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.

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

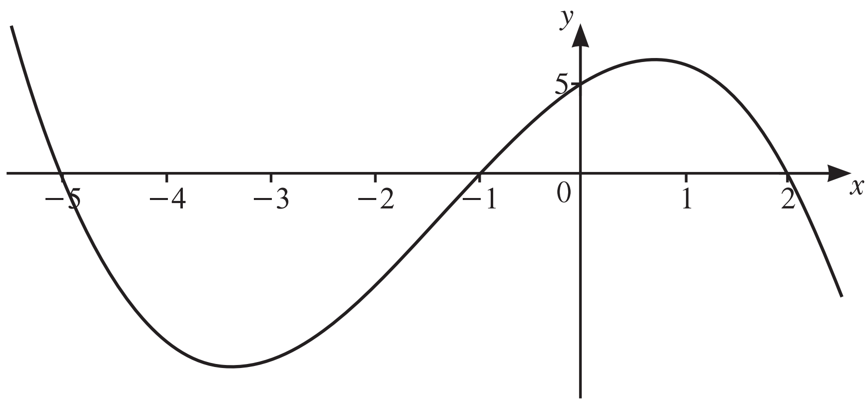
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

1 The 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.

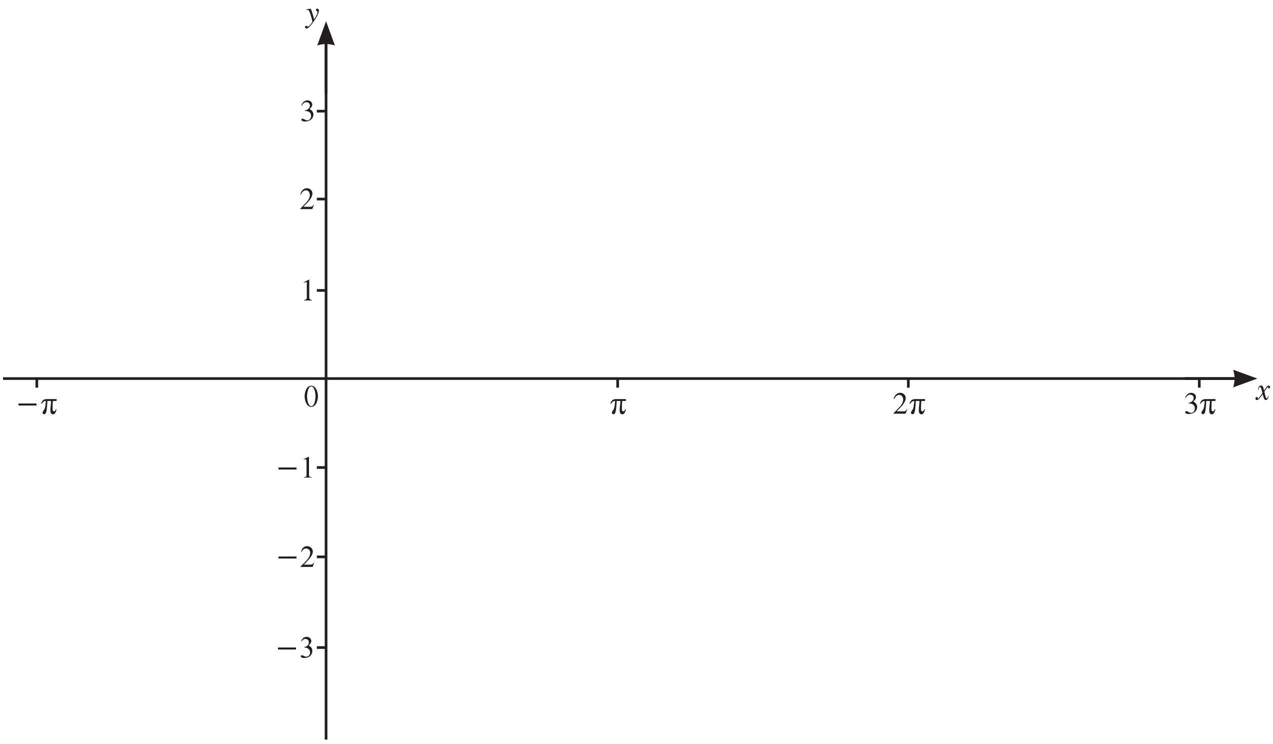
(a) Find $\mathrm{f}(x)$. [3]

(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]

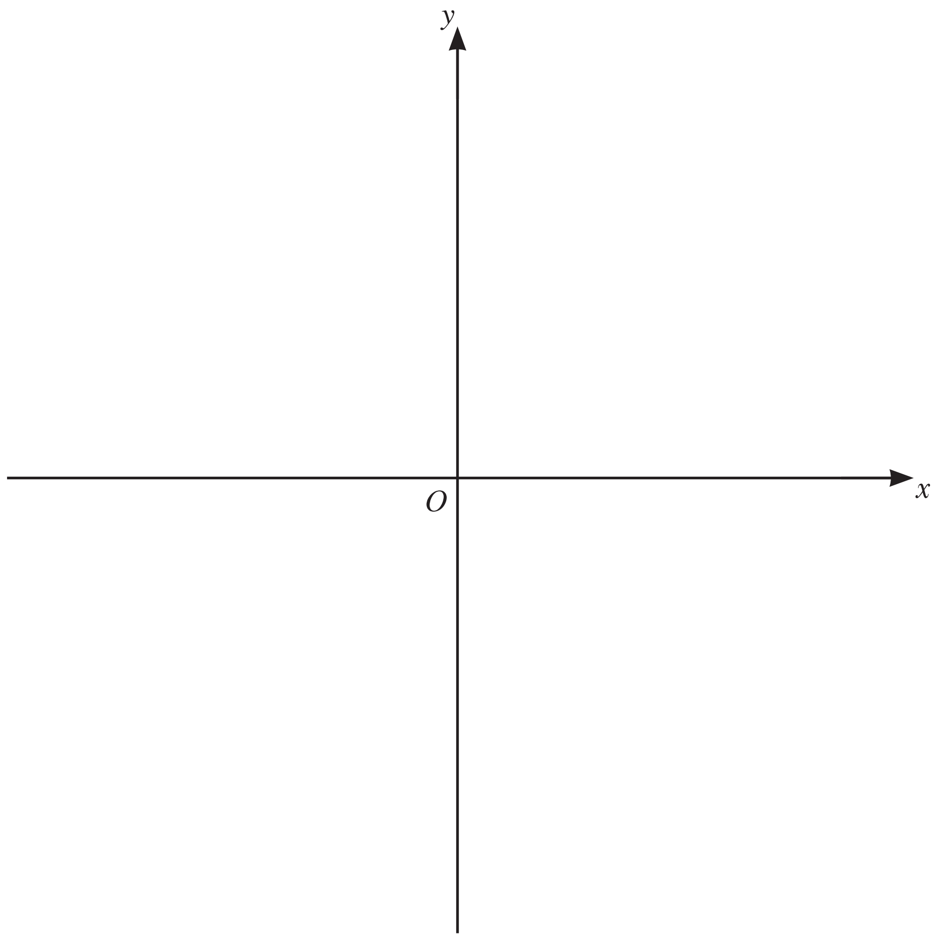
(b) Find the least number of terms of the progression for their sum to be negative. [3]

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 $y = \dfrac{\ln(3x^2 - 5)}{2x + 1}$ 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 $\frac{dy}{dx} = \frac{4(Ax+B)}{\sqrt{4x+3}}$, 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 $x - 2$.

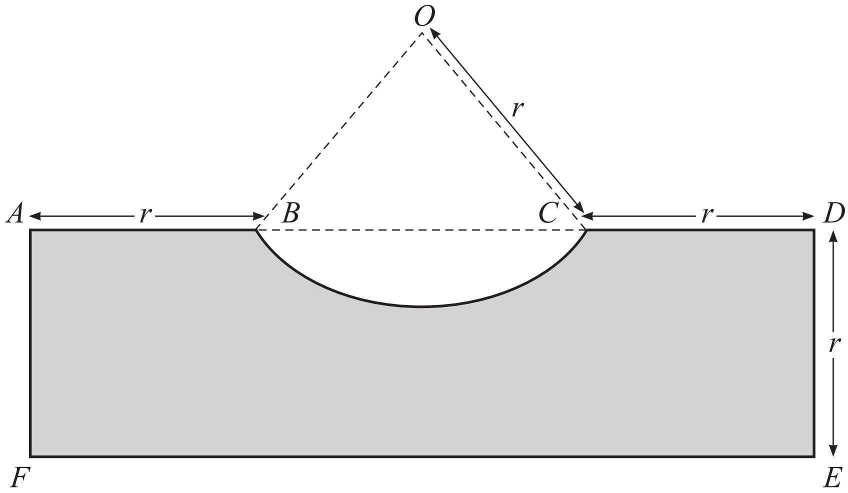
(a) Given that $p(1) = -2p(0)$, find the value of a and of b. [4]

(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.

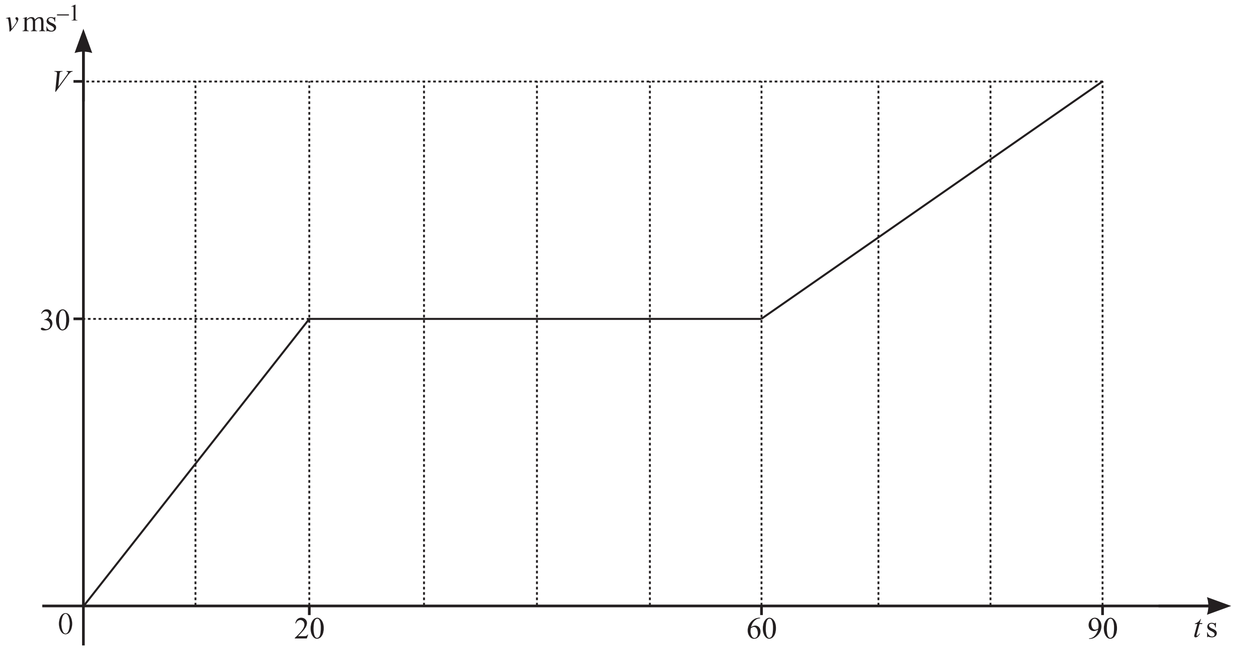


The diagram shows the rectangle *ADEF*, where $AF = DE = r$. The points *B* and *C* lie on *AD* such that $AB = CD = r$. The curve *BC* is an arc of the circle, centre *O*, radius *r* and has a length of $1.5r$.

(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 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]

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