Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

5325132921

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **February/March 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

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 **15** printed pages and **1** blank page.

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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

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

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

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

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1 The remainder obtained when the polynomial $p(x) = x^3 + ax^2 - 3x + b$ is divided by $x + 3$ is twice the remainder obtained when $p(x)$ is divided by $x - 2$. Given also that $p(x)$ is divisible by $x + 1$, find the value of a and of b. [5]

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2 A curve has equation $y = 4 + 5\sin 3x$.

(i) Find $\frac{dy}{dx}$. [2]

(ii) Hence find the equation of the tangent to the curve $y = 4 + 5\sin 3x$ at the point where $x = \frac{\pi}{3}$. [3]

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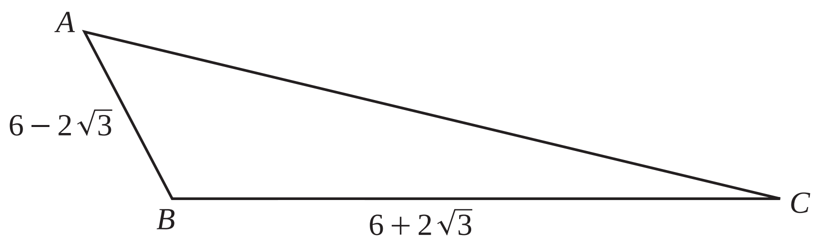
3 Do not use a calculator in this question.

(a) Simplify $\dfrac{(3+2\sqrt{5})(6-2\sqrt{5})}{(4-\sqrt{5})}$, giving your answer in the form $a+b\sqrt{5}$, where a and b are integers. [3]

(b) In this part, all lengths are in centimetres.



The diagram shows the triangle ABC with $AB = 6-2\sqrt{3}$ and $BC = 6+2\sqrt{3}$. Given that $\cos ABC = -\dfrac{1}{2}$, find the length of AC in the form $c\sqrt{d}$, where c and d are integers. [3]

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4 It is given that $y = \dfrac{\ln(4x^2 - 1)}{x + 2}$.

(i) Find the values of x for which y is not defined. [2]

(ii) Find $\dfrac{dy}{dx}$. [3]

(iii) Hence find the approximate increase in y when x increases from 2 to $2 + h$, where h is small. [2]

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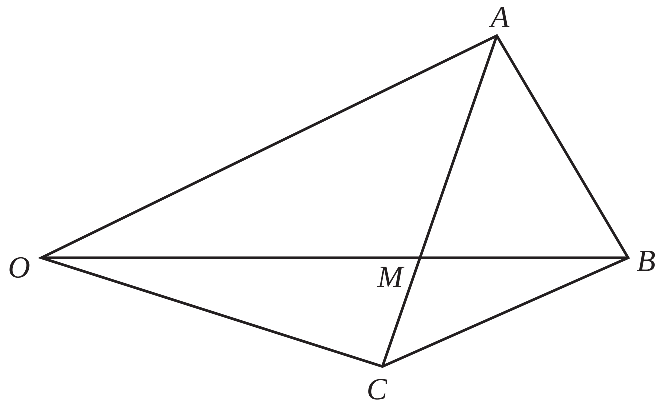
5 The first 3 terms in the expansion of $(2+ax)^n$ are equal to $1024-1280x+bx^2$, where n, a and b are constants.

(i) Find the value of each of n, a and b. [5]

(ii) Hence find the term independent of x in the expansion of $(2+ax)^n\left(x-\frac{1}{x}\right)^2$. [3]

6



The diagram shows the quadrilateral $OABC$ such that $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{OC} = \mathbf{c}$. It is given that $AM : MC = 2 : 1$ and $OM : MB = 3 : 2$.

(i) Find $\overrightarrow{AC}$ in terms of $\mathbf{a}$ and $\mathbf{c}$. [1]

(ii) Find $\overrightarrow{OM}$ in terms of $\mathbf{a}$ and $\mathbf{c}$. [2]

(iii) Find $\overrightarrow{OM}$ in terms of $\mathbf{b}$. [1]

(iv) Find $5\mathbf{a} + 10\mathbf{c}$ in terms of $\mathbf{b}$. [2]

(v) Find $\overrightarrow{AB}$ in terms of $\mathbf{a}$ and $\mathbf{c}$, giving your answer in its simplest form. [2]

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7 **(a)** Find the values of a for which $\det\begin{pmatrix} 2a & 1 \\ 4a & a \end{pmatrix} = 6 - 3a$. [3]

(b) It is given that $\mathbf{A} = \begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 2 & 0 \\ -3 & 5 \end{pmatrix}$.

(i) Find $\mathbf{A}^{-1}$. [2]

(ii) Hence find the matrix $\mathbf{C}$ such that $\mathbf{AC} = \mathbf{B}$. [3]

(c) Find the 2×2 matrix $\mathbf{D}$ such that $4\mathbf{D} + 3\mathbf{I} = \mathbf{O}$. [1]

8 A particle P, moving in a straight line, passes through a fixed point O at time $t = 0$ s. At time t s after leaving O, the displacement of the particle is x m and its velocity is v ms^{-1}, where $v = 12e^{2t} - 48t$, $t \geqslant 0$.

(i) Find x in terms of t. [4]

(ii) Find the value of t when the acceleration of P is zero. [3]

(iii) Find the velocity of P when the acceleration is zero. [2]

9 The table shows values of the variables x and y.

x	2	4	6	8	10
y	736	271	100	37	13

The relationship between x and y is thought to be of the form $y = A\mathrm{e}^{bx}$, where A and b are constants.

(i) Transform this relationship into straight line form. [1]

(ii) Hence, by plotting a suitable graph, show that the relationship $y = A\mathrm{e}^{bx}$ is correct. [2]

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(iii) Use your graph to find the value of A and of b. [4]

(iv) Estimate the value of x when $y = 500$. [2]

(v) Estimate the value of y when $x = 5$. [2]

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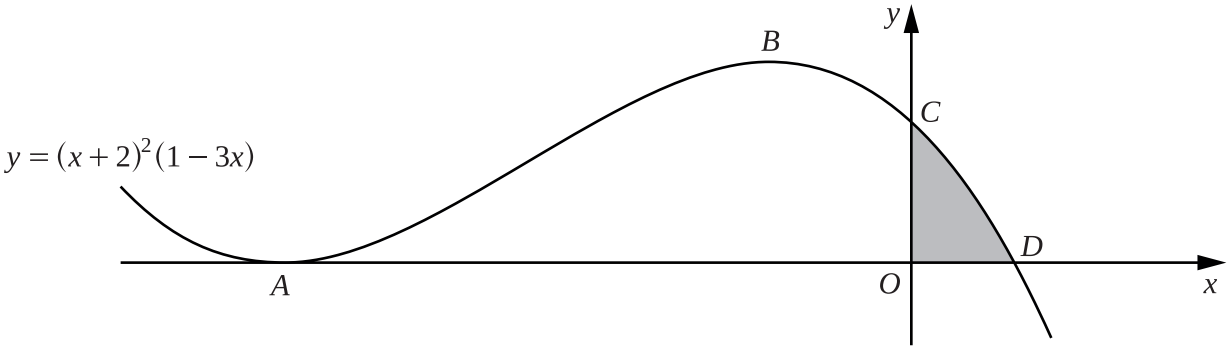

The diagram shows the graph of $y = (x+2)^2(1-3x)$. The curve has a minimum at the point A, a maximum at the point B and intersects the y-axis and the x-axis at the points C and D respectively.

(i) Find the x-coordinate of A and of B. [5]

(ii) Write down the coordinates of C and of D. [2]

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(iii) Showing all your working, find the area of the shaded region. [5]

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