| Centre No. | | | | | | Paper Reference | | | | | | | Surname | Initial(s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Candidate No. | | | | | | 6 | 6 | 6 | 5 | / | 0 | 1 | Signature | |

Paper Reference(s)

**6665/01**

# Edexcel GCE

## Core Mathematics C3

## Advanced

Thursday 11 June 2009 – Morning

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

| Question Number | Leave Blank |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| Total | |

**Materials required for examination**
Mathematical Formulae (Orange or Green)

**Items included with question papers**
Nil

**Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.**

### Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions.
You must write your answer for each question in the space following the question.
When a calculator is used, the answer should be given to an appropriate degree of accuracy.

### Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 8 questions in this question paper. The total mark for this paper is 75.
There are 28 pages in this question paper. Any blank pages are indicated.

### Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You should show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.

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H 3 4 2 6 4 A 0 1 2 8

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**1.**

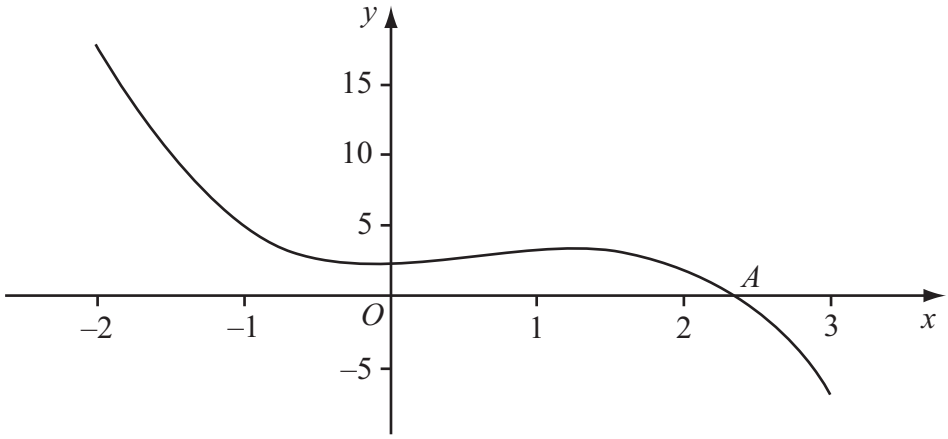


**Figure 1**

Figure 1 shows part of the curve with equation $y = -x^3 + 2x^2 + 2$, which intersects the $x$-axis at the point $A$ where $x = \alpha$.

To find an approximation to $\alpha$, the iterative formula

$$x_{n+1} = \frac{2}{(x_n)^2} + 2$$

is used.

(a) Taking $x_0 = 2.5$, find the values of $x_1$, $x_2$, $x_3$ and $x_4$.
Give your answers to 3 decimal places where appropriate.

**(3)**

(b) Show that $\alpha = 2.359$ correct to 3 decimal places.

**(3)**



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**Question 1 continued**

**Q1**

**(Total 6 marks)**

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**2.** (a) Use the identity $\cos^2\theta + \sin^2\theta = 1$ to prove that $\tan^2\theta = \sec^2\theta - 1$.

**(2)**

(b) Solve, for $0 \leqslant \theta < 360°$, the equation

$$2\tan^2\theta + 4\sec\theta + \sec^2\theta = 2$$

**(6)**



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**Question 2 continued**

**Q2**

**(Total 8 marks)**

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**3.** Rabbits were introduced onto an island. The number of rabbits, $P$, $t$ years after they were introduced is modelled by the equation

$$P = 80e^{\frac{1}{5}t}, \qquad t \in \mathbb{R},\ t \geqslant 0$$

(a) Write down the number of rabbits that were introduced to the island.
**(1)**

(b) Find the number of years it would take for the number of rabbits to first exceed 1000.
**(2)**

(c) Find $\frac{dP}{dt}$.
**(2)**

(d) Find $P$ when $\frac{dP}{dt} = 50$.
**(3)**



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**Question 3 continued**

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**Question 3 continued**

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**Question 3 continued**

**Q3**

**(Total 8 marks)**

Leave blank

**4.** (i) Differentiate with respect to $x$

(a) $x^2 \cos 3x$

**(3)**

(b) $\dfrac{\ln(x^2+1)}{x^2+1}$

**(4)**

(ii) A curve $C$ has the equation

$$y = \sqrt{(4x+1)}, \quad x > -\tfrac{1}{4}, \quad y > 0$$

The point $P$ on the curve has $x$-coordinate 2. Find an equation of the tangent to $C$ at $P$ in the form $ax + by + c = 0$, where $a$, $b$ and $c$ are integers.

**(6)**



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**Question 4 continued**

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**Question 4 continued**

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**Question 4 continued**

**Q4**

**(Total 13 marks)**

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**5.**

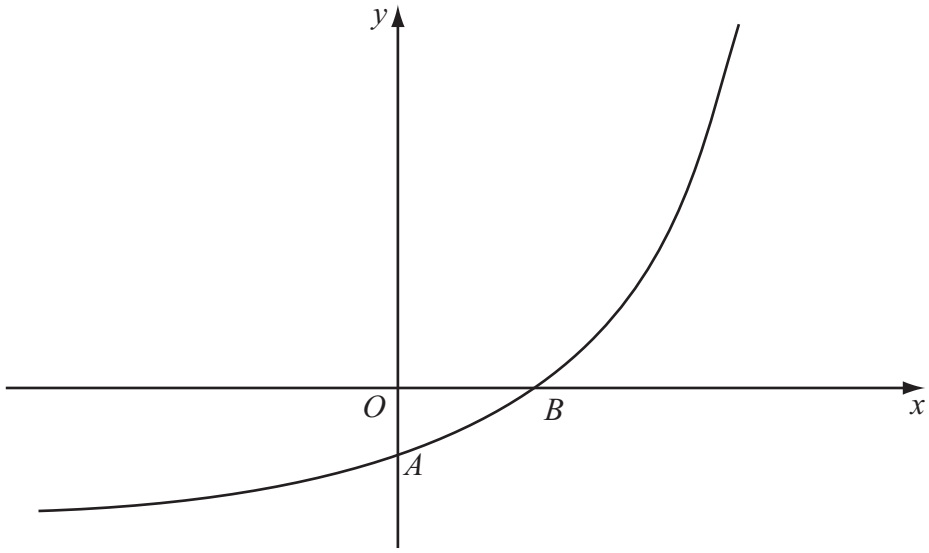


**Figure 2**

Figure 2 shows a sketch of part of the curve with equation $y = \mathrm{f}(x)$, $x \in \mathbb{R}$.
The curve meets the coordinate axes at the points $A(0, 1-k)$ and $B(\frac{1}{2}\ln k, 0)$,
where $k$ is a constant and $k > 1$, as shown in Figure 2.

On separate diagrams, sketch the curve with equation

(a) $y = |\mathrm{f}(x)|$,

**(3)**

(b) $y = \mathrm{f}^{-1}(x)$.

**(2)**

Show on each sketch the coordinates, in terms of $k$, of each point at which the curve meets or cuts the axes.

Given that $\mathrm{f}(x) = \mathrm{e}^{2x} - k$,

(c) state the range of f ,

**(1)**

(d) find $\mathrm{f}^{-1}(x)$,

**(3)**

(e) write down the domain of $\mathrm{f}^{-1}$.

**(1)**



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**Question 5 continued**

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**Question 5 continued**

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**Question 5 continued**

**Q5**

**(Total 10 marks)**

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**6.** (a) Use the identity $\cos(A+B) = \cos A \cos B - \sin A \sin B$, to show that

$$\cos 2A = 1 - 2\sin^2 A$$

**(2)**

The curves $C_1$ and $C_2$ have equations

$$C_1: \quad y = 3\sin 2x$$

$$C_2: \quad y = 4\sin^2 x - 2\cos 2x$$

(b) Show that the $x$-coordinates of the points where $C_1$ and $C_2$ intersect satisfy the equation

$$4\cos 2x + 3\sin 2x = 2$$

**(3)**

(c) Express $4\cos 2x + 3\sin 2x$ in the form $R\cos(2x - \alpha)$, where $R > 0$ and $0 < \alpha < 90°$, giving the value of $\alpha$ to 2 decimal places.

**(3)**

(d) Hence find, for $0 \leqslant x < 180°$, all the solutions of

$$4\cos 2x + 3\sin 2x = 2$$

giving your answers to 1 decimal place.

**(4)**



H 3 4 2 6 4 A 0 1 8 2 8

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**Question 6 continued**

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**Question 6 continued**

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**Question 6 continued**

**Q6**

**(Total 12 marks)**

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**7.** The function f is defined by

$$f(x) = 1 - \frac{2}{(x+4)} + \frac{x-8}{(x-2)(x+4)}, \quad x \in \mathbb{R},\ x \neq -4,\ x \neq 2$$

(a) Show that $f(x) = \dfrac{x-3}{x-2}$ **(5)**

The function g is defined by

$$g(x) = \frac{e^x - 3}{e^x - 2}, \quad x \in \mathbb{R},\ x \neq \ln 2$$

(b) Differentiate $g(x)$ to show that $g'(x) = \dfrac{e^x}{(e^x - 2)^2}$ **(3)**

(c) Find the exact values of $x$ for which $g'(x) = 1$ **(4)**



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**Question 7 continued**

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**Question 7 continued**

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**Question 7 continued**

**Q7**

**(Total 12 marks)**

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**8.** (a) Write down $\sin 2x$ in terms of $\sin x$ and $\cos x$.

**(1)**

(b) Find, for $0 < x < \pi$, all the solutions of the equation

$$\operatorname{cosec} x - 8\cos x = 0$$

giving your answers to 2 decimal places.

**(5)**



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**Question 8 continued**

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**Question 8 continued**

Q8

**(Total 6 marks)**

**TOTAL FOR PAPER: 75 MARKS**

**END**



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