Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

6935113223

ADDITIONAL MATHEMATICS **4037/12**

Paper 1 **October/November 2018**

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

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CAMBRIDGE
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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 $\binom{n}{r} = \frac{n!}{(n-r)!\,r!}$.

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

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

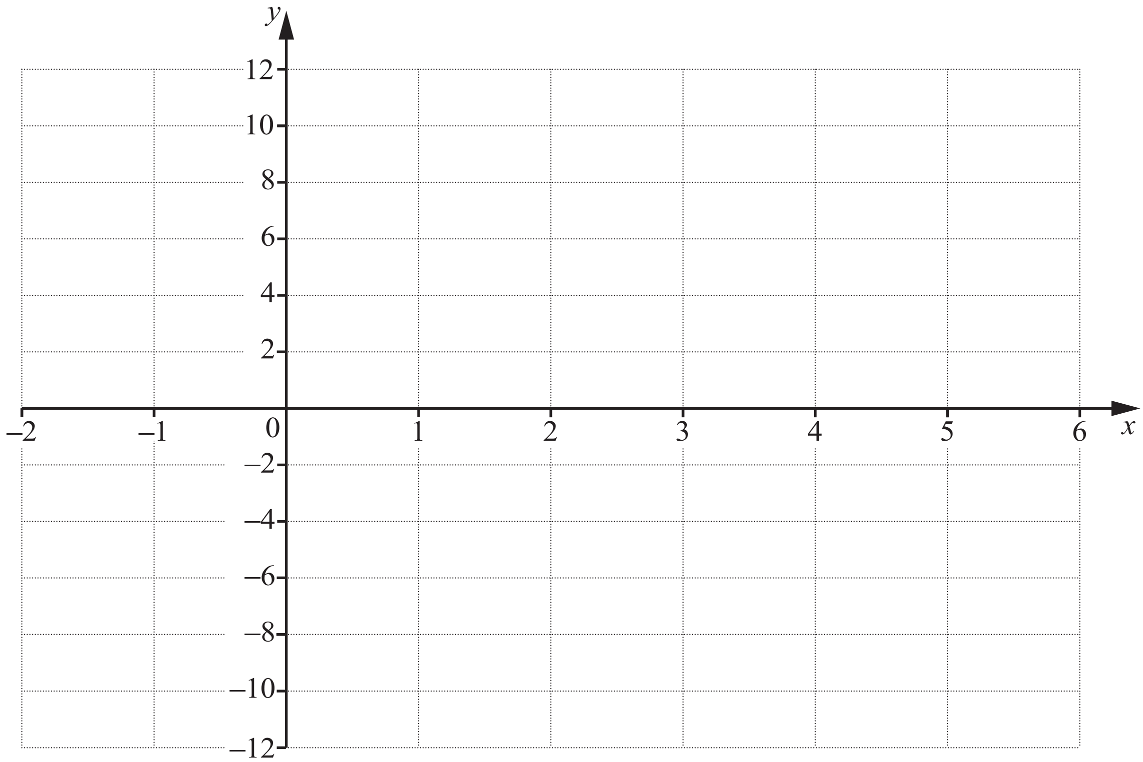
$$a^2 = b^2 + c^2 - 2bc \cos A$$

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

1 Solve $1+\sqrt{2}\sin(x+50°)=0$ for $-180° \leqslant x \leqslant 180°$. [4]

2 Find the equation of the curve which has a gradient of 4 at the point $(0, -3)$ and is such that $\dfrac{d^2y}{dx^2} = 5 + e^{2x}$. [5]

3 **(i)** On the axes below, sketch the graph of $y = |6 - 3x|$, showing the coordinates of the points where the graph meets the coordinate axes. [2]



(ii) Solve $|6 - 3x| = 2$. [3]

(iii) Hence find the values of x for which $|6 - 3x| > 2$. [1]

4 $$y = x^3 \ln(2x + 1)$$

(i) Find the value of $\frac{dy}{dx}$ when $x = 0.3$. You must show all your working. [4]

(ii) Hence find the approximate increase in y when x increases from 0.3 to $0.3 + h$, where h is small. [1]

5 The 7th term in the expansion of $(a+bx)^{12}$ in ascending powers of x is $924x^6$. It is given that a and b are positive constants.

(i) Show that $b = \frac{1}{a}$. [2]

The 6th term in the expansion of $(a+bx)^{12}$ in ascending powers of x is $198x^5$.

(ii) Find the value of a and of b. [4]

6 **(i)** Find $\frac{d}{dx}(5x^2-125)^{\frac{2}{3}}$. [2]

(ii) Using your answer to part **(i)**, find $\int x(5x^2-125)^{-\frac{1}{3}}dx$. [2]

(iii) Hence find $\int_6^{10} x(5x^2-125)^{-\frac{1}{3}}dx$. [2]

7 **(a)** The vector **v** has a magnitude of 39 units and is in the same direction as $\begin{pmatrix} -12 \\ 5 \end{pmatrix}$. Write **v** in the form $\begin{pmatrix} a \\ b \end{pmatrix}$, where a and b are constants. [2]

(b) Vectors **p** and **q** are such that $\mathbf{p} = \begin{pmatrix} r+s \\ r+6 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} 5r+1 \\ 2s-1 \end{pmatrix}$, where r and s are constants. Given that $2\mathbf{p} + 3\mathbf{q} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$, find the value of r and of s. [4]

8 $\mathbf{A} = \begin{pmatrix} a & 3 \\ 4 & a+4 \end{pmatrix}$

(i) Find the values of the constant a for which $\mathbf{A}^{-1}$ does not exist. [3]

(ii) Given that $a = 4$, find $\mathbf{A}^{-1}$. [2]

(iii) Hence find the matrix $\mathbf{B}$ such that $\mathbf{AB} = \begin{pmatrix} 2 & 3 \\ 4 & -5 \end{pmatrix}$. [3]

9 The polynomial $p(x) = ax^3 + bx^2 + cx - 9$ is divisible by $x + 3$. It is given that $p'(0) = 36$ and $p''(0) = 86$.

(i) Find the value of each of the constants a, b and c. [6]

(ii) Using your values of a, b and c, find the remainder when $p(x)$ is divided by $2x - 1$. [2]

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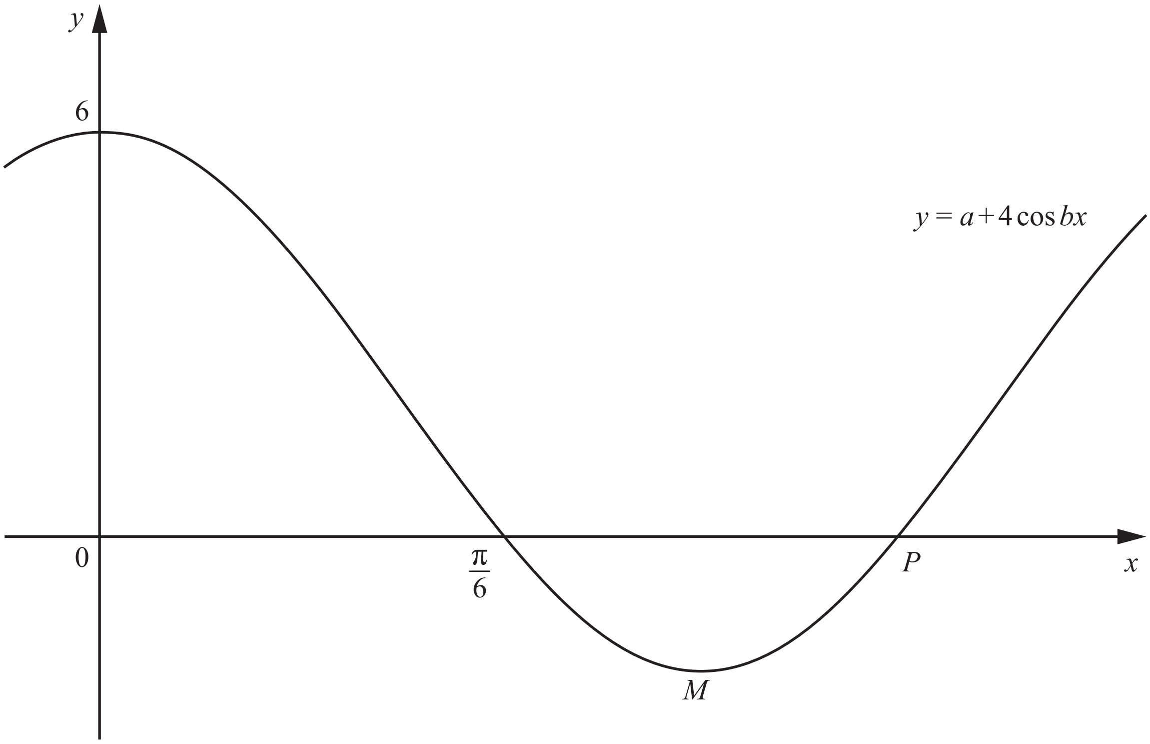


The diagram shows part of the curve $y = a + 4\cos bx$, where a and b are positive constants. The curve meets the y-axis at the point $(0, 6)$ and the x-axis at the point $\left(\frac{\pi}{6}, 0\right)$. The curve meets the x-axis again at the point P and has a minimum at the point M.

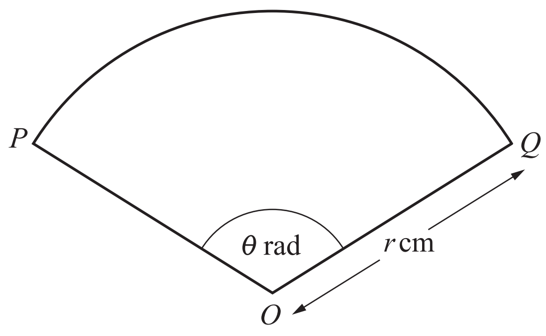
(i) Find the value of a and of b. [3]

Using your values of a and b find,

(ii) the exact coordinates of P, [2]

(iii) the exact coordinates of M. [2]

11



The diagram shows the sector OPQ of a circle, centre O, radius r cm, where angle $POQ = \theta$ radians. The perimeter of the sector is 10 cm.

(i) Show that area, A cm^2, of the sector is given by $A = \dfrac{50\theta}{(2+\theta)^2}$. [5]

It is given that θ can vary and A has a maximum value.

(ii) Find the maximum value of A. [5]

Question 12 is printed on the next page.

12 The line $y = 2x + 5$ intersects the curve $y + xy = 5$ at the points A and B. Find the coordinates of the point where the perpendicular bisector of the line AB intersects the line $y = x$. [9]