Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME											
CENTRE NUMBER							CANDIDATE NUMBER				

7876434750

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **October/November 2021**

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.

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 $\binom{n}{r} = \dfrac{n!}{(n-r)!r!}$

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

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

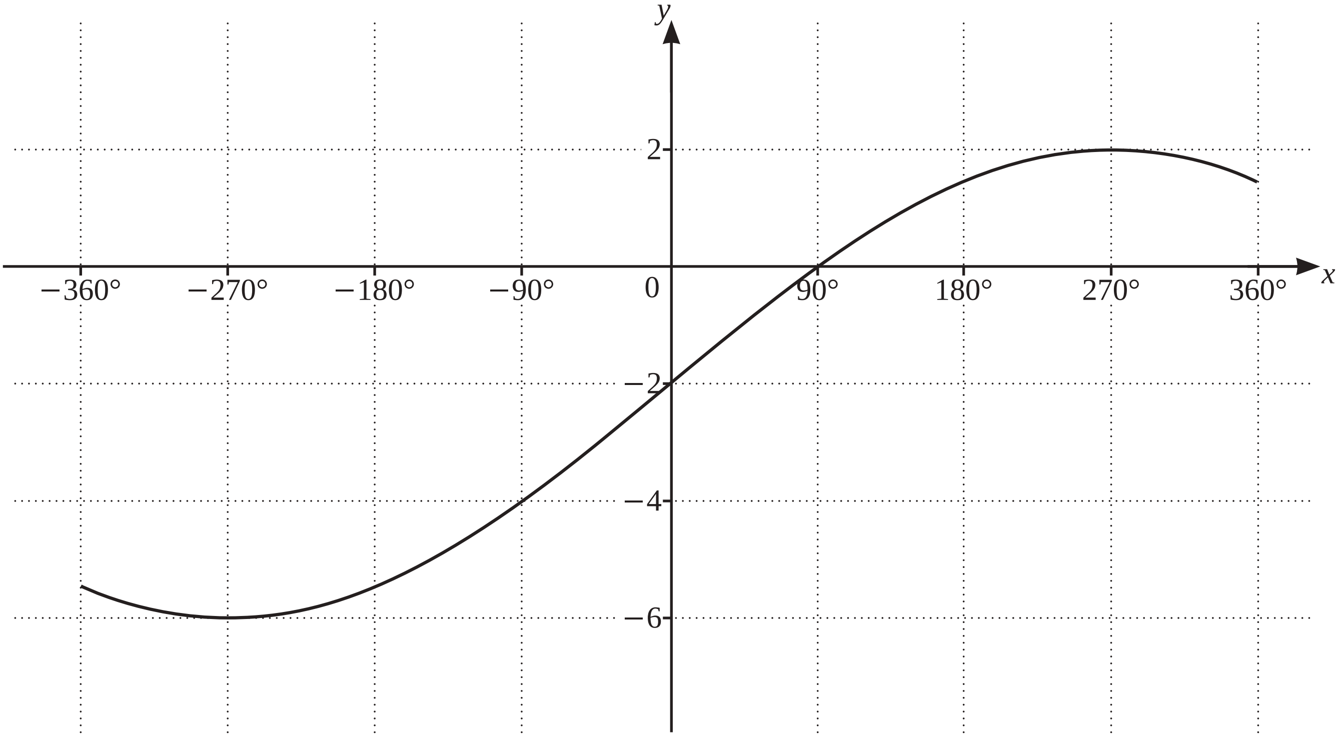
Formulae for ΔABC

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

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

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

1



The diagram shows the graph of $y = a\sin\frac{x}{b} + c$ for $-360° \leqslant x \leqslant 360°$, where a, b and c are integers.

(a) Write down the period of $a\sin\frac{x}{b} + c$. [1]

(b) Find the value of a, of b and of c. [3]

2 Points A and C have coordinates $(-4, 6)$ and $(2, 18)$ respectively. The point B lies on the line AC such that $\overrightarrow{AB} = \frac{2}{3}\overrightarrow{AC}$.

(a) Find the coordinates of B. [2]

(b) Find the equation of the line l, which is perpendicular to AC and passes through B. [2]

(c) Find the area enclosed by the line l and the coordinate axes. [2]

3 **(a)** Find the vector which has magnitude 39 and is in the same direction as $\begin{pmatrix} 12 \\ -5 \end{pmatrix}$. [2]

(b) Given that $\mathbf{a} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -4 \\ 5 \end{pmatrix}$, find the constants λ and μ such that $5\mathbf{a} + \lambda\begin{pmatrix} 4 \\ 6 \end{pmatrix} = \mu\mathbf{b}$. [4]

4 **(a)** Given that $\dfrac{q^{-2}\sqrt{pr}}{\sqrt[3]{r}\left(pq\right)^{-3}} = p^a q^b r^c$, find the value of each of the constants a, b and c. [3]

(b) Solve the equation $3x^{\frac{4}{5}} - 8x^{\frac{2}{5}} + 5 = 0$. [4]

5 The polynomial $p(x) = ax^3 + bx^2 + 6x + 4$, where a and b are integers, is divisible by $x - 2$. When $p'(x)$ is divided by $x + 1$ the remainder is -7.

(a) Find the value of a and of b. [5]

(b) Using your answers to **part (a)**, find the remainder when $p''(x)$ is divided by x. [2]

6 A curve with equation $y = \mathrm{f}(x)$ is such that $\frac{\mathrm{d}^2 y}{\mathrm{d}x^2} = 6\mathrm{e}^{3x} + 4x$. The curve has a gradient of 5 at the point $\left(0, \frac{5}{3}\right)$. Find $\mathrm{f}(x)$. [7]

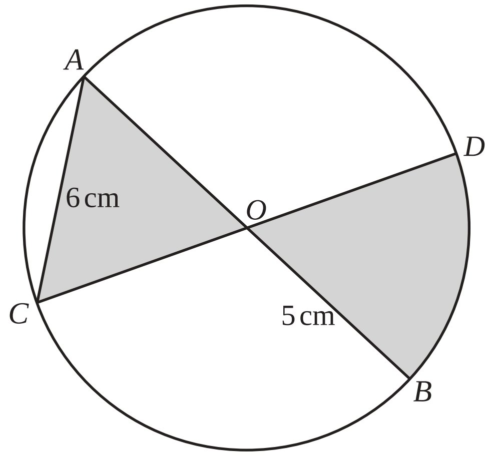
7 The first three terms, in ascending powers of x, in the expansion of $(2+ax)^n$ can be written as $64+bx+cx^2$, where n, a, b and c are constants.

(a) Find the value of n. [1]

(b) Show that $5b^2 = 768c$. [4]

(c) Given that $b = 12$, find the exact value of a and of c. [2]

8



The diagram shows a circle, centre O, radius 5 cm. The lines AOB and COD are diameters of this circle. The line AC has length 6 cm.

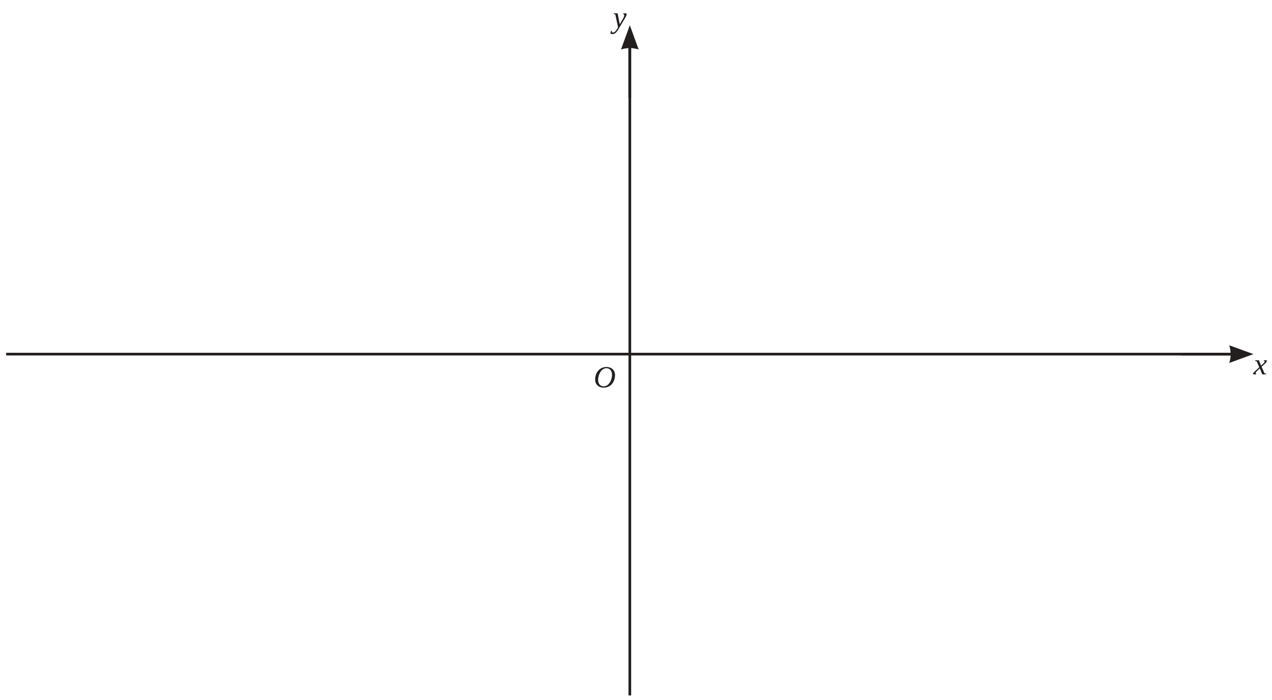
(a) Show that angle $AOC = 1.287$ radians, correct to 3 decimal places. [2]

(b) Find the perimeter of the shaded region. [2]

(c) Find the area of the shaded region. [3]

9 **(a)** Find the coordinates of the stationary points on the curve $y = (2x+1)(x-3)^2$. Give your answers in exact form. [4]

(b) On the axes below, sketch the graph of $y = \left|(2x+1)(x-3)^2\right|$, stating the coordinates of the points where the curve meets the axes. [4]



(c) Hence write down the value of the constant k such that $\left|(2x+1)(x-3)^2\right| = k$ has exactly 3 distinct solutions. [1]

10 **(a)** Jess runs on 5 days each week to prepare for a race.
In week 1, every run is 2 km.
In week 2, every run is 2.5 km.
In week 3, every run is 3 km.
Jess increases the distance of the run by 0.5 km every week.

(i) Find the week in which Jess runs 16 km on each of the 5 days. [2]

(ii) Find the total distance Jess will have run by the end of week 8. [3]

(b) Kyle also runs on 5 days each week to prepare for a race.
In week 1, every run is 2 km.
In week 2, every run is 2.5 km.
In week 3, every run is 3.125 km.
The distances he runs each week form a geometric progression.

(i) Find the common ratio of the geometric progression. [1]

(ii) Find the first week in which Kyle will run more than 16 km on each of the 5 days. [3]

(iii) Find the total distance Kyle will have run by the end of week 8. [3]

Question 11 is printed on the next page.

11 **(a)** Solve the equation $3\operatorname{cosec}^2\theta - 5 = 5\cot\theta$ for $0° \leqslant \theta \leqslant 180°$. [4]

(b) Solve the equation $\sin\left(\phi + \frac{\pi}{3}\right) = -\frac{1}{2}$, where ϕ is in radians and $-\pi \leqslant \phi \leqslant \pi$. Give your answers in terms of π. [4]