UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8006817548

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **October/November 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.

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.

For Examiner's Use	
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This document consists of **16** printed pages.

DC (CW/SW) 50035/5

UNIVERSITY *of* CAMBRIDGE
International Examinations

[Turn over

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 It is given that $\mathbf{a} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 21 \\ 2 \end{pmatrix}$.

(i) Find $|\mathbf{a} + \mathbf{b} + \mathbf{c}|$. [2]

(ii) Find λ and μ such that $\lambda \mathbf{a} + \mu \mathbf{b} = \mathbf{c}$. [3]

2 **(i)** Find the inverse of the matrix $\begin{pmatrix} 2 & -1 \\ -1 & 1.5 \end{pmatrix}$.

(ii) Hence find the matrix **A** such that $\begin{pmatrix} 2 & -1 \\ -1 & 1.5 \end{pmatrix} \mathbf{A} = \begin{pmatrix} 1 & 6 \\ -0.5 & 4 \end{pmatrix}$. [3]

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3 **(i)** Show that $\cot\theta + \dfrac{\sin\theta}{1 + \cos\theta} = \operatorname{cosec}\theta$. [5]

(ii) Explain why the equation $\cot\theta + \dfrac{\sin\theta}{1 + \cos\theta} = \dfrac{1}{2}$ has no solution. [1]

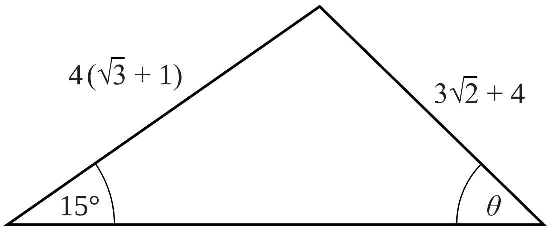
4 Given that $\log_a pq = 9$ and $\log_a p^2q = 15$, find the value of

(i) $\log_a p$ and of $\log_a q$, [4]

(ii) $\log_p a + \log_q a$. [2]

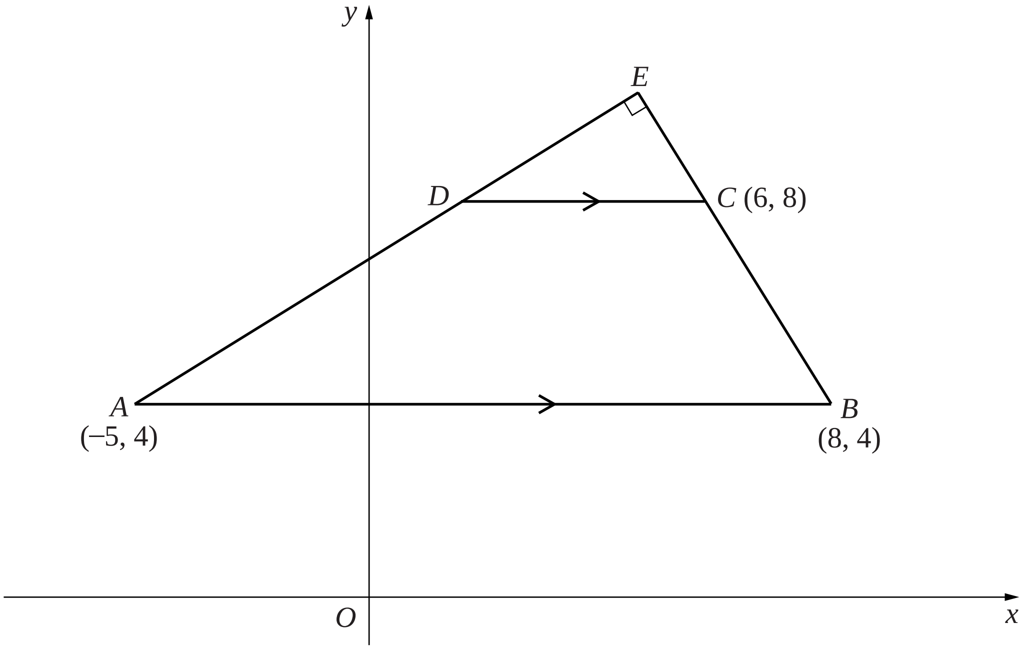
5 The line $x - 2y = 6$ intersects the curve $x^2 + xy + 10y + 4y^2 = 156$ at the points A and B. Find the length of AB.

6



Using $\sin 15° = \frac{\sqrt{2}}{4}(\sqrt{3} - 1)$ and without using a calculator, find the value of $\sin\theta$ in the form $a + b\sqrt{2}$, where a and b are integers. [5]

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

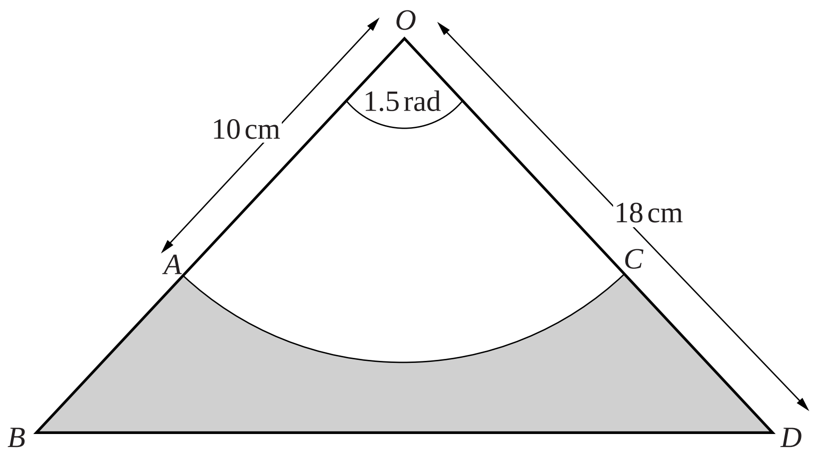


The vertices of the trapezium *ABCD* are the points *A*(–5, 4), *B*(8, 4), *C*(6, 8) and *D*. The line *AB* is parallel to the line *DC*. The lines *AD* and *BC* are extended to meet at *E* and angle *AEB* = 90°.

(i) Find the coordinates of *D* and of *E*. [6]

(ii) Find the area of the trapezium *ABCD*.

8



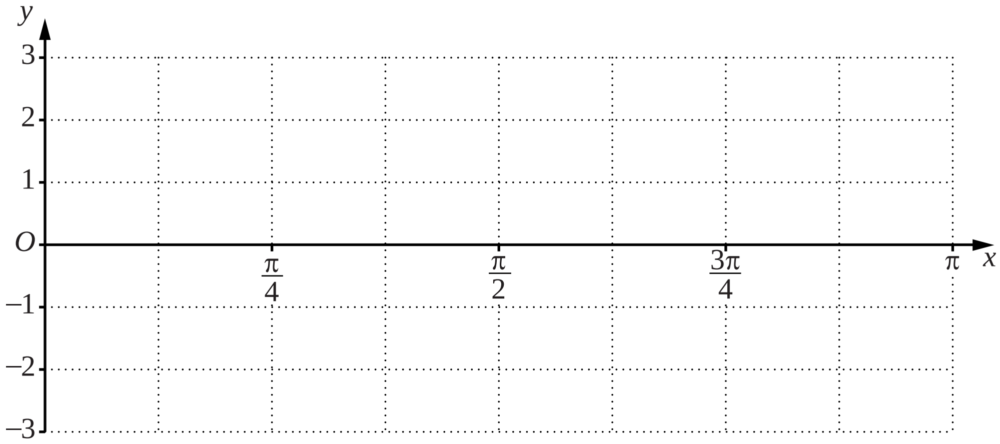
The diagram shows an isosceles triangle *OBD* in which *OB* = *OD* = 18 cm and angle *BOD* = 1.5 radians. An arc of the circle, centre *O* and radius 10 cm, meets *OB* at *A* and *OD* at *C*.

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

(ii) Find the perimeter of the shaded region. [4]

9 **(a)** **(i)** Using the axes below, sketch for $0 \leqslant x \leqslant \pi$, the graphs of

$$y = \sin 2x \quad \text{and} \quad y = 1 + \cos 2x.$$ [4]



(ii) Write down the solutions of the equation $\sin 2x - \cos 2x = 1$, for $0 \leqslant x \leqslant \pi$. [2]

(b) **(i)** Write down the amplitude and period of $5\cos 4x - 3$. [2]

(ii) Write down the period of $4\tan 3x$. [1]

10 A function f is such that $f(x) = 4x^3 + 4x^2 + ax + b$. It is given that $2x - 1$ is a factor of both f(x) and $f'(x)$.

(i) Show that $b = 2$ and find the value of a. [5]

Using the values of a and b from part **(i)**,

(ii) find the remainder when $f(x)$ is divided by $x + 3$, [2]

(iii) express f(x) in the form $\mathrm{f}(x) = (2x - 1)(px^2 + qx + r)$, where p, q and r are integers to be found,

(iv) find the values of x for which $\mathrm{f}(x) = 0$. [2]

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

EITHER

A curve is such that $y = \dfrac{5x^2}{1 + x^2}$.

(i) Show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{kx}{(1 + x^2)^2}$, where k is an integer to be found. [4]

(ii) Find the coordinates of the stationary point on the curve and determine the nature of this stationary point. [3]

(iii) By using your result from part **(i)**, find $\displaystyle\int \frac{x}{(1 + x^2)^2}\,\mathrm{d}x$ and hence evaluate $\displaystyle\int_{-1}^{2} \frac{x}{(1 + x^2)^2}\,\mathrm{d}x$. [4]

OR

A curve is such that $y = \dfrac{Ax^2 + B}{x^2 - 2}$, where A and B are constants.

(i) Show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = -\dfrac{2x(2A + B)}{(x^2 - 2)^2}$. [4]

It is given that $y = -3$ and $\dfrac{\mathrm{d}y}{\mathrm{d}x} = -10$ when $x = 1$.

(ii) Find the value of A and of B. [3]

(iii) Using your values of A and B, find the coordinates of the stationary point on the curve, and determine the nature of this stationary point. [4]

Start your answer to Question 11 here.

Indicate which question you are answering.

EITHER	
OR	

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Continue your answer here.

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Continue your answer here if necessary.