

# **Cambridge IGCSE**<sup>™</sup>

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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 
$$u_n = ar^{n-1}$$

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

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

### 2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\csc^2 A = 1 + \cot^2 A$$

Formulae for  $\triangle ABC$ 

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

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

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

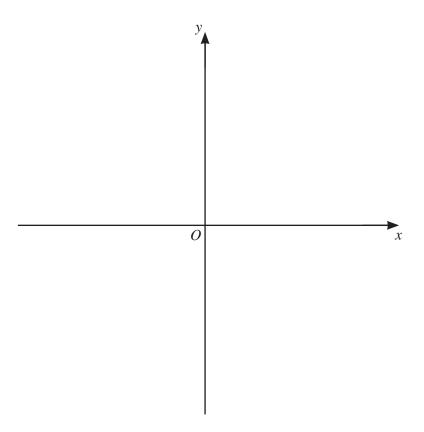
1 Find the values of x for which  $12x^2 - 20x + 5 < (2x+1)(x-1)$ . [4]

Variables x and y are such that, when 1gy 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  $\overrightarrow{OC}$ .

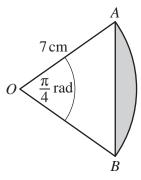
5 (a) On the axes below, sketch the graph of y = |5x-7|, showing the coordinates of the points where the graph meets the coordinate axes. [3]



**(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)** 



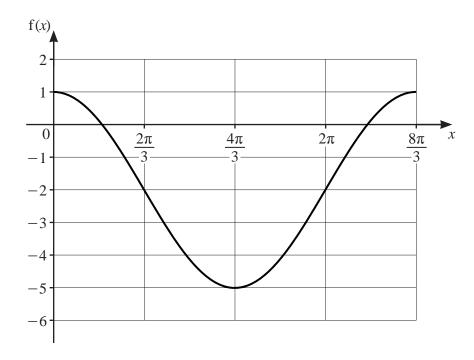
The diagram shows the sector AOB of a circle with centre O and radius 7 cm. Angle  $AOB = \frac{\pi}{4}$  radians. Find the perimeter of the shaded region. [3]

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

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[1]

8



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

- (a) Explain why f is a function.
- (b) Write down the range of f. [1]
- (c) Find the value of each of the constants a, b and c. [4]

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]

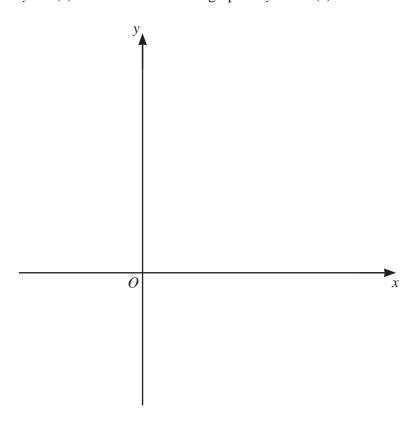
**10** (a) 
$$g(x) = 3 + \frac{1}{x}$$
 for  $x \ge 1$ .

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

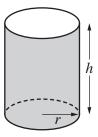
- (ii) Write down the range of  $g^{-1}$ . [1]
- (iii) Find the domain of  $g^{-1}$ . [2]

**(b)** 

 $h(x) = 2 \ln(3x - 1)$  for  $x \ge \frac{2}{3}$ . 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  $y = h^{-1}(x)$ .



11



A container is a circular cylinder, open at one end, with a base radius of rcm and a height of hcm. The volume of the container is  $1000 \,\mathrm{cm}^3$ . 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 $a = -6$ . 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]

14

| 13 | (a) | The sum of th | ne first two | terms of a | geometric r | progression i    | s 10 | and the | third to | erm is ' | 9 |
|----|-----|---------------|--------------|------------|-------------|------------------|------|---------|----------|----------|---|
| LU | (4) | The sum of u  | ic inst two  | terms or a | gcometre i  | JI OZI COSIOII I | 0 10 | and the | umu      |          | , |

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

[5]

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

[1]

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

16

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