Cambridge Assessment International Education

# Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*7394703437*

## ADDITIONAL MATHEMATICS 0606/12

Paper 1

October/November 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.

DC (PQ/FC) 187996/3

***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 $\Delta ABC$*

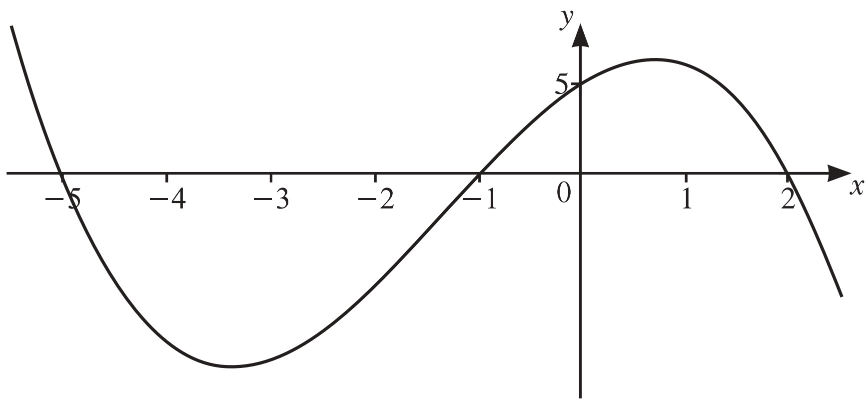
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

**1** The curve $y = 2x^2 + k + 4$ intersects the straight line $y = (k+4)x$ at two distinct points. Find the possible values of $k$. [4]

**2**




The diagram shows the graph of $y = \mathrm{f}(x)$, where $\mathrm{f}(x)$ is a cubic polynomial.

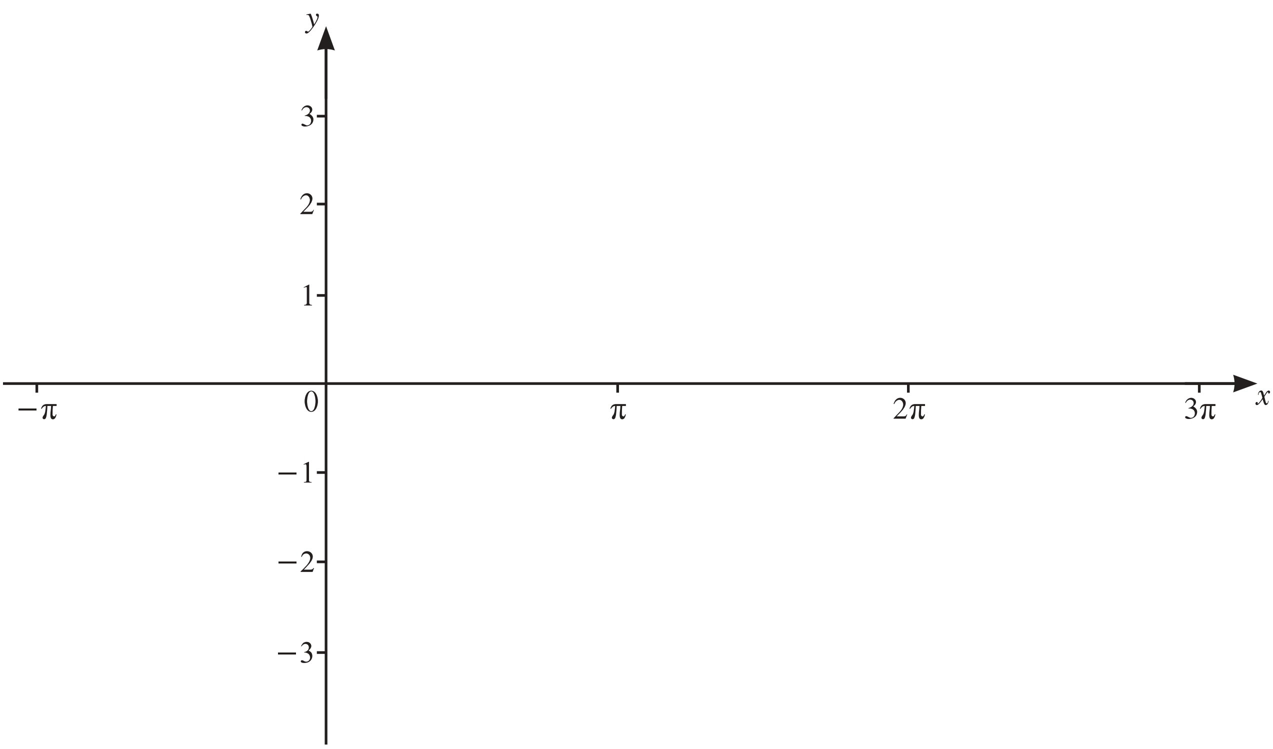
**(a)** Find $\mathrm{f}(x)$. [3]

**(b)** Write down the values of $x$ such that $\mathrm{f}(x) < 0$. [2]

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

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

**(c)** On the axes below, sketch the graph of $y = 2\cos\frac{x}{3} - 1$ for $-\pi \leqslant x \leqslant 3\pi$ radians.




[3]

**4** The 7th and 10th terms of an arithmetic progression are 158 and 149 respectively.

**(a)** Find the common difference and the first term of the progression. [3]

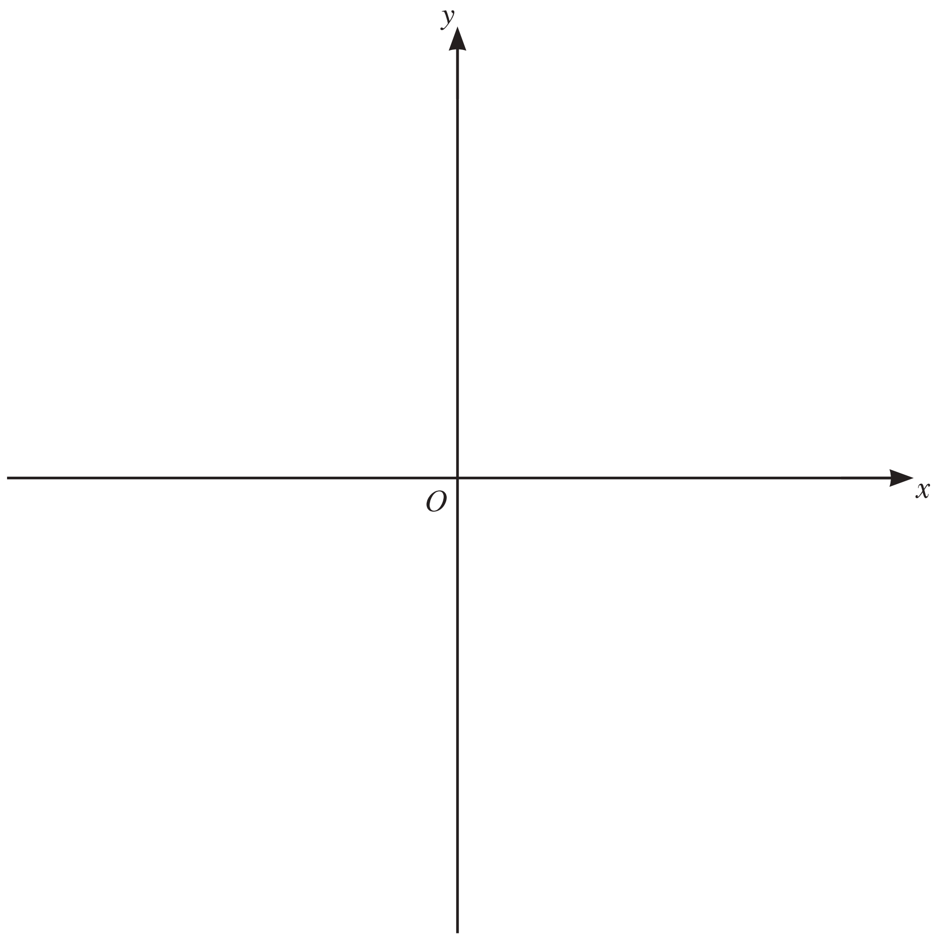
**(b)** Find the least number of terms of the progression for their sum to be negative. [3]

**5** Find the coefficient of $x^2$ in the expansion of $\left(x-\frac{3}{x}\right)\left(x+\frac{2}{x}\right)^5$. [5]

**6** $$f(x) = x^2 + 2x - 3 \quad \text{for } x \geqslant -1$$

**(a)** Given that the minimum value of $x^2 + 2x - 3$ occurs when $x = -1$, explain why $f(x)$ has an inverse. [1]

**(b)** On the axes below, sketch the graph of $y = f(x)$ and the graph of $y = f^{-1}(x)$. Label each graph and state the intercepts on the coordinate axes.




[4]

**7** A curve has equation $y = \dfrac{\ln\left(3x^2 - 5\right)}{2x+1}$ for $3x^2 > 5$.

**(a)** Find the equation of the normal to the curve at the point where $x = \sqrt{2}$. [6]

**(b)** Find the approximate change in $y$ as $x$ increases from $\sqrt{2}$ to $\sqrt{2}+h$, where $h$ is small. [1]

**8** **(a)** Find the number of ways in which 12 people can be put into 3 groups containing 3, 4 and 5 people respectively. [3]

**(b)** 4-digit numbers are to be formed using four of the digits 2, 3, 7, 8 and 9. Each digit may be used once only in any 4-digit number. Find how many 4-digit numbers can be formed if

**(i)** there are no restrictions, [1]

**(ii)** the number is even, [1]

**(iii)** the number is greater than 7000 and odd. [3]

**9** A curve has equation $y = (2x-1)\sqrt{4x+3}$.

**(a)** Show that $\dfrac{dy}{dx} = \dfrac{4(Ax+B)}{\sqrt{4x+3}}$, where $A$ and $B$ are constants. [5]

**(b)** Hence write down the $x$-coordinate of the stationary point of the curve. [1]

**(c)** Determine the nature of this stationary point. [2]

**10** The polynomial $p(x) = 6x^3 + ax^2 + bx + 2$, where $a$ and $b$ are integers, has a factor of $x - 2$.

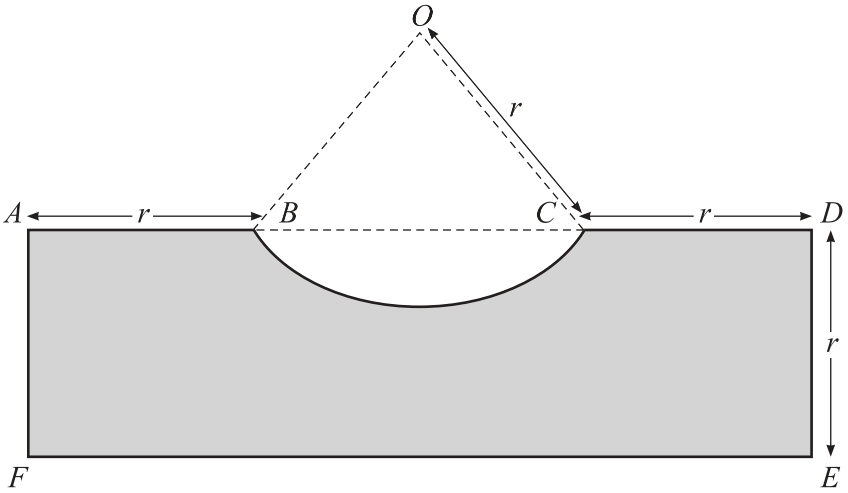
**(a)** Given that $p(1) = -2p(0)$, find the value of $a$ and of $b$. [4]

**(b)** Using your values of $a$ and $b$,

**(i)** find the remainder when $p(x)$ is divided by $2x - 1$, [2]

**(ii)** factorise $p(x)$. [2]

**11** In this question all lengths are in centimetres and all angles are in radians.

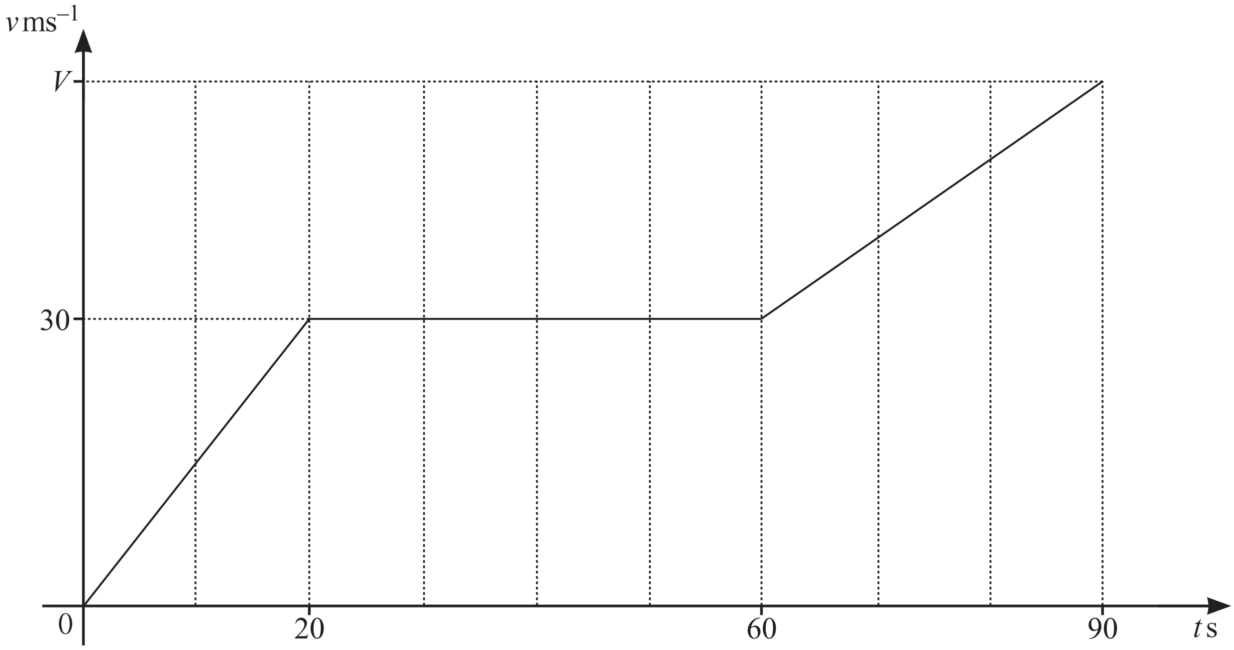



The diagram shows the rectangle *ADEF*, where $AF = DE = r$. The points *B* and *C* lie on *AD* such that $AB = CD = r$. The curve *BC* is an arc of the circle, centre *O*, radius *r* and has a length of $1.5r$.

**(a)** Show that the perimeter of the shaded region is $(7.5 + 2\sin 0.75)r$. [5]

**(b)** Find the area of the shaded region, giving your answer in the form $kr^2$, where $k$ is a constant correct to 2 decimal places. [4]

**12 (a)**




The diagram shows the velocity–time graph of a particle $P$ that travels 2775 m in 90 s, reaching a final velocity of $V\,\text{ms}^{-1}$.

**(i)** Find the value of $V$. [3]

**(ii)** Write down the acceleration of $P$ when $t = 40$. [1]

**(b)** The acceleration, $a$ ms$^{-2}$, of a particle $Q$ travelling in a straight line, is given by $a = 6\cos 2t$ at time $t$ s. When $t = 0$ the particle is at point $O$ and is travelling with a velocity of $10\,\text{ms}^{-1}$.

**(i)** Find the velocity of $Q$ at time $t$. [3]

**(ii)** Find the displacement of $Q$ from $O$ at time $t$. [3]