| 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

Tuesday 15 June 2010 – 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 (Pink)

**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 to 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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**Turn over**

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**1.** (a) Show that

$$\frac{\sin 2\theta}{1+\cos 2\theta} = \tan\theta$$

**(2)**

(b) Hence find, for $-180° \leqslant \theta < 180°$, all the solutions of

$$\frac{2\sin 2\theta}{1+\cos 2\theta} = 1$$

Give your answers to 1 decimal place.

**(3)**

Leave blank

**2.** A curve $C$ has equation

$$y = \frac{3}{(5-3x)^2}, \quad x \neq \frac{5}{3}$$

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

**(7)**

Leave blank

**3.** $\mathrm{f}(x) = 4\operatorname{cosec} x - 4x + 1$, where $x$ is in radians.

(a) Show that there is a root $\alpha$ of $\mathrm{f}(x) = 0$ in the interval $[1.2, 1.3]$.

**(2)**

(b) Show that the equation $\mathrm{f}(x) = 0$ can be written in the form

$$x = \frac{1}{\sin x} + \frac{1}{4}$$

**(2)**

(c) Use the iterative formula

$$x_{n+1} = \frac{1}{\sin x_n} + \frac{1}{4}, \qquad x_0 = 1.25,$$

to calculate the values of $x_1$, $x_2$ and $x_3$, giving your answers to 4 decimal places.

**(3)**

(d) By considering the change of sign of $\mathrm{f}(x)$ in a suitable interval, verify that $\alpha = 1.291$ correct to 3 decimal places.

**(2)**

Leave blank

**Question 3 continued**

Leave blank

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

$$\mathrm{f} : x \mapsto |2x-5|, \quad x \in \mathbb{R}$$

(a) Sketch the graph with equation $y = \mathrm{f}(x)$, showing the coordinates of the points where the graph cuts or meets the axes.

**(2)**

(b) Solve $\mathrm{f}(x) = 15 + x$.

**(3)**

The function g is defined by

$$\mathrm{g} : x \mapsto x^2 - 4x + 1, \quad x \in \mathbb{R}, \quad 0 \leqslant x \leqslant 5$$

(c) Find $\mathrm{fg}(2)$.

**(2)**

(d) Find the range of g.

**(3)**

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**Question 4 continued**

**5.**

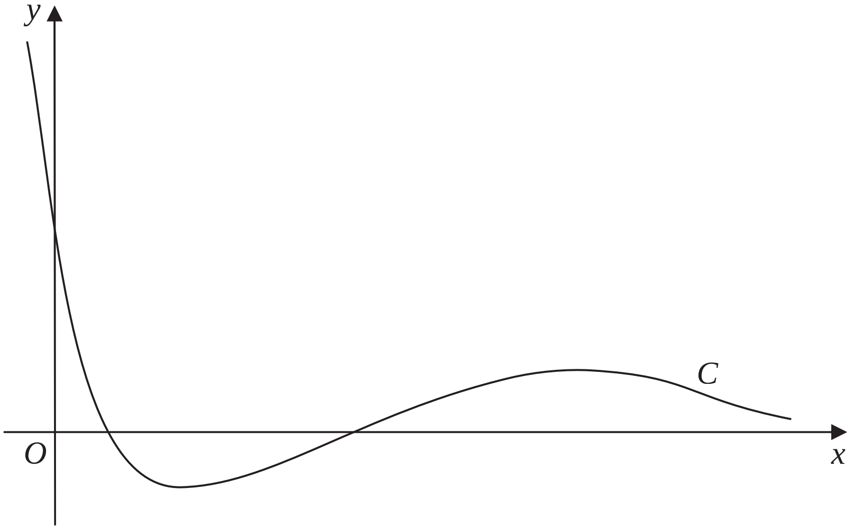


**Figure 1**

Figure 1 shows a sketch of the curve $C$ with the equation $y = (2x^2 - 5x + 2)e^{-x}$.

(a) Find the coordinates of the point where $C$ crosses the $y$-axis.

**(1)**

(b) Show that $C$ crosses the $x$-axis at $x = 2$ and find the $x$-coordinate of the other point where $C$ crosses the $x$-axis.

**(3)**

(c) Find $\dfrac{dy}{dx}$.

**(3)**

(d) Hence find the exact coordinates of the turning points of $C$.

**(5)**

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**Question 5 continued**

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**6.**

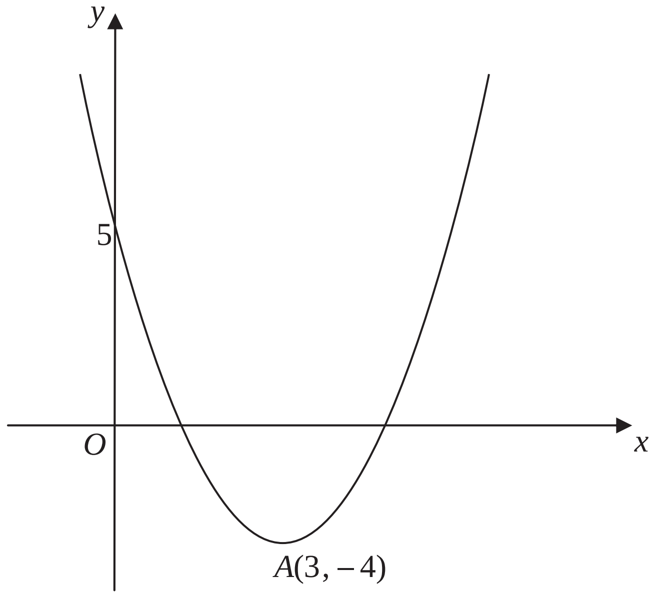


**Figure 2**

Figure 2 shows a sketch of the curve with the equation $y = \mathrm{f}(x)$, $x \in \mathbb{R}$.
The curve has a turning point at $A(3, -4)$ and also passes through the point $(0, 5)$.

(a) Write down the coordinates of the point to which $A$ is transformed on the curve with equation

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

(ii) $y = 2\mathrm{f}(\frac{1}{2}x)$.

**(4)**

(b) Sketch the curve with equation

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

On your sketch show the coordinates of all turning points and the coordinates of the point at which the curve cuts the $y$-axis.

**(3)**

The curve with equation $y = \mathrm{f}(x)$ is a translation of the curve with equation $y = x^2$.

(c) Find $\mathrm{f}(x)$.

**(2)**

(d) Explain why the function f does not have an inverse.

**(1)**



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**Question 6 continued**

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**7.** (a) Express $2\sin\theta - 1.5\cos\theta$ in the form $R\sin(\theta - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{\pi}{2}$.

Give the value of $\alpha$ to 4 decimal places.

**(3)**

(b) (i) Find the maximum value of $2\sin\theta - 1.5\cos\theta$.

(ii) Find the value of $\theta$, for $0 \leqslant \theta < \pi$, at which this maximum occurs.

**(3)**

Tom models the height of sea water, $H$ metres, on a particular day by the equation

$$H = 6 + 2\sin\left(\frac{4\pi t}{25}\right) - 1.5\cos\left(\frac{4\pi t}{25}\right), \quad 0 \leqslant t < 12,$$

where $t$ hours is the number of hours after midday.

(c) Calculate the maximum value of $H$ predicted by this model and the value of $t$, to 2 decimal places, when this maximum occurs.

**(3)**

(d) Calculate, to the nearest minute, the times when the height of sea water is predicted, by this model, to be 7 metres.

**(6)**

Leave blank

**Question 7 continued**

Leave blank

**8.** (a) Simplify fully

$$\frac{2x^2 + 9x - 5}{x^2 + 2x - 15}$$

**(3)**

Given that

$$\ln(2x^2 + 9x - 5) = 1 + \ln(x^2 + 2x - 15), \quad x \neq -5,$$

(b) find $x$ in terms of e.

**(4)**