UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*4611981584*

**ADDITIONAL MATHEMATICS** **4037/13**

Paper 1 **October/November 2013**

**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.

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

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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* $\Delta ABC$

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

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

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

1 The coefficient of $x^2$ in the expansion of $(2 + px)^6$ is 60.

For Examiner's Use

**(i)** Find the value of the positive constant $p$. [3]

**(ii)** Using your value of $p$, find the coefficient of $x^2$ in the expansion of $(3 - x)(2 + px)^6$. [3]

**2** Solve $2\lg y - \lg(5y + 60) = 1$. [5]

For Examiner's Use

3 Show that $\tan^2\theta - \sin^2\theta = \sin^4\theta\sec^2\theta$. [4]

*For Examiner's Use*

For Examiner's Use

**4** A curve has equation $y = \dfrac{e^{2x}}{(x+3)^2}$.

**(i)** Show that $\dfrac{dy}{dx} = \dfrac{Ae^{2x}(x+2)}{(x+3)^3}$, where $A$ is a constant to be found. [4]

**(ii)** Find the exact coordinates of the point on the curve where $\dfrac{dy}{dx} = 0$. [2]

**5** For $x \in \mathbb{R}$, the functions f and g are defined by

$$f(x) = 2x^3,$$

$$g(x) = 4x - 5x^2.$$

For Examiner's Use

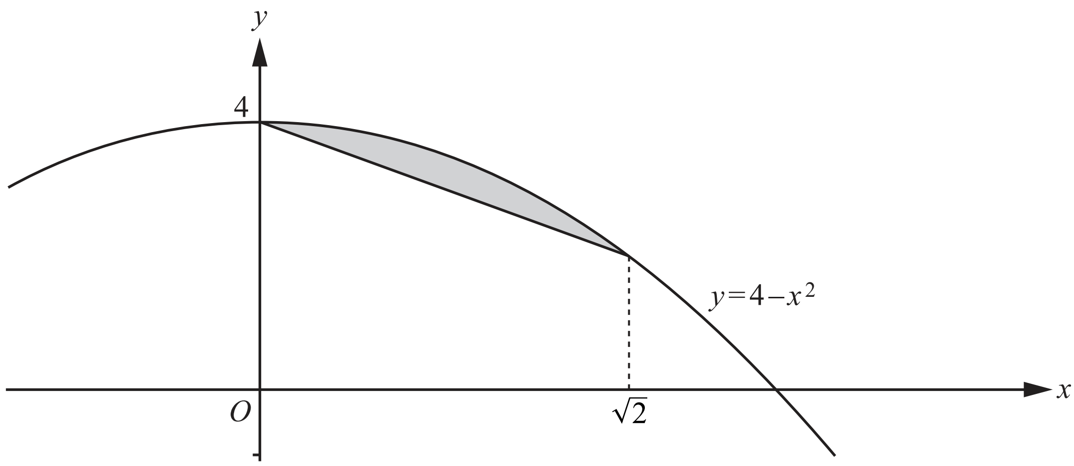
**(i)** Express $f^2\left(\frac{1}{2}\right)$ as a power of 2. [2]

**(ii)** Find the values of $x$ for which f and g are increasing at the same rate with respect to $x$. [4]

**6 Do not use a calculator in this question.**

*For Examiner's Use*

The diagram shows part of the curve $y = 4 - x^2$.




Show that the area of the shaded region can be written in the form $\frac{\sqrt{2}}{p}$, where $p$ is an integer to be found. [6]

For Examiner's Use

**7** It is given that $\mathbf{A} = \begin{pmatrix} 2t & 2 \\ t^2 - t + 1 & t \end{pmatrix}$.

**(i)** Find the value of $t$ for which det $\mathbf{A} = 1$. [3]

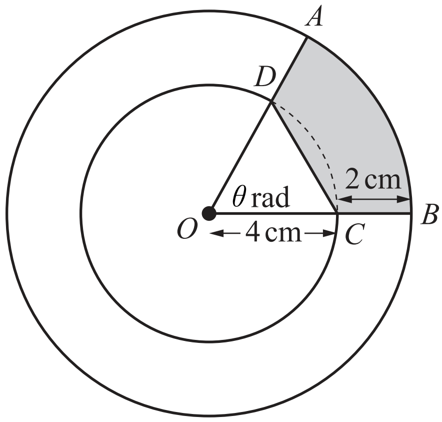
**(ii)** In the case when $t = 3$, find $\mathbf{A}^{-1}$ and hence solve

$$3x + y = 5,$$
$$7x + 3y = 11.$$

[5]

8 The diagram shows two concentric circles, centre $O$, radii 4 cm and 6 cm. The points $A$ and $B$ lie on the larger circle and the points $C$ and $D$ lie on the smaller circle such that $ODA$ and $OCB$ are straight lines.

For Examiner's Use




**(i)** Given that the area of triangle $OCD$ is $7.5\,\text{cm}^2$, show that $\theta = 1.215$ radians, to 3 decimal places. [2]

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

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

*For Examiner's Use*

**9** **(a)** **(i)** Solve $6\sin^2 x = 5 + \cos x$ for $0° < x < 180°$. [4]

*For Examiner's Use*

**(ii)** Hence, or otherwise, solve $6\cos^2 y = 5 + \sin y$ for $0° < y < 180°$. [3]

**(b)** Solve $4\cot^2 z - 3\cot z = 0$ for $0 < z < \pi$ radians. [4]

*For Examiner's Use*

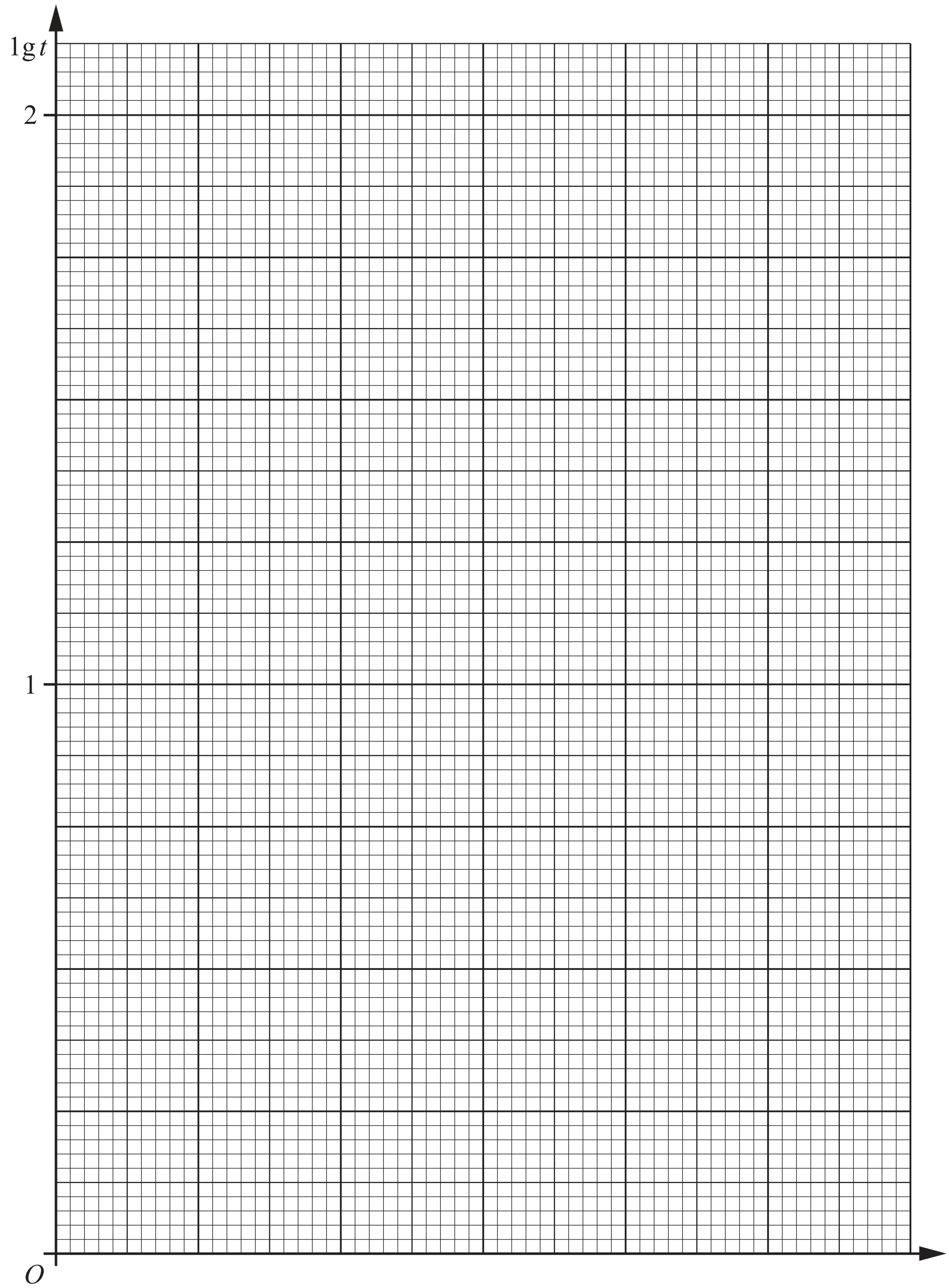
**10** The variables $s$ and $t$ are related by the equation $t = ks^n$, where $k$ and $n$ are constants. The table below shows values of variables $s$ and $t$.



| $s$ | 2 | 4 | 6 | 8 |
|---|---|---|---|---|
| $t$ | 25.00 | 6.25 | 2.78 | 1.56 |

**(i)** A straight line graph is to be drawn for this information with $\lg t$ plotted on the vertical axis. State the variable which must be plotted on the horizontal axis. [1]

**(ii)** Draw this straight line graph on the grid below. [3]



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

*For Examiner's Use*

**(iv)** Estimate the value of $s$ when $t = 4$. [2]

**Question 11 is printed on the next page.**

**[Turn over**

For Examiner's Use

**11 (i)** Given that $\int_0^k \left(2e^{2x} - \frac{5}{2}e^{-2x}\right) dx = \frac{3}{4}$, where $k$ is a constant, show that

$$4e^{4k} - 12e^{2k} + 5 = 0.$$ [5]

**(ii)** Using a substitution of $y = e^{2k}$, or otherwise, find the possible values of $k$. [4]