\left(4-2\sqrt{7}\right)x-1=0$, giving your answer in the form $a+b\sqrt{7}$, where a and b are fractions in their simplest form. [5]

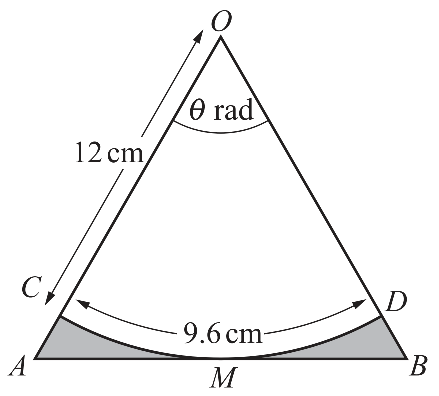
5 Find the equation of the tangent to the curve $y = \dfrac{\ln\left(3x^2 - 1\right)}{x+2}$ at the point where $x = 1$. Give your answer in the form $y = mx + c$, where m and c are constants correct to 3 decimal places. [6]

6 The line $y = 5x + 6$ meets the curve $xy = 8$ at the points A and B.

(a) Find the coordinates of A and of B. [3]

(b) Find the coordinates of the point where the perpendicular bisector of the line AB meets the line $y = x$. [5]

7



The diagram shows an isosceles triangle OAB such that $OA = OB$ and angle $AOB = \theta$ radians. The points C and D lie on OA and OB respectively. CD is an arc of length 9.6 cm of the circle, centre O, radius 12 cm. The arc CD touches the line AB at the point M.

(a) Find the value of θ. [1]

(b) Find the total area of the shaded regions. [4]

(c) Find the total perimeter of the shaded regions. [3]

8 **(a)** Show that $\frac{3}{2x-3}+\frac{3}{2x+3}$ can be written as $\frac{12x}{4x^2-9}$. [2]

(b) Hence find $\int \frac{12x}{4x^2-9}\,\mathrm{d}x$, giving your answer as a single logarithm and an arbitrary constant. [3]

(c) Given that $\int_2^a \frac{12x}{4x^2-9}\,dx = \ln 5\sqrt{5}$, where $a > 2$, find the exact value of a. [4]

9 **(a)** An arithmetic progression has a second term of -14 and a sum to 21 terms of 84. Find the first term and the 21st term of this progression. [5]

(b) A geometric progression has a second term of $27p^2$ and a fifth term of p^5. The common ratio, r, is such that $0 < r < 1$.

(i) Find r in terms of p. [2]

(ii) Hence find, in terms of p, the sum to infinity of the progression. [3]

(iii) Given that the sum to infinity is 81, find the value of p. [2]

10 **(a)** **(i)** Show that $\frac{1}{\sec\theta - 1} - \frac{1}{\sec\theta + 1} = 2\cot^2\theta$. [3]

(ii) Hence solve $\frac{1}{\sec 2x - 1} - \frac{1}{\sec 2x + 1} = 6$ for $-90° < x < 90°$. [5]

(b) Solve $\operatorname{cosec}\left(y+\frac{\pi}{3}\right)=2$ for $0 \leqslant y \leqslant 2\pi$ radians, giving your answers in terms of π. [4]

Question 11 is printed on the next page.

11 A curve is such that $\dfrac{d^2y}{dx^2} = 5\cos 2x$. This curve has a gradient of $\dfrac{3}{4}$ at the point $\left(-\dfrac{\pi}{12}, \dfrac{5\pi}{4}\right)$. Find the equation of this curve. [8]