UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

ADDITIONAL MATHEMATICS **0606/01**

Paper 1 **May/June 2009**

2 hours

Additional Materials: Answer Booklet/Paper; Electronic calculator; Graph paper (2 sheets); Mathematical tables

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
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 soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.
Write your answers on the separate Answer Booklet/Paper provided.
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 **6** printed pages and **2** blank pages.

UNIVERSITY of CAMBRIDGE International Examinations

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

$$\sin^2 A + \cos^2 A = 1.$$

$$\sec^2 A = 1 + \tan^2 A.$$

$$\text{cosec}^2 A = 1 + \cot^2 A.$$

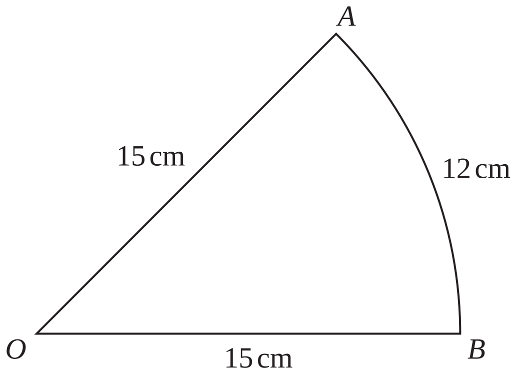
Formulae for ΔABC

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

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

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

1



The diagram shows a sector AOB of a circle, centre O, radius 15 cm. The length of the arc AB is 12 cm.

(i) Find, in radians, angle AOB. [2]

(ii) Find the area of the sector AOB. [2]

2 The equation of a curve is $y = x^3 - 8$. Find the equation of the normal to the curve at the point where the curve crosses the x-axis. [4]

3 Show that $\dfrac{1 - \cos^2\theta}{\sec^2\theta - 1} = 1 - \sin^2\theta$. [4]

4 The line $y = 5x - 3$ is a tangent to the curve $y = kx^2 - 3x + 5$ at the point A. Find

(i) the value of k, [3]

(ii) the coordinates of A. [2]

5 **(a)** Solve the equation $9^{2x-1} = 27^x$. [3]

(b) Given that $\dfrac{a^{-\frac{1}{2}}b^{\frac{2}{3}}}{\sqrt{a^3b^{-\frac{2}{3}}}} = a^pb^q$, find the value of p and of q. [2]

6 Solve the equation $2x^3 + 3x^2 - 32x + 15 = 0$. [6]

7 **(i)** Find $\dfrac{\mathrm{d}}{\mathrm{d}x}\left(x\mathrm{e}^{3x} - \dfrac{\mathrm{e}^{3x}}{3}\right)$. [3]

(ii) Hence find $\int x\mathrm{e}^{3x}\mathrm{d}x$. [3]

8 A curve has equation $y = \dfrac{2x}{x^2 + 9}$.

(i) Find the x-coordinate of each of the stationary points of the curve. [4]

(ii) Given that x is increasing at the rate of 2 units per second, find the rate of increase of y when $x = 1$. [3]

9 At 10 00 hours, a ship P leaves a point A with position vector $(-4\mathbf{i} + 8\mathbf{j})$ km relative to an origin O, where **i** is a unit vector due East and **j** is a unit vector due North. The ship sails north-east with a speed of $10\sqrt{2}$ km h^{-1}. Find

(i) the velocity vector of P, [2]

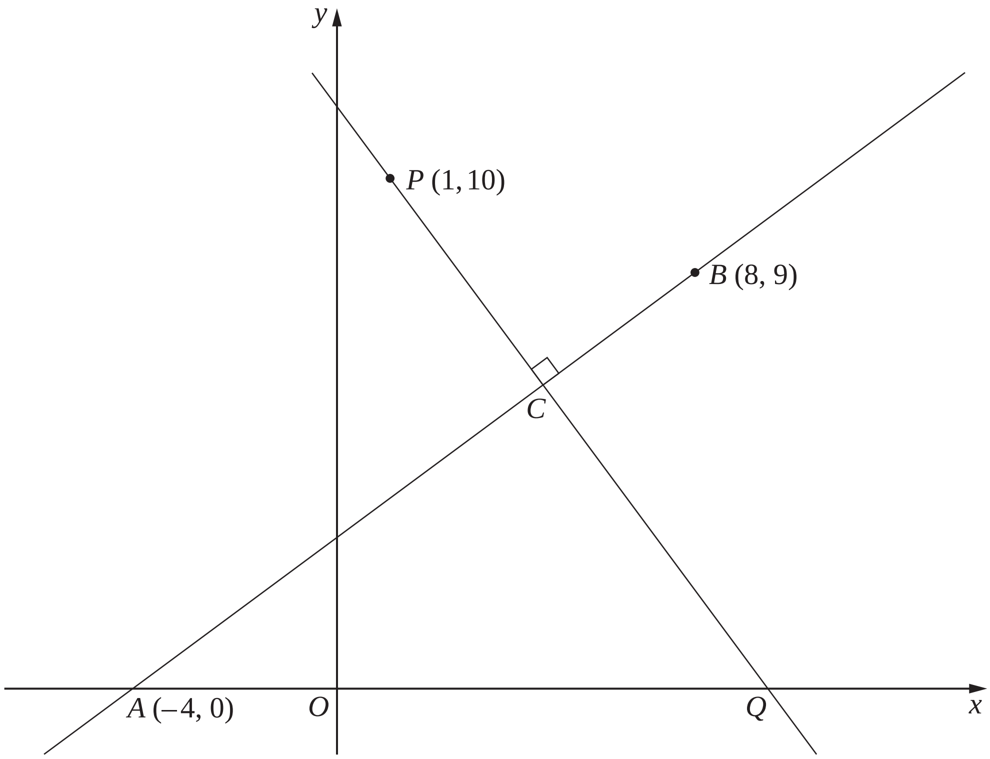
(ii) the position vector of P at 12 00 hours. [2]

At 12 00 hours, a second ship Q leaves a point B with position vector $(19\mathbf{i} + 34\mathbf{j})$ km travelling with velocity vector $(8\mathbf{i} + 6\mathbf{j})$ km h^{-1}.

(iii) Find the velocity of P relative to Q. [2]

(iv) Hence, or otherwise, find the time at which P and Q meet and the position vector of the point where this happens. [3]

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



The diagram shows the line AB passing through the points $A(-4, 0)$ and $B(8, 9)$. The line through the point $P(1, 10)$, perpendicular to AB, meets AB at C and the x-axis at Q. Find

(i) the coordinates of C and of Q, [7]

(ii) the area of triangle ACQ. [2]

11 The table shows experimental values of variables s and t.

t	5	15	30	70	100
s	1305	349	152	55	36

(i) By plotting a suitable straight line graph, show that s and t are related by the equation $s = kt^n$, where k and n are constants. [4]

(ii) Use your graph to find the value of k and of n. [4]

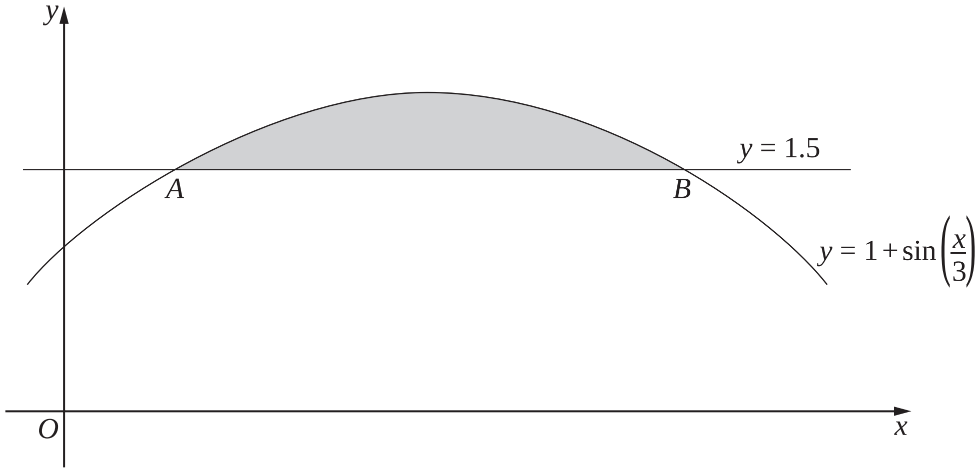
(iii) Estimate the value of s when $t = 50$. [2]

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

EITHER

(i) State the amplitude of $1 + \sin\left(\frac{x}{3}\right)$. [1]

(ii) State, in radians, the period of $1 + \sin\left(\frac{x}{3}\right)$. [1]



The diagram shows the curve $y = 1 + \sin\left(\frac{x}{3}\right)$ meeting the line $y = 1.5$ at points A and B. Find

(iii) the x-coordinate of A and of B, [3]

(iv) the area of the shaded region. [6]

OR

A particle moves in a straight line such that t s after passing through a fixed point O, its velocity, $v\ \mathrm{m\,s^{-1}}$, is given by $v = k\cos 4t$, where k is a positive constant. Find

(i) the value of t when the particle is first instantaneously at rest, [1]

(ii) an expression for the acceleration of the particle t s after passing through O. [2]

Given that the acceleration of the particle is $12\ \mathrm{m\,s^{-2}}$ when $t = \frac{3\pi}{8}$,

(iii) find the value of k. [2]

Using your value for k,

(iv) sketch the velocity-time curve for the particle for $0 \leqslant t \leqslant \pi$, [2]

(v) find the displacement of the particle from O when $t = \frac{\pi}{24}$. [4]

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