



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

**ADDITIONAL MATHEMATICS**

**4037/02**

Paper 2

**October/November 2008**

**2 hours**

Additional Materials:     Answer Booklet/Paper  
                                     Graph Paper (1 sheet)  
                                     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.



## 1. ALGEBRA

### Quadratic Equation

For the equation  $ax^2 + bx + c = 0$ ,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} .$$

### Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \dots + \binom{n}{r} a^{n-r} b^r + \dots + b^n,$$

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 $\triangle ABC$

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

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

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

- 1 Given that  $\mathbf{A} = \begin{pmatrix} 13 & 6 \\ 7 & 4 \end{pmatrix}$ , find the inverse matrix  $\mathbf{A}^{-1}$  and hence solve the simultaneous equations

$$\begin{aligned} 13x + 6y &= 41, \\ 7x + 4y &= 24. \end{aligned}$$

[4]

- 2 Variables  $x$  and  $y$  are connected by the equation  $y = (2x - 9)^3$ . Given that  $x$  is increasing at the rate of 4 units per second, find the rate of increase of  $y$  when  $x = 7$ . [4]

- 3 Find the set of values of  $m$  for which the line  $y = mx + 2$  does not meet the curve  $y = x^2 - 5x + 18$ . [5]

- 4 (i) Differentiate  $x \ln x$  with respect to  $x$ . [2]

(ii) Hence find  $\int \ln x \, dx$ . [3]

- 5 Solve the equation

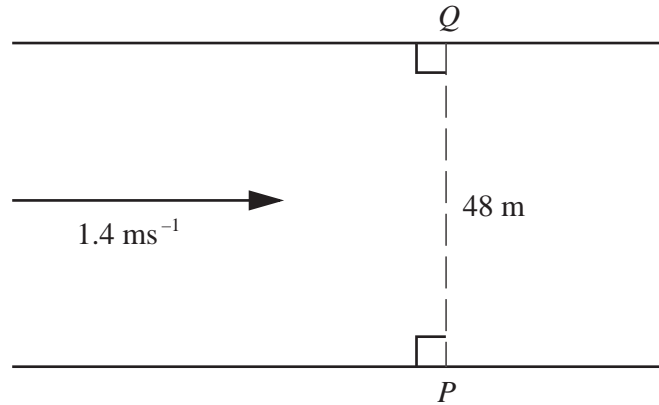
(i)  $\frac{4^x}{2^{5-x}} = \frac{2^{4x}}{8^{x-3}}$ , [3]

(ii)  $\lg(2y + 10) + \lg y = 2$ . [3]

- 6 (a) A sports team of 3 attackers, 2 centres and 4 defenders is to be chosen from a squad of 5 attackers, 3 centres and 6 defenders. Calculate the number of different ways in which this can be done. [3]

- (b) How many different 4-digit numbers greater than 3000 can be formed using the six digits 1, 2, 3, 4, 5 and 6 if no digit can be used more than once? [3]

7



The diagram shows a river with parallel banks. The river is 48 m wide and is flowing with a speed of  $1.4 \text{ ms}^{-1}$ . A boat travels in a straight line from a point  $P$  on one bank to a point  $Q$  which is on the other bank directly opposite  $P$ . Given that the boat takes 10 seconds to cross the river, find

- (i) the speed of the boat in still water, [4]
- (ii) the angle to the bank at which the boat should be steered. [2]

8 The function  $f$  is defined, for  $0 \leq x \leq 2\pi$ , by

$$f(x) = 3 + 5 \sin 2x.$$

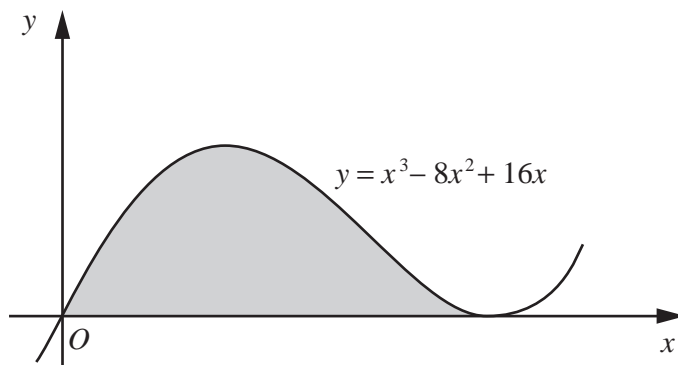
State

- (i) the amplitude of  $f$ , [1]
- (ii) the period of  $f$ , [1]
- (iii) the maximum and minimum values of  $f$ . [2]

Sketch the graph of  $y = f(x)$ . [3]

9 The line  $y = 2x - 9$  intersects the curve  $x^2 + y^2 + xy + 3x = 46$  at the points  $A$  and  $B$ . Find the equation of the perpendicular bisector of  $AB$ . [8]

10



The diagram shows part of the curve  $y = x^3 - 8x^2 + 16x$ .

- (i) Show that the curve has a minimum point at  $(4, 0)$  and find the coordinates of the maximum point. [4]
- (ii) Find the area of the shaded region enclosed by the  $x$ -axis and the curve. [4]

11 The table shows experimental values of two variables  $x$  and  $y$ .

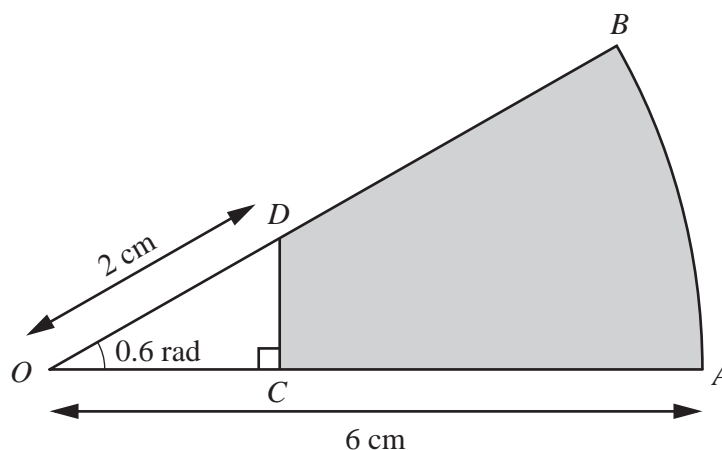
$x$	2	4	6	8
$y$	2.25	0.81	0.47	0.33

- (i) Using graph paper, plot  $xy$  against  $\frac{1}{x}$  and draw a straight line graph. [3]
- (ii) Use your graph to express  $y$  in terms of  $x$ . [5]
- (iii) Estimate the value of  $x$  and of  $y$  for which  $xy = 4$ . [3]

[Question 12 is printed on the next page.]

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

**EITHER**



The diagram shows a sector  $AOB$  of a circle with centre  $O$  and radius 6 cm. Angle  $AOB = 0.6$  radians. The point  $D$  lies on  $OB$  such that the length of  $OD$  is 2 cm. The point  $C$  lies on  $OA$  such that  $OCD$  is a right angle.

- (i) Show that the length of  $OC$  is approximately 1.65 cm and find the length of  $CD$ . [4]
- (ii) Find the perimeter of the shaded region. [3]
- (iii) Find the area of the shaded region. [3]

**OR**

A particle moves in a straight line so that  $t$  seconds after passing a fixed point  $O$  its acceleration,  $a \text{ ms}^{-2}$ , is given by  $a = 4t - 12$ . Given that its speed at  $O$  is  $16 \text{ ms}^{-1}$ , find

- (i) the values of  $t$  at which the particle is stationary, [5]
- (ii) the distance the particle travels in the fifth second. [5]



---

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.