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| 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

Friday 12 June 2015 – 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 | |
| 9 | |
| Total | |

| **Materials required for examination** | **Items included with question papers** |
|---|---|
| Mathematical Formulae (Pink) | 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 or symbolic differentiation/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 9 questions in this question paper. The total mark for this paper is 75.
There are 32 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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P 4 4 8 2 5 A 0 1 3 2

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**1.** Given that

$$\tan\theta° = p, \text{ where } p \text{ is a constant, } p \neq \pm 1$$

use standard trigonometric identities, to find in terms of $p$,

(a) $\tan 2\theta°$
**(2)**

(b) $\cos\theta°$
**(2)**

(c) $\cot(\theta - 45)°$
**(2)**

Write each answer in its simplest form.

Leave blank

**2.** Given that

$$f(x) = 2e^x - 5, \quad x \in \mathbb{R}$$

(a) sketch, on separate diagrams, the curve with equation

(i) $y = f(x)$

(ii) $y = |f(x)|$

On each diagram, show the coordinates of each point at which the curve meets or cuts the axes.

On each diagram state the equation of the asymptote.

**(6)**

(b) Deduce the set of values of $x$ for which $f(x) = |f(x)|$

**(1)**

(c) Find the exact solutions of the equation $|f(x)| = 2$

**(3)**

Leave blank

**Question 2 continued**

Leave blank

**3.** $$g(\theta) = 4\cos 2\theta + 2\sin 2\theta$$

Given that $g(\theta) = R\cos(2\theta - \alpha)$, where $R > 0$ and $0 < \alpha < 90°$,

(a) find the exact value of $R$ and the value of $\alpha$ to 2 decimal places.

**(3)**

(b) Hence solve, for $-90° < \theta < 90°$,

$$4\cos 2\theta + 2\sin 2\theta = 1$$

giving your answers to one decimal place.

**(5)**

Given that $k$ is a constant and the equation $g(\theta) = k$ has no solutions,

(c) state the range of possible values of $k$.

**(2)**

Leave blank

**Question 3 continued**



P 4 4 8 2 5 A 0 9 3 2

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**4.** Water is being heated in an electric kettle. The temperature, $\theta$ °C, of the water $t$ seconds after the kettle is switched on, is modelled by the equation

$$\theta = 120 - 100e^{-\lambda t}, \qquad 0 \leqslant t \leqslant T$$

(a) State the value of $\theta$ when $t = 0$

**(1)**

Given that the temperature of the water in the kettle is 70 °C when $t = 40$,

(b) find the exact value of $\lambda$, giving your answer in the form $\frac{\ln a}{b}$, where $a$ and $b$ are integers.

**(4)**

When $t = T$, the temperature of the water reaches 100 °C and the kettle switches off.

(c) Calculate the value of $T$ to the nearest whole number.

**(2)**

Leave blank

**5.** The point $P$ lies on the curve with equation

$$x = (4y - \sin 2y)^2$$

Given that $P$ has $(x, y)$ coordinates $\left(p, \frac{\pi}{2}\right)$, where $p$ is a constant,

(a) find the exact value of $p$.

**(1)**

The tangent to the curve at $P$ cuts the $y$-axis at the point $A$.

(b) Use calculus to find the coordinates of $A$.

**(6)**

Leave blank

**Question 5 continued**



P 4 4 8 2 5 A 0 1 5 3 2

**Turn over**

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**6.**

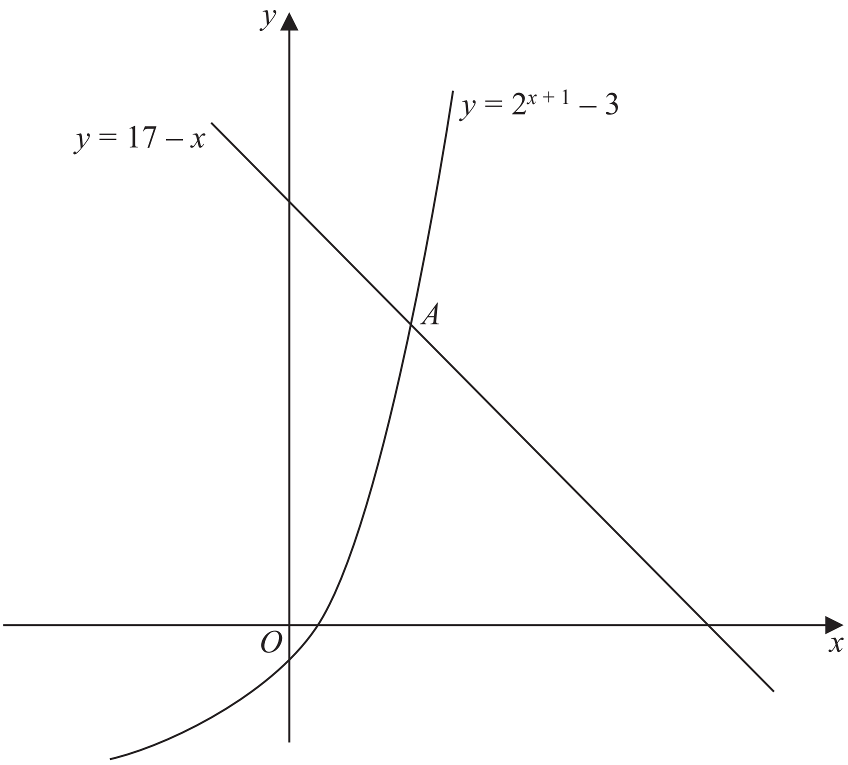


**Figure 1**

Figure 1 is a sketch showing part of the curve with equation $y = 2^{x+1} - 3$ and part of the line with equation $y = 17 - x$.

The curve and the line intersect at the point $A$.

(a) Show that the $x$ coordinate of $A$ satisfies the equation

$$x = \frac{\ln(20 - x)}{\ln 2} - 1$$

**(3)**

(b) Use the iterative formula

$$x_{n+1} = \frac{\ln(20 - x_n)}{\ln 2} - 1, \quad x_0 = 3$$

to calculate the values of $x_1$, $x_2$ and $x_3$, giving your answers to 3 decimal places.

**(3)**

(c) Use your answer to part (b) to deduce the coordinates of the point $A$, giving your answers to one decimal place.

**(2)**



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**Question 6 continued**

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**7.**

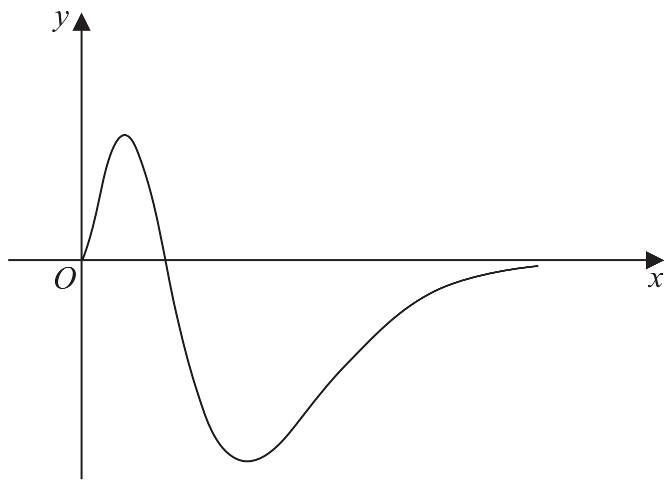


**Figure 2**

Figure 2 shows a sketch of part of the curve with equation

$$g(x) = x^2(1 - x)e^{-2x}, \quad x \geqslant 0$$

(a) Show that $g'(x) = f(x)e^{-2x}$, where $f(x)$ is a cubic function to be found.

**(3)**

(b) Hence find the range of g.

**(6)**

(c) State a reason why the function $g^{-1}(x)$ does not exist.

**(1)**

Leave blank

**Question 7 continued**

Leave blank

**8.** (a) Prove that

$$\sec 2A + \tan 2A \equiv \frac{\cos A + \sin A}{\cos A - \sin A}, \qquad A \neq \frac{(2n+1)\pi}{4}, \ n \in \mathbb{Z}$$

**(5)**

(b) Hence solve, for $0 \leqslant \theta < 2\pi$,

$$\sec 2\theta + \tan 2\theta = \frac{1}{2}$$

Give your answers to 3 decimal places.

**(4)**

Leave blank

**Question 8 continued**



P 4 4 8 2 5 A 0 2 7 3 2

Turn over

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**9.** Given that $k$ is a **negative** constant and that the function $f(x)$ is defined by

$$f(x) = 2 - \frac{(x-5k)(x-k)}{x^2 - 3kx + 2k^2}, \quad x \geqslant 0$$

(a) show that $f(x) = \dfrac{x+k}{x-2k}$

**(3)**

(b) Hence find $f'(x)$, giving your answer in its simplest form.

**(3)**

(c) State, with a reason, whether $f(x)$ is an increasing or a decreasing function.

Justify your answer.

**(2)**

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**Question 9 continued**

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