UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

ADDITIONAL MATHEMATICS **4037/12**

Paper 1 **May/June 2011**

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 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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
Total	

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

© UCLES 2011

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

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

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

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

© UCLES 2011

1 Find the value of k for which the x-axis is a tangent to the curve

$$y = x^2 + (2k + 10)x + k^2 + 5.$$ [3]

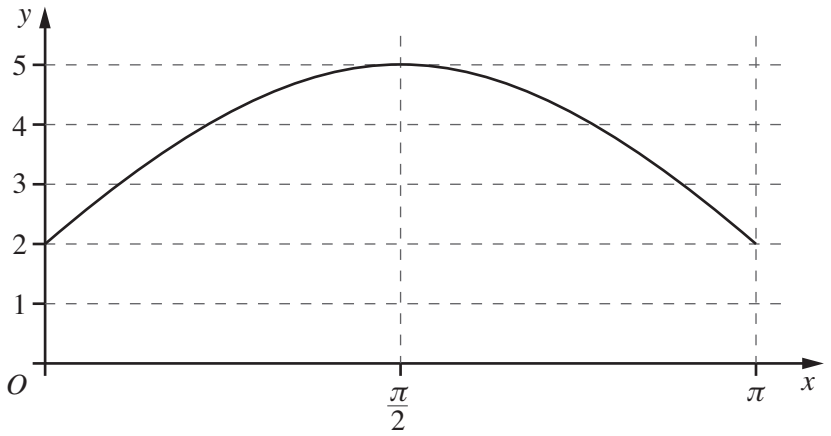
For Examiner's Use

2 The coefficient of x^3 in the expansion of $(2 + ax)^5$ is 10 times the coefficient of x^2 in the expansion of $\left(1 + \frac{ax}{3}\right)^4$. Find the value of a. [4]

For Examiner's Use

3 (a)

For Examiner's Use



The figure shows the graph of $y = k + m\sin px$ for $0 \leqslant x \leqslant \pi$, where k, m and p are positive constants. Complete the following statements.

k = ... m = ... p = ... [3]

(b) The function g is such that $g(x) = 1 + 5\cos 3x$. Write down

(i) the amplitude of g, [1]

(ii) the period of g in terms of π. [1]

4 You must not use a calculator in Question 4.

For Examiner's Use

In the triangle ABC, angle $B = 90°$, $AB = 4 + 2\sqrt{2}$ and $BC = 1 + \sqrt{2}$.

(i) Find $\tan C$, giving your answer in the form $k\sqrt{2}$. [2]

(ii) Find the area of the triangle ABC, giving your answer in the form $p + q\sqrt{2}$, where p and q are integers. [2]

(iii) Find the area of the square whose side is of length AC, giving your answer in the form $s + t\sqrt{2}$, where s and t are integers. [2]

© UCLES 2011

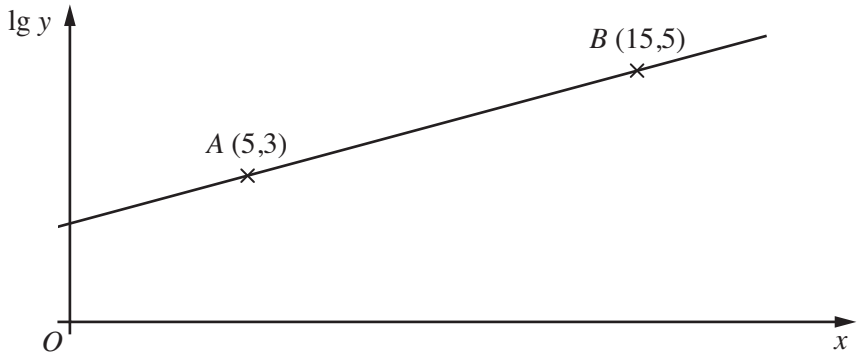
5 **(i)** Show that $2x - 1$ is a factor of $2x^3 - 5x^2 + 10x - 4$. [2]

For Examiner's Use

(ii) Hence show that $2x^3 - 5x^2 + 10x - 4 = 0$ has only one real root and state the value of this root. [4]

6 The figure shows the graph of a straight line with $\lg y$ plotted against x. The straight line passes through the points $A(5,3)$ and $B(15,5)$.

For Examiner's Use



(i) Express $\lg y$ in terms of x. [3]

(ii) Show that $y = a(10^{bx})$ where a and b are to be found. [3]

7 A team of 6 members is to be selected from 6 women and 8 men.

For Examiner's Use

(i) Find the number of different teams that can be selected. [1]

(ii) Find the number of different teams that consist of 2 women and 4 men. [3]

(iii) Find the number of different teams that contain no more than 1 woman. [3]

8 **(i)** Sketch the curve $y = (2x - 5)(2x + 1)$ for $-1 \leqslant x \leqslant 3$, stating the coordinates of the points where the curve meets the coordinate axes. [4]

For Examiner's Use

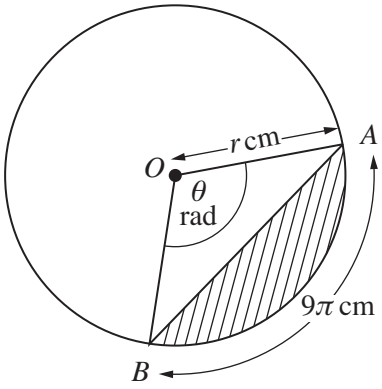
(ii) State the coordinates of the stationary point on the curve. [1]

(iii) Using your answers to parts **(i)** and **(ii)**, sketch the curve $y = \left|(2x - 5)(2x + 1)\right|$ for $-1 \leqslant x \leqslant 3$. [2]

© UCLES 2011

9 The figure shows a circle, centre O, radius r cm. The length of the arc AB of the circle is 9π cm. Angle AOB is θ radians and is 3 times angle OBA.

For Examiner's Use



(i) Show that $\theta = \frac{3\pi}{5}$. [2]

(ii) Find the value of r. [2]

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

10 Relative to an origin O, points A and B have position vectors $\begin{pmatrix} 5 \\ -6 \end{pmatrix}$ and $\begin{pmatrix} 29 \\ -13 \end{pmatrix}$ respectively.

For Examiner's Use

(i) Find a unit vector parallel to $\overrightarrow{AB}$. [3]

The points A, B and C lie on a straight line such that $2\overrightarrow{AC} = 3\overrightarrow{AB}$.

(ii) Find the position vector of the point C. [4]

© UCLES 2011

11 Solve

For Examiner's Use

(i) $2\cot^2 x - 5\operatorname{cosec} x - 1 = 0$ for $0° < x < 180°$, [5]

(ii) $5\cos 2y - 4\sin 2y = 0$ for $0° < y < 180°$, [4]

(iii) $\cos\left(z + \frac{\pi}{6}\right) = -\frac{1}{2}$ for $0 < z < 2\pi$ radians. [3]

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

For Examiner's Use

EITHER

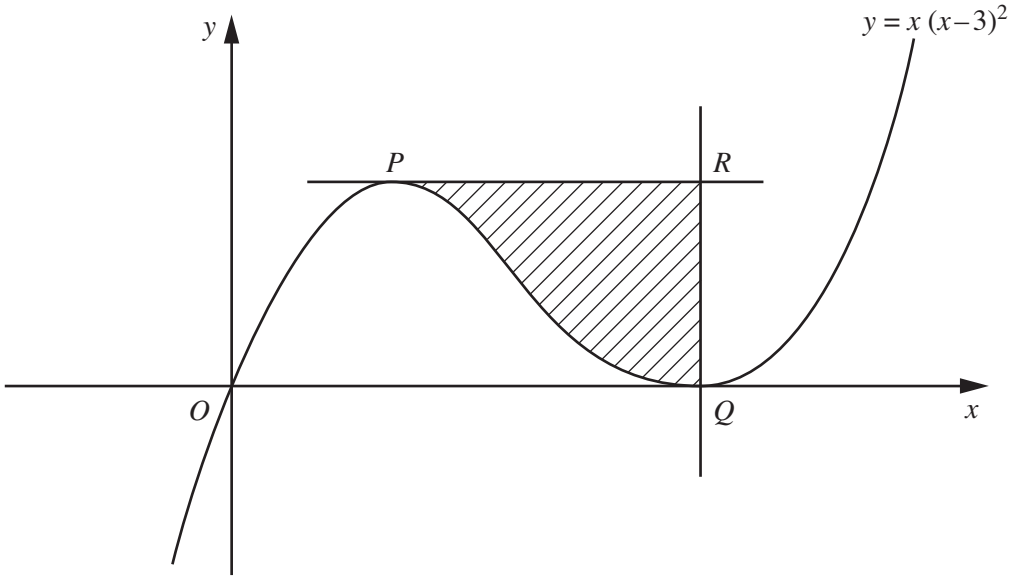
The tangent to the curve $y = 3x^3 + 2x^2 - 5x + 1$ at the point where $x = -1$ meets the y-axis at the point A.

(i) Find the coordinates of the point A. [3]

The curve meets the y-axis at the point B. The normal to the curve at B meets the x-axis at the point C. The tangent to the curve at the point where $x = -1$ and the normal to the curve at B meet at the point D.

(ii) Find the area of the triangle ACD. [7]

OR



The diagram shows the curve $y = x(x - 3)^2$. The curve has a maximum at the point P and touches the x-axis at the point Q. The tangent at P and the normal at Q meet at the point R. Find the area of the shaded region PQR. [10]

© UCLES 2011

Start your answer to Question 12 here.

Indicate which question you are answering.

EITHER	
OR	

For Examiner's Use

Continue your answer here if necessary.

For Examiner's Use

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2011