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 13 June 2013 – Morning

Time: 1 hour 30 minutes

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.

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
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9	
Total	

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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PEARSON

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1. $$g(x) = \frac{6x + 12}{x^2 + 3x + 2} - 2, \quad x \geqslant 0$$

(a) Show that $g(x) = \dfrac{4 - 2x}{x + 1}, \ x \geqslant 0$

(3)

(b)

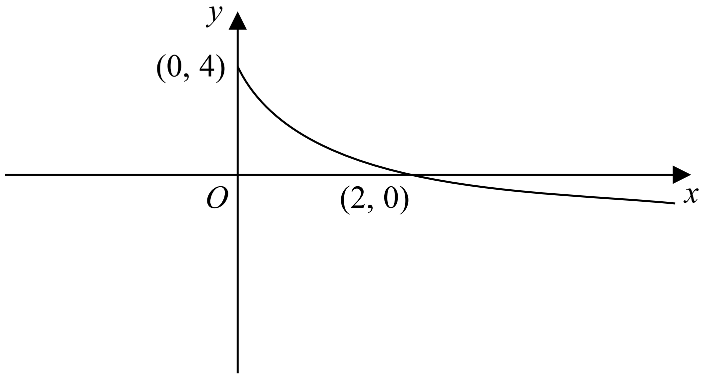

Figure 1

Figure 1 shows a sketch of the curve with equation $y = g(x), \ x \geqslant 0$

The curve meets the y-axis at (0, 4) and crosses the x-axis at (2, 0).

On separate diagrams sketch the graph with equation

(i) $y = 2g(2x)$,

(ii) $y = g^{-1}(x)$.

Show on each sketch the coordinates of each point at which the graph meets or crosses the axes.

(5)

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Question 1 continued

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2. Given that $\tan 40° = p$, find in terms of p

(a) $\cot 40°$

(1)

(b) $\sec 40°$

(2)

(c) $\tan 85°$

(2)

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3.

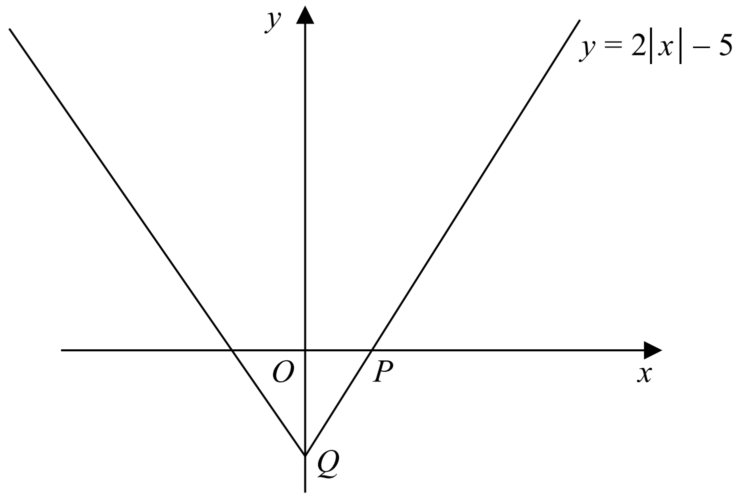

Figure 2

Figure 2 shows a sketch of the graph with equation $y = 2|x| - 5$.

The graph intersects the positive x-axis at the point P and the negative y-axis at the point Q.

(a) State the coordinates of P and the coordinates of Q.

(2)

(b) Solve the equation

$$2|x| - 5 = 3 - x$$

(3)

Leave blank

4. (a) On the same diagram, sketch and clearly label the graphs with equations

$$y = e^x \quad \text{and} \quad y = 10 - x$$

Show on your sketch the coordinates of each point at which the graphs cut the axes.
(3)

(b) Explain why the equation $e^x - 10 + x = 0$ has only one solution.
(1)

(c) Show that the solution of the equation

$$e^x - 10 + x = 0$$

lies between $x = 2$ and $x = 3$
(2)

(d) Use the iterative formula

$$x_{n+1} = \ln(10 - x_n), \quad x_1 = 2$$

to calculate the values of x_2, x_3 and x_4.

Give your answers to 4 decimal places.
(3)

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Question 4 continued

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5. (i) (a) Show that $\frac{\mathrm{d}}{\mathrm{d}x}\left(x^{\frac{1}{2}}\ln x\right) = \frac{\ln x}{2\sqrt{x}} + \frac{1}{\sqrt{x}}$

(3)

The curve with equation $y = x^{\frac{1}{2}}\ln x,\ \ x > 0$ has one turning point at the point P.

(b) Find the exact coordinates of P. Give your answer in its simplest form.

(4)

(ii) A curve C has equation $y = \frac{x - k}{x + k}$, where k is a positive constant.

Find $\frac{\mathrm{d}y}{\mathrm{d}x}$, and show that C has no turning points.

(4)

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Question 5 continued

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6.

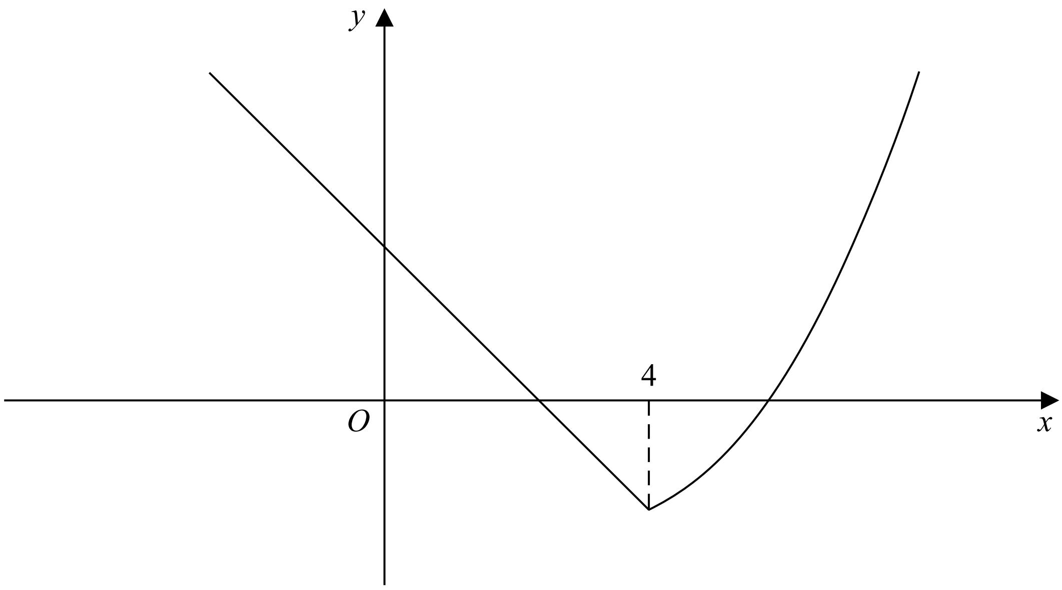

Figure 3

Figure 3 shows a sketch of the graph of $y = \mathrm{f}(x)$ where

$$\mathrm{f}(x) = \begin{cases} 5 - 2x, & x \leqslant 4 \\ \mathrm{e}^{2x-8} - 4, & x > 4 \end{cases}$$

(a) State the range of $\mathrm{f}(x)$.

(1)

(b) Determine the exact value of $\mathrm{ff}(0)$.

(2)

(c) Solve $\mathrm{f}(x) = 21$

Give each answer as an exact answer.

(5)

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

(1)

Leave blank

Question 6 continued

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7. (a) Prove that

$$\frac{\cos x}{1 - \sin x} + \frac{1 - \sin x}{\cos x} = 2\sec x, \qquad x \neq (2n+1)\frac{\pi}{2}, \quad n \in \mathbb{Z}$$

(4)

(b) Hence find, for $0 < x < \frac{\pi}{4}$, the exact solution of

$$\frac{\cos x}{1 - \sin x} + \frac{1 - \sin x}{\cos x} = 8\sin x$$

(4)

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Question 7 continued

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8. (a) Express $9\cos\theta - 2\sin\theta$ in the form $R\cos(\theta + \alpha)$, where $R > 0$ and $0 < \alpha < \frac{\pi}{2}$.

Give the exact value of R and give the value of α to 4 decimal places.

(3)

(b) (i) State the maximum value of $9\cos\theta - 2\sin\theta$

(ii) Find the value of θ, for $0 < \theta < 2\pi$, at which this maximum occurs.

(3)

Ruth models the height H above the ground of a passenger on a Ferris wheel by the equation

$$H = 10 - 9\cos\left(\frac{\pi t}{5}\right) + 2\sin\left(\frac{\pi t}{5}\right)$$

where H is measured in metres and t is the time in minutes after the wheel starts turning.

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

(4)

(d) Determine the time for the Ferris wheel to complete two revolutions.

(2)

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Question 8 continued

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9.

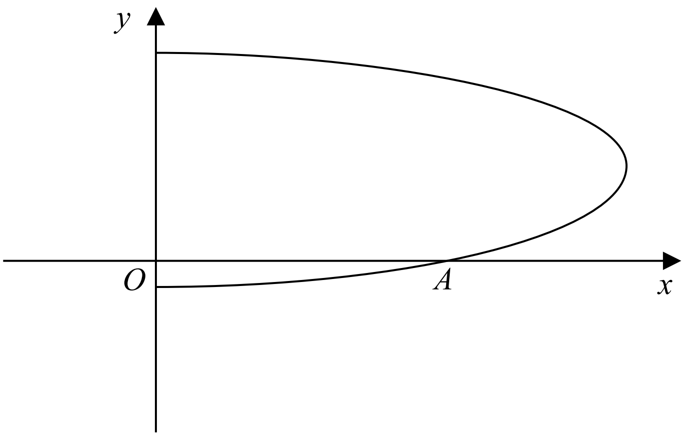

Figure 4

Figure 4 shows a sketch of the curve with equation $x = (9 + 16y - 2y^2)^{\frac{1}{2}}$.

The curve crosses the x-axis at the point A.

(a) State the coordinates of A.

(1)

(b) Find an expression for $\frac{dx}{dy}$, in terms of y.

(3)

(c) Find an equation of the tangent to the curve at A.

(4)

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Question 9 continued

Q9

(Total 8 marks)

TOTAL FOR PAPER: 75 MARKS

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