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

Paper Reference(s)

6666/01

Edexcel GCE

Core Mathematics C4

Advanced

Tuesday 18 June 2013 – 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	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 8 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. (a) Find the binomial expansion of

$$\sqrt{(9 + 8x)}, \quad |x| < \frac{9}{8}$$

in ascending powers of x, up to and including the term in x^2.
Give each coefficient as a simplified fraction.

(5)

(b) Use your expansion to estimate the value of $\sqrt{(11)}$, giving your answer as a single fraction.

(3)

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Question 1 continued

Q1

(Total 8 marks)

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2.

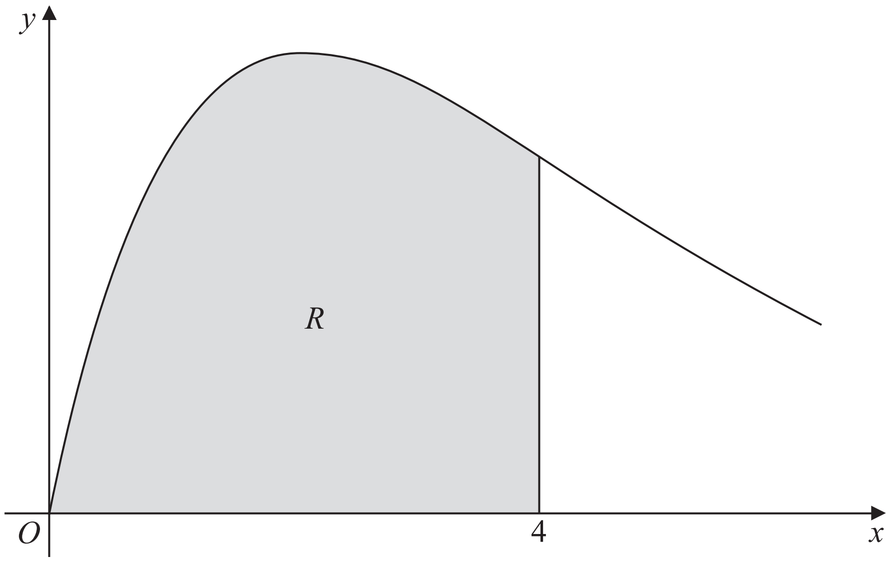

Figure 1

Figure 1 shows a sketch of part of the curve with equation $y = x\mathrm{e}^{-\frac{1}{2}x}$, $x \geqslant 0$.

The finite region R, shown shaded in Figure 1, is bounded by the curve, the x-axis, and the line $x = 4$.

The table shows corresponding values of x and y for $y = x\mathrm{e}^{-\frac{1}{2}x}$.

x	0	1	2	3	4
y	0	$\mathrm{e}^{-\frac{1}{2}}$		$3\mathrm{e}^{-\frac{3}{2}}$	$4\mathrm{e}^{-2}$

(a) Complete the table with the value of y corresponding to $x = 2$

(1)

(b) Use the trapezium rule, with all the values of y in the completed table, to obtain an estimate for the area of R, giving your answer to 2 decimal places.

(4)

(c) (i) Find $\int x\mathrm{e}^{-\frac{1}{2}x}\,\mathrm{d}x$.

(ii) Hence find the exact area of R, giving your answer in the form $a + b\mathrm{e}^{-2}$, where a and b are integers.

(6)

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Question 2 continued

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Question 2 continued

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Question 2 continued

Q2

(Total 11 marks)

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3. A curve C has parametric equations

$$x = 2t + 5, \quad y = 3 + \frac{4}{t}, \qquad t \neq 0$$

(a) Find the value of $\frac{\mathrm{d}y}{\mathrm{d}x}$ at the point on C with coordinates (9, 5).

(4)

(b) Find a cartesian equation of the curve in the form

$$y = \frac{ax + b}{cx + d}$$

where a, b, c and d are integers.

(3)

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Question 3 continued

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Question 3 continued

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Question 3 continued

Q3

(Total 7 marks)

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4. With respect to a fixed origin O, the line l_1 has vector equation

$$\mathbf{r} = \begin{pmatrix} -9 \\ 8 \\ 5 \end{pmatrix} + \mu \begin{pmatrix} 5 \\ -4 \\ -3 \end{pmatrix}$$

where μ is a scalar parameter.

The point A is on l_1 where $\mu = 2$.

(a) Write down the coordinates of A.

(1)

The acute angle between OA and l_1 is θ, where O is the origin.

(b) Find the value of $\cos \theta$.

(3)

The point B is such that $\overrightarrow{OB} = 3\overrightarrow{OA}$.

The line l_2 passes through the point B and is parallel to the line l_1.

(c) Find a vector equation of l_2.

(2)

(d) Find the length of OB, giving your answer as a simplified surd.

(1)

The point X lies on l_2. Given that the vector $\overrightarrow{OX}$ is perpendicular to l_2,

(e) find the length of OX, giving your answer to 3 significant figures.

(3)

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Question 4 continued

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Question 4 continued

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Question 4 continued

Q4

(Total 10 marks)

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5. The curve C has the equation

$$\sin(\pi y) - y - x^2 y = -5, \qquad x > 0$$

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ in terms of x and y.
(5)

The point P with coordinates $(2, 1)$ lies on C.
The tangent to C at P meets the x-axis at the point A.

(b) Find the exact value of the x-coordinate of A.
(4)

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Question 5 continued

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Question 5 continued

Question 5 continued

(Total 9 marks)

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Q5

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6. (i) (a) Express $\dfrac{7x}{(x+3)(2x-1)}$ in partial fractions.

(3)

(b) Given that $x > \dfrac{1}{2}$, find

$$\int \frac{7x}{(x+3)(2x-1)}\,\mathrm{d}x$$

(3)

(ii) Using the substitution $u^3 = x$, or otherwise, find

$$\int \frac{1}{x + x^{\frac{1}{3}}}\,\mathrm{d}x, \qquad x > 0$$

(5)

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Question 6 continued

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Question 6 continued

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Question 6 continued

Q6

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7.

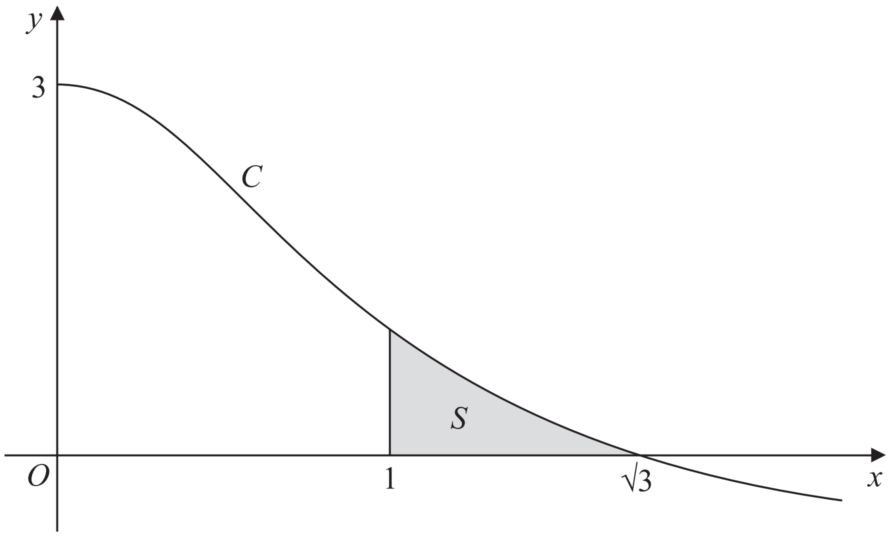

Figure 2

Figure 2 shows a sketch of part of the curve C with parametric equations

$$x = \tan\theta, \qquad y = 1 + 2\cos 2\theta, \qquad 0 \leqslant \theta < \frac{\pi}{2}$$

The curve C crosses the x-axis at $(\sqrt{3}, 0)$. The finite shaded region S shown in Figure 2 is bounded by C, the line $x = 1$ and the x-axis. This shaded region is rotated through 2π radians about the x-axis to form a solid of revolution.

(a) Show that the volume of the solid of revolution formed is given by the integral

$$k\int_{\frac{\pi}{4}}^{\frac{\pi}{3}} (16\cos^2\theta - 8 + \sec^2\theta)\,\mathrm{d}\theta$$

where k is a constant.

(5)

(b) Hence, use integration to find the exact value for this volume.

(5)

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Question 7 continued

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Question 7 continued

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Question 7 continued

Q7

(Total 10 marks)

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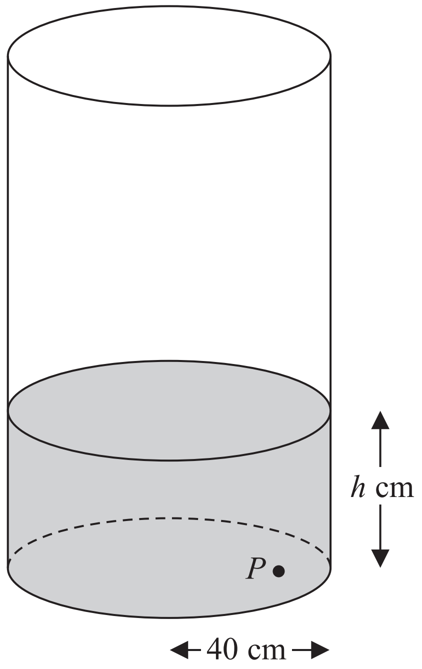

Figure 3

Figure 3 shows a large vertical cylindrical tank containing a liquid. The radius of the circular cross-section of the tank is 40 cm. At time t minutes, the depth of liquid in the tank is h centimetres. The liquid leaks from a hole P at the bottom of the tank.

The liquid leaks from the tank at a rate of $32\pi\sqrt{h}$ cm^3 min^{-1}.

(a) Show that at time t minutes, the height h cm of liquid in the tank satisfies the differential equation

$$\frac{dh}{dt} = -0.02\sqrt{h}$$

(4)

(b) Find the time taken, to the nearest minute, for the depth of liquid in the tank to decrease from 100 cm to 50 cm.

(5)

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Question 8 continued

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Question 8 continued

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Question 8 continued

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Question 8 continued

Q8

(Total 9 marks)

TOTAL FOR PAPER: 75 MARKS

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