



# Cambridge IGCSE™

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**ADDITIONAL MATHEMATICS**

**0606/22**

Paper 2

**February/March 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.

**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 Find the values of  $x$  for which  $12x^2 - 20x + 5 < (2x + 1)(x - 1)$ . [4]

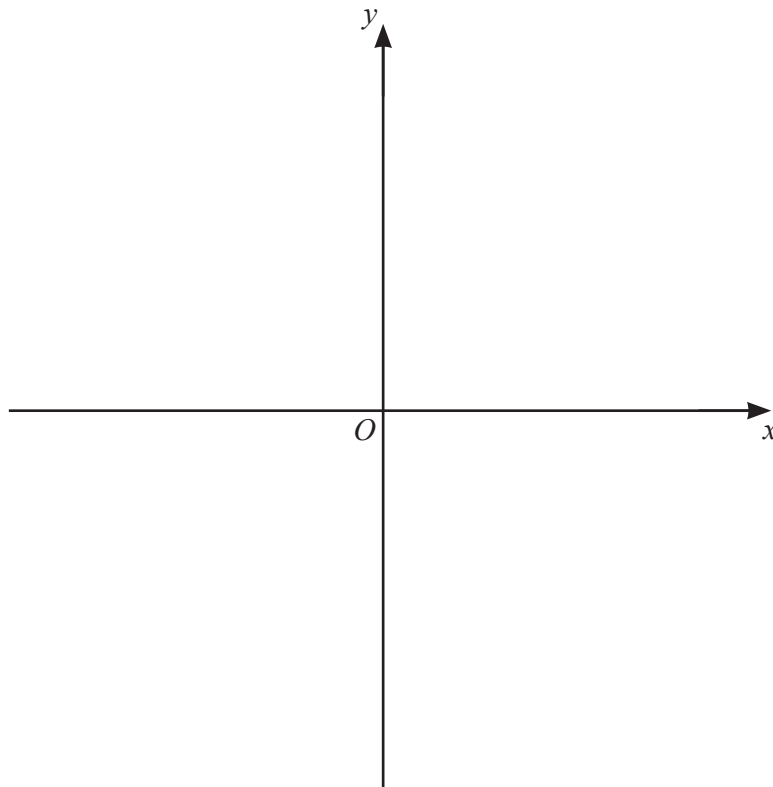
2 Variables  $x$  and  $y$  are such that, when  $\lg y$  is plotted against  $x^3$ , a straight line graph passing through the points (6, 7) and (10, 9) is obtained. Find  $y$  as a function of  $x$ . [4]

3 Find the exact solution of  $3^{2x} - 3^{x+1} - 4 = 0$ .

[4]

4 The position vectors of three points,  $A$ ,  $B$  and  $C$ , relative to an origin  $O$ , are  $\begin{pmatrix} -5 \\ -7 \end{pmatrix}$ ,  $\begin{pmatrix} 10 \\ -4 \end{pmatrix}$  and  $\begin{pmatrix} x \\ y \end{pmatrix}$  respectively. Given that  $\overrightarrow{AC} = 4\overrightarrow{BC}$ , find the unit vector in the direction of  $\overrightarrow{OC}$ . [5]

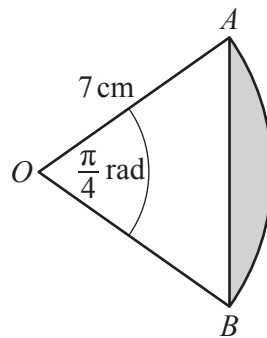
- 5 (a) On the axes below, sketch the graph of  $y = |5x - 7|$ , showing the coordinates of the points where the graph meets the coordinate axes. [3]



- (b) Solve  $5|5x - 7| - 1 = 14$ . [3]

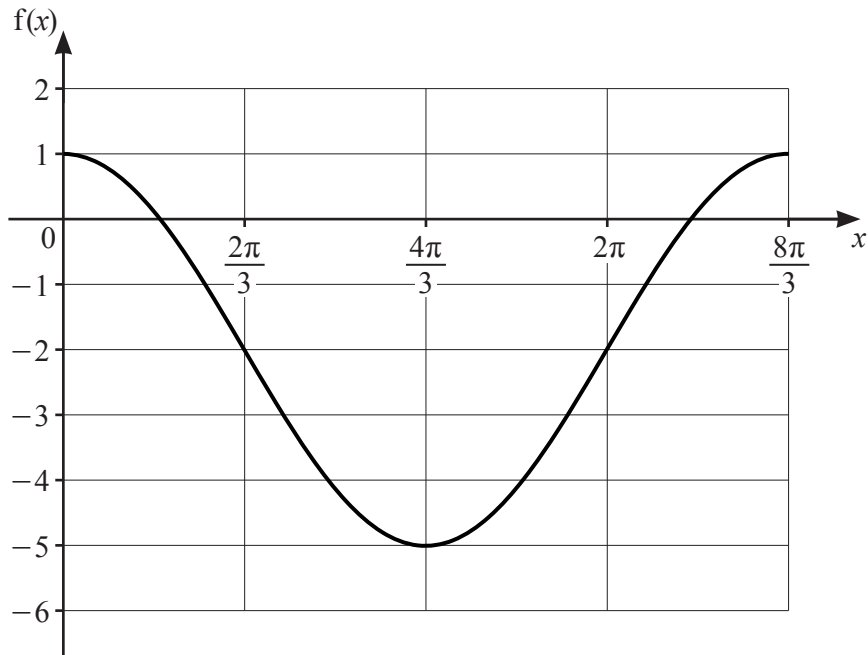
- 6 (a) A circle has a radius of 6 cm. A sector of this circle has a perimeter of  $2(6 + 5\pi)$  cm. Find the area of this sector. [4]

(b)



The diagram shows the sector  $AOB$  of a circle with centre  $O$  and radius  $7$  cm. Angle  $AOB = \frac{\pi}{4}$  radians. Find the perimeter of the shaded region. [3]

7 Find the coordinates of the points of intersection of the curves  $x^2 = 5y - 1$  and  $y = x^2 - 2x + 1$ . [5]



The diagram shows the graph of  $f(x) = a \cos bx + c$  for  $0 \leq x \leq \frac{8\pi}{3}$  radians.

(a) Explain why  $f$  is a function. [1]

(b) Write down the range of  $f$ . [1]

(c) Find the value of each of the constants  $a$ ,  $b$  and  $c$ . [4]



- 9 Variables  $x$  and  $y$  are such that  $y = \frac{e^{3x} \sin x}{x^2}$ . Use differentiation to find the approximate change in  $y$  as  $x$  increases from 0.5 to  $0.5 + h$ , where  $h$  is small. [6]

**10 (a)**  $g(x) = 3 + \frac{1}{x}$  for  $x \geq 1$ .

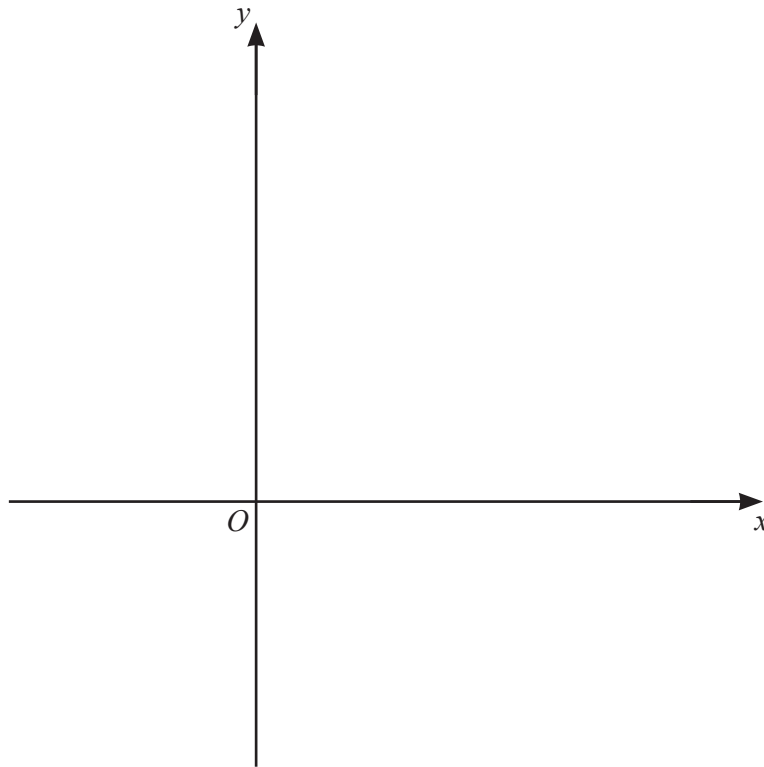
**(i)** Find an expression for  $g^{-1}(x)$ . [2]

**(ii)** Write down the range of  $g^{-1}$ . [1]

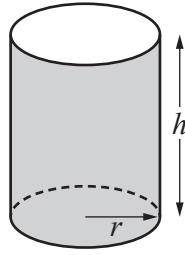
**(iii)** Find the domain of  $g^{-1}$ . [2]

(b)  $h(x) = 2 \ln(3x - 1)$  for  $x \geq \frac{2}{3}$ .

The graph of  $y = h(x)$  intersects the line  $y = x$  at two distinct points. On the axes below, sketch the graph of  $y = h(x)$  and hence sketch the graph of  $y = h^{-1}(x)$ . [4]



11



A container is a circular cylinder, open at one end, with a base radius of  $r$  cm and a height of  $h$  cm. The volume of the container is  $1000 \text{ cm}^3$ . Given that  $r$  and  $h$  can vary and that the total outer surface area of the container has a minimum value, find this value. [8]

12 A particle  $P$  moves in a straight line such that,  $t$  seconds after passing through a fixed point  $O$ , its acceleration,  $a \text{ ms}^{-2}$ , is given by  $a = -6t$ . When  $t = 0$ , the velocity of  $P$  is  $18 \text{ ms}^{-1}$ .

(a) Find the time at which  $P$  comes to instantaneous rest. [3]

(b) Find the distance travelled by  $P$  in the 3rd second. [3]

13 (a) The sum of the first two terms of a geometric progression is 10 and the third term is 9.

(i) Find the possible values of the common ratio and the first term. [5]

(ii) Find the sum to infinity of the convergent progression. [1]

- (b) In an arithmetic progression,  $u_1 = -10$  and  $u_4 = 14$ . Find  $u_{100} + u_{101} + u_{102} + \dots + u_{200}$ , the sum of the 100th to the 200th terms of the progression. [4]

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