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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

Thursday 16 June 2011 – Afternoon

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 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 8 questions in this question paper. The total mark for this paper is 75.
There are 24 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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1. Differentiate with respect to x

(a) $\ln\left(x^2 + 3x + 5\right)$

(2)

(b) $\dfrac{\cos x}{x^2}$

(3)

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Question 1 continued

Q1

(Total 5 marks)

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2. $$\mathrm{f}(x) = 2\sin(x^2) + x - 2, \qquad 0 \leqslant x < 2\pi$$

(a) Show that $\mathrm{f}(x) = 0$ has a root α between $x = 0.75$ and $x = 0.85$

(2)

The equation $\mathrm{f}(x) = 0$ can be written as $x = \left[\arcsin\left(1 - 0.5x\right)\right]^{\frac{1}{2}}$.

(b) Use the iterative formula

$$x_{n+1} = \left[\arcsin\left(1 - 0.5x_n\right)\right]^{\frac{1}{2}}, \quad x_0 = 0.8$$

to find the values of x_1, x_2 and x_3, giving your answers to 5 decimal places.

(3)

(c) Show that $\alpha = 0.80157$ is correct to 5 decimal places.

(3)

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Question 2 continued

Q2

(Total 8 marks)

Leave blank

3.

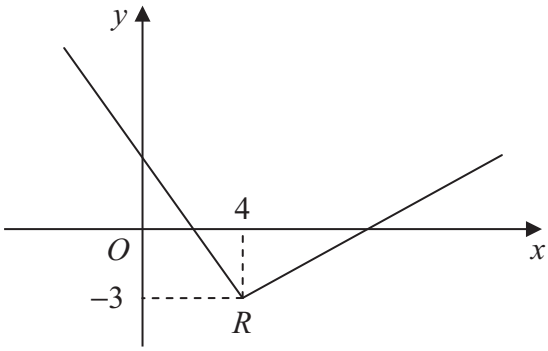

Figure 1

Figure 1 shows part of the graph of $y = \mathrm{f}(x),\ x \in \mathbb{R}$.

The graph consists of two line segments that meet at the point $R(4, -3)$, as shown in Figure 1.

Sketch, on separate diagrams, the graphs of

(a) $y = 2\mathrm{f}(x+4)$,

(3)

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

(3)

On each diagram, show the coordinates of the point corresponding to R.

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Question 3 continued

Q3

(Total 6 marks)

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4. The function f is defined by

$$\mathrm{f} : x \mapsto 4 - \ln(x+2), \quad x \in \mathbb{R},\ x \geqslant -1$$

(a) Find $\mathrm{f}^{-1}(x)$.

(3)

(b) Find the domain of f^{-1}.

(1)

The function g is defined by

$$\mathrm{g} : x \mapsto \mathrm{e}^{x^2} - 2, \quad x \in \mathbb{R}$$

(c) Find $\mathrm{fg}(x)$, giving your answer in its simplest form.

(3)

(d) Find the range of fg.

(1)

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Question 4 continued

Q4

(Total 8 marks)

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5. The mass, m grams, of a leaf t days after it has been picked from a tree is given by

$$m = p\,\mathrm{e}^{-kt}$$

where k and p are positive constants.

When the leaf is picked from the tree, its mass is 7.5 grams and 4 days later its mass is 2.5 grams.

(a) Write down the value of p.

(1)

(b) Show that $k = \frac{1}{4}\ln 3$.

(4)

(c) Find the value of t when $\frac{\mathrm{d}m}{\mathrm{d}t} = -0.6\ln 3$.

(6)

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Question 5 continued

(Total 11 marks)

Q5

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6. (a) Prove that

$$\frac{1}{\sin 2\theta} - \frac{\cos 2\theta}{\sin 2\theta} = \tan\theta, \quad \theta \neq 90n°, \ n \in \mathbb{Z}$$

(4)

(b) Hence, or otherwise,

(i) show that $\tan 15° = 2 - \sqrt{3}$,

(3)

(ii) solve, for $0 < x < 360°$,

$$\operatorname{cosec} 4x - \cot 4x = 1$$

(5)

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Question 6 continued

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Question 6 continued

Leave blank

Question 6 continued

(Total 12 marks)

Q6

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7. $$\mathrm{f}(x) = \frac{4x-5}{(2x+1)(x-3)} - \frac{2x}{x^2-9}, \qquad x \neq \pm 3,\ x \neq -\frac{1}{2}$$

(a) Show that

$$\mathrm{f}(x) = \frac{5}{(2x+1)(x+3)}$$

(5)

The curve C has equation $y = \mathrm{f}(x)$. The point $P\left(-1, -\frac{5}{2}\right)$ lies on C.

(b) Find an equation of the normal to C at P.

(8)

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Question 7 continued

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Question 7 continued

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Question 7 continued

(Total 13 marks)

Q7

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8. (a) Express $2\cos 3x - 3\sin 3x$ in the form $R\cos(3x+\alpha)$, where R and α are constants, $R > 0$ and $0 < \alpha < \frac{\pi}{2}$. Give your answers to 3 significant figures.

(4)

$$\mathrm{f}(x) = \mathrm{e}^{2x}\cos 3x$$

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

$$\mathrm{f}'(x) = R\,\mathrm{e}^{2x}\cos(3x+\alpha)$$

where R and α are the constants found in part (a).

(5)

(c) Hence, or otherwise, find the smallest positive value of x for which the curve with equation $y = \mathrm{f}(x)$ has a turning point.

(3)

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Question 8 continued

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Question 8 continued

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Question 8 continued

Q8

(Total 12 marks)

TOTAL FOR PAPER: 75 MARKS

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