



# Cambridge IGCSE™

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NUMBER

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**ADDITIONAL MATHEMATICS**

**0606/22**

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.

**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*

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

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*

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

*Formulae for  $\triangle ABC$* 

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

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

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

- 1 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  $(1 - \sqrt{5}, p)$  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  $p(x) = 0$ , where  $p(x) = 2x^3 + ax^2 + bx + c$  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  $y = p(x)$  is 4. Find  $p(x)$ , simplifying your coefficients. [5]

**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]

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

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

(b)  $\int_0^{\ln 2} (e^{4x+2})^2 dx.$  [5]

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

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



9 (a) Solve the equation  $\frac{9^{5x}}{27^{x-2}} = 243$ .

[3]

(b)  $\log_a \sqrt{b} - \frac{1}{2} = \log_b a$ , 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      -2      1      -0.5      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]

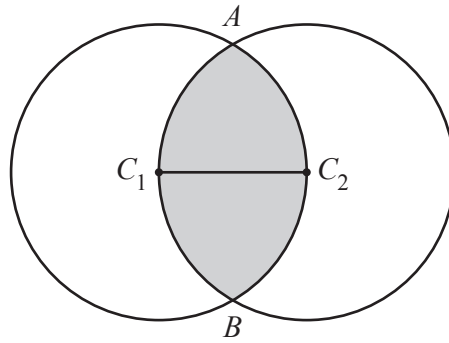
(b) The tenth term of an arithmetic progression is 15 times the second term. The sum of the first 6 terms of the progression is 87.

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

(ii) For this progression, the  $n$ th 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  $4\pi$  cm, find the value of  $r$ . [4]

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

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