UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | | CANDIDATE NUMBER | | | | |

ADDITIONAL MATHEMATICS **0606/21**

Paper 2 **May/June 2012**

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 a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, 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.

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

DC (SLM) 57491

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International Examinations

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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 **(i)** Given that $\mathbf{A} = \begin{pmatrix} 4 & -3 \\ 2 & 5 \end{pmatrix}$, find the inverse matrix $\mathbf{A}^{-1}$. [2]

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(ii) Use your answer to part **(i)** to solve the simultaneous equations

$$4x - 3y = -10,$$
$$2x + 5y = 21.$$

[2]

2 A cuboid has a square base of side $(2 + \sqrt{3})$ cm and a volume of $(16 + 9\sqrt{3})\,\text{cm}^3$. Without using a calculator, find the height of the cuboid in the form $(a + b\sqrt{3})$ cm, where a and b are integers. [4]

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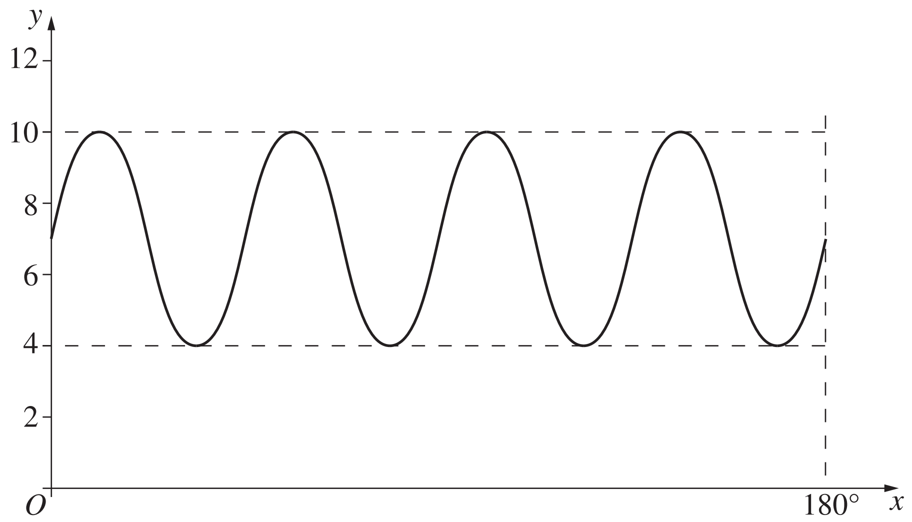
3 **(a)**



The diagram shows a sketch of the curve $y = a\sin(bx) + c$ for $0° \leqslant x \leqslant 180°$. Find the values of a, b and c. [3]

(b) Given that $f(x) = 5\cos 3x + 1$, for all x, state

(i) the period of f, [1]

(ii) the amplitude of f. [1]

4 **(i)** Find $\frac{\mathrm{d}}{\mathrm{d}x}(x^2 \ln x)$. [2]

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(ii) Hence, or otherwise, find $\int x \ln x \, \mathrm{d}x$. [3]

5 **(a)** Solve the equation $3^{2x} = 1000$, giving your answer to 2 decimal places. [2]

For Examiner's Use

(b) Solve the equation $\dfrac{36^{2y-5}}{6^{3y}} = \dfrac{6^{2y-1}}{216^{y+6}}$. [4]

6 By shading the Venn diagrams below, investigate whether each of the following statements is true or false. State your conclusions clearly.

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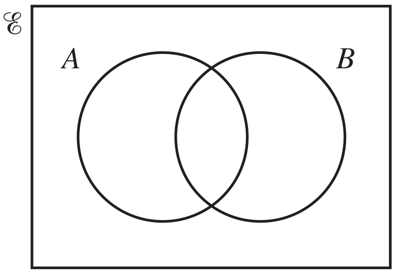
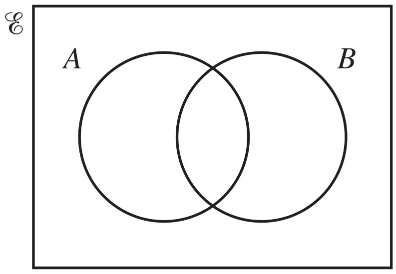
(i) $A \cap B' = (A' \cap B)'$ [2]

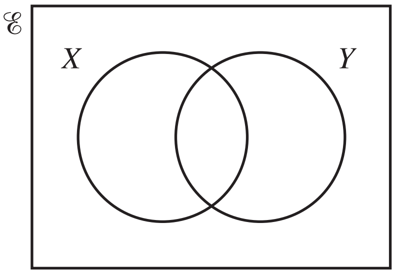


$A \cap B'$

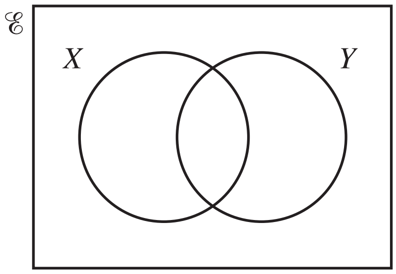


$(A' \cap B)'$

(ii) $X \cap Y = X' \cup Y'$ [2]

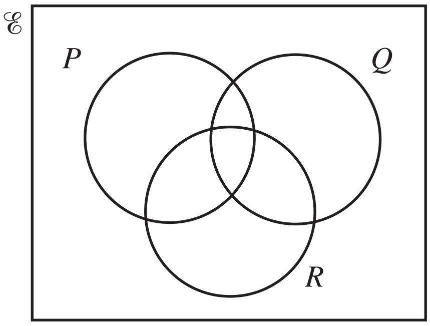


$X \cap Y$

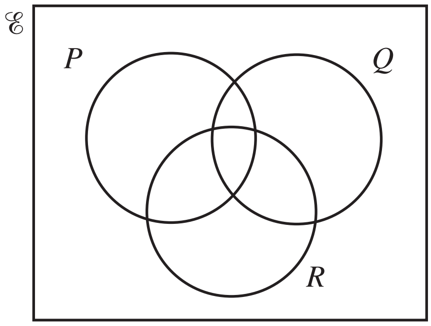


$X' \cup Y'$

(iii) $(P \cap Q) \cup (Q \cap R) = Q \cap (P \cup R)$ [2]



$(P \cap Q) \cup (Q \cap R)$



$Q \cap (P \cup R)$

7 Given that $f(x) = x^2 - \dfrac{648}{\sqrt{x}}$, find the value of x for which $f''(x) = 0$. [6]

For Examiner's Use

8 Relative to an origin O, the position vectors of the points A and B are $2\mathbf{i} - 3\mathbf{j}$ and $11\mathbf{i} + 42\mathbf{j}$ respectively.

For Examiner's Use

(i) Write down an expression for $\overrightarrow{AB}$. [2]

The point C lies on AB such that $\overrightarrow{AC} = \frac{1}{3}\overrightarrow{AB}$.

(ii) Find the length of $\overrightarrow{OC}$. [4]

The point D lies on $\overrightarrow{OA}$ such that $\overrightarrow{DC}$ is parallel to $\overrightarrow{OB}$.

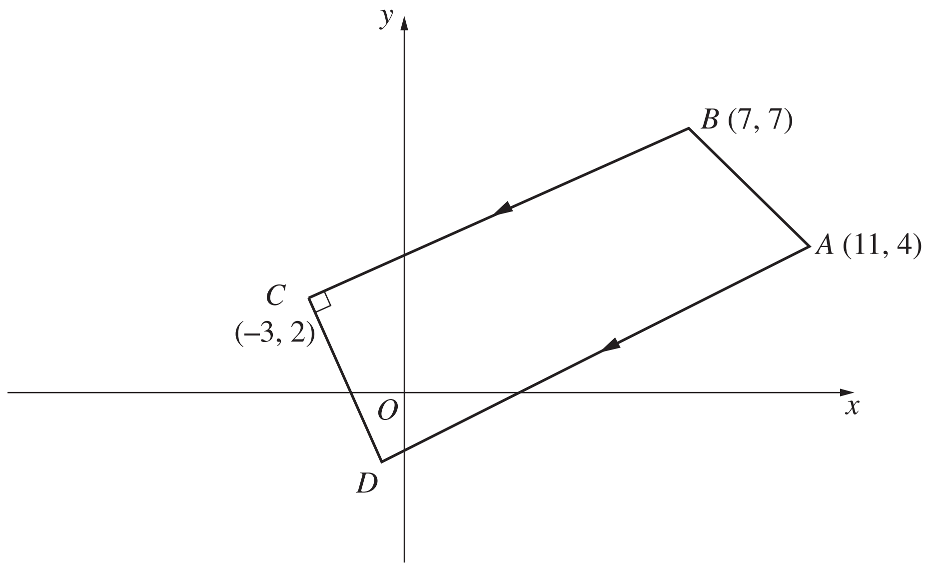
(iii) Find the position vector of D. [2]

9 A particle moves in a straight line so that, t s after passing through a fixed point O, its velocity, $v\,\text{ms}^{-1}$, is given by $v = 2t - 11 + \dfrac{6}{t+1}$. Find the acceleration of the particle when it is at instantaneous rest. [7]

For Examiner's Use

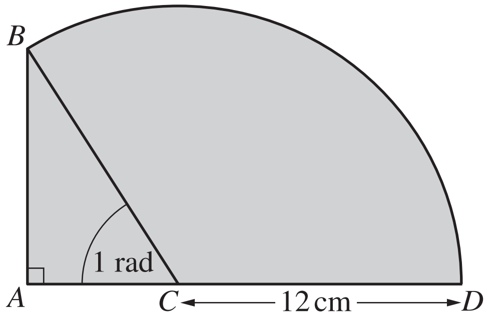
10 Solutions to this question by accurate drawing will not be accepted.

For Examiner's Use



The diagram shows a trapezium *ABCD* with vertices *A*(11, 4), *B*(7, 7), *C*(–3, 2) and *D*. The side *AD* is parallel to *BC* and the side *CD* is perpendicular to *BC*. Find the area of the trapezium *ABCD*. [9]

11



The diagram shows a right-angled triangle *ABC* and a sector *CBDC* of a circle with centre *C* and radius 12 cm. Angle *ACB* = 1 radian and *ACD* is a straight line.

(i) Show that the length of *AB* is approximately 10.1 cm. [1]

(ii) Find the perimeter of the shaded region. [5]

(iii) Find the area of the shaded region. [4]

For Examiner's Use

12 Answer only **one** of the following two alternatives.

EITHER

The equation of a curve is $y = 2x^2 - 20x + 37$.

(i) Express y in the form $a(x + b)^2 + c$, where a, b and c are integers. [3]

(ii) Write down the coordinates of the stationary point on the curve. [1]

A function f is defined by $\mathrm{f} : x \mapsto 2x^2 - 20x + 37$ for $x > k$. Given that the function $\mathrm{f}^{-1}(x)$ exists,

(iii) write down the least possible value of k, [1]

(iv) sketch the graphs of $y = \mathrm{f}(x)$ and $y = \mathrm{f}^{-1}(x)$ on the axes provided, [2]

(v) obtain an expression for f^{-1}. [3]

OR

A function g is defined by $\mathrm{g} : x \mapsto 5x^2 + px + 72$, where p is a constant. The function can also be written as $\mathrm{g} : x \mapsto 5(x - 4)^2 + q$.

(i) Find the value of p and of q. [3]

(ii) Find the range of the function g. [1]

(iii) Sketch the graph of the function on the axes provided. [2]

(iv) Given that the function h is defined by $\mathrm{h} : x \mapsto \ln x$, where $x > 0$, solve the equation $\mathrm{gh}(x) = 12$. [4]

Start your answer to Question 12 here.

Indicate which question you are answering.

EITHER	
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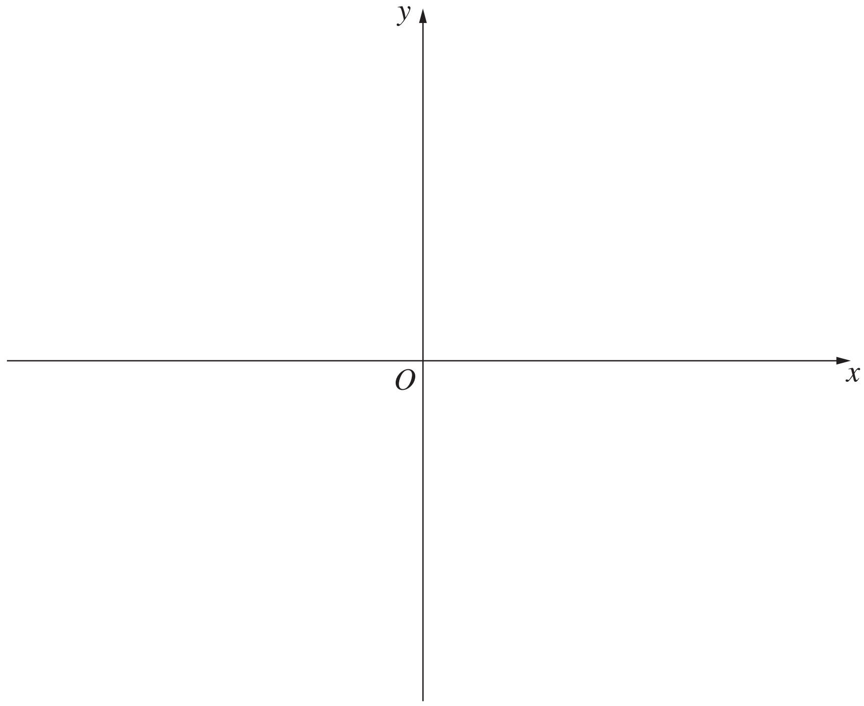

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