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

Thursday 21 June 2012 – 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	
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 7 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

PEARSON

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1. $$f(x) = \frac{2x+1}{(1+x)(1-x)^2}, \quad x \in \mathbb{R}, \ |x| < 1$$

Given that $f(x) = \frac{A}{1+x} + \frac{B}{1-x} + \frac{C}{(1-x)^2}$ where A, B and C are constants,

(a) find the values of A, B and C.

(4)

(b) Hence, or otherwise, find the series expansion of $f(x)$ in ascending powers of x up to and including the term in x^2. Simplify fully each term.

(6)

Leave blank

Question 1 continued

Leave blank

Question 1 continued

Leave blank

Question 1 continued

Q1

(Total 10 marks)

Leave blank

2. A curve C has parametric equations

$$x = \cos t, \ y = \sin^2 2t, \quad 0 \leqslant t \leqslant \pi$$

(a) State

(i) the greatest and least value of x,

(ii) the greatest and least value of y.

(2)

(b) Find the cartesian equation of the curve C.

(3)

(c) Find the exact coordinates of the points where C meets the x-axis and the y-axis.

(3)

Leave blank

Question 2 continued

Leave blank

Question 2 continued

Leave blank

Question 2 continued

Q2

(Total 8 marks)

Leave blank

3. (a) Given that $y = 3^x$, find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

(1)

(b) Find an equation of the tangent to the curve

$$y = 3^x - 3^{-x} + 2$$

at the point (0, 2).

(5)

Leave blank

Question 3 continued

Q3

(Total 6 marks)

Leave blank

4. The straight lines l_1 and l_2 have vector equations

$$\mathbf{r} = 2\mathbf{i} + 3\mathbf{j} + 4\mathbf{k} + s(3\mathbf{i} + 4\mathbf{j} + 5\mathbf{k})$$

$$\mathbf{r} = 2\mathbf{i} + \mathbf{j} + t(\mathbf{i} + 2\mathbf{j} + 3\mathbf{k})$$

respectively, where s and t are scalar parameters.

(a) Show that l_1 and l_2 intersect and find the position vector of the point of intersection.

(5)

(b) Calculate, in degrees to 1 decimal place, the acute angle between l_1 and l_2.

(4)

Leave blank

Question 4 continued

Leave blank

Question 4 continued

Leave blank

Question 4 continued

Q4

(Total 9 marks)

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5. Integrate the following with respect to x.

(a) $x^2 \ln x$

(4)

(b) $\sec 2x \tan 2x + \sec^2 x$

(3)

Using the substitution $u = 2 + \cos\theta$, or otherwise,

(c) find the exact value of

$$\int_0^{\frac{\pi}{2}} \frac{\sin 2\theta}{2 + \cos\theta} \, \mathrm{d}\theta$$

giving your answer in the form $a \ln b + c$, where a, b and c are constants to be found.

(8)

Leave blank

Question 5 continued

Leave blank

Question 5 continued

Leave blank

Question 5 continued

Q5

(Total 15 marks)

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6. A circular cylinder has a perpendicular height equal to the radius of the base r cm.

Given that the volume of this cylinder is V cm^3,

(a) show that $V = \pi r^3$

(1)

Given that r varies with time,

(b) find $\frac{dV}{dr}$ in terms of r.

(1)

The rate of change of the volume of the cylinder at time t seconds, $\frac{dV}{dt}$ cm^{3}s^{-1}, is given by

$$\frac{dV}{dt} = \frac{2t}{2+t^2}$$

Given that $V = 3$ when $t = 0$,

(c) find V in terms of t.

(4)

(d) When $t = 1$, find r. Give your answer to 3 significant figures.

(4)

(e) Using the Chain Rule, or otherwise, find $\frac{dr}{dt}$ in terms of r and t.

(2)

(f) When $t = 1$, find the value of $\frac{dr}{dt}$. Give your answer to 3 significant figures.

(2)

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Question 6 continued

Leave blank

Question 6 continued

Leave blank

Question 6 continued

Q6

(Total 14 marks)

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7.

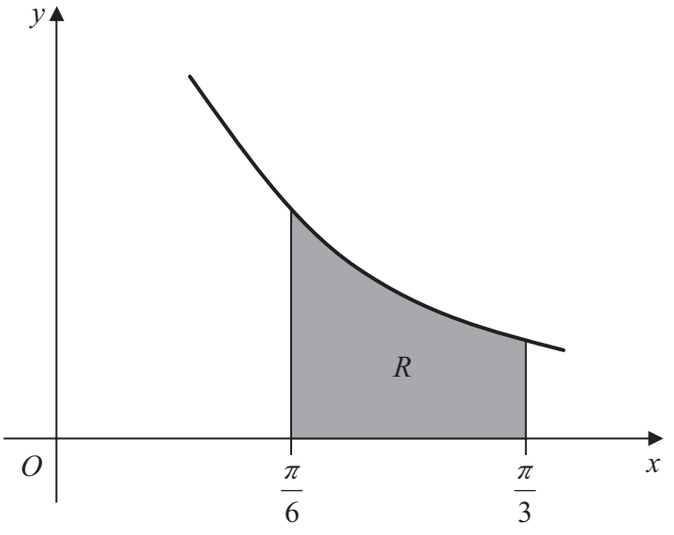

Figure 1

Figure 1 shows a sketch of part of the curve with equation $y = \operatorname{cosec} x$.

The finite region R is bounded by the curve, the x-axis and the lines $x = \frac{\pi}{6}$ and $x = \frac{\pi}{3}$ as shown shaded in Figure 1.

(a) Use calculus to find the value of the area of R to 3 decimal places.

(3)

(b) Use the trapezium rule, with 2 strips of equal width, to estimate the area of R. Give your answer to 3 decimal places.

(5)

(c) Find the value of the error of your estimate in part (b).

(1)

(d) Find the exact value of the volume of the solid formed when the region R is rotated through 2π radians about the x-axis. Give your answer in the form $a\pi\sqrt{3}$ where a is a constant.

(4)

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Question 7 continued

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Question 7 continued

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Question 7 continued

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Question 7 continued

Q7

(Total 13 marks)

TOTAL FOR PAPER: 75 MARKS

END