Winter 2012
Past Paper
www.mystudybro.com
This resource was created and owned by Pearson Edexcel
Mathematics C4
6666

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

Wednesday 25 January 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	
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 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.

Printer's Log. No.
P40085A

W850/R6665/57570   5/4/5

Turn over

PEARSON

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave
blank

1. The curve C has the equation $2x + 3y^2 + 3x^2y = 4x^2$.
   The point P on the curve has coordinates $(-1, 1)$.

   (a) Find the gradient of the curve at P.

   (5)

   (b) Hence find the equation of the normal to C at P, giving your answer in the form $ax+by+c = 0$, where a, b and c are integers.

   (3)

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave blank

Question 1 continued

Q1

(Total 8 marks)

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave blank

2. (a) Use integration by parts to find $\int x \sin 3x \, dx$.

(3)

(b) Using your answer to part (a), find $\int x^2 \cos 3x \, dx$.

(3)

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave blank

Question 2 continued

Q2

(Total 6 marks)

Turn over

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave
blank

3. (a) Expand

$$\frac{1}{(2-5x)^2} \ , \quad |x| < \frac{2}{5}$$

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

(5)

Given that the binomial expansion of $\dfrac{2+kx}{(2-5x)^2} \ , \quad |x| < \dfrac{2}{5}$, is

$$\frac{1}{2} + \frac{7}{4}x + Ax^2 + ...$$

(b) find the value of the constant k,

(2)

(c) find the value of the constant A.

(2)

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave
blank

Question 3 continued

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave blank

Question 3 continued

P40085A0828

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave blank

Question 3 continued

(Total 9 marks)

Q3

P40085A0928

Winter 2012
Past Paper
www.mystudybro.com
This resource was created and owned by Pearson Edexcel
Mathematics C4
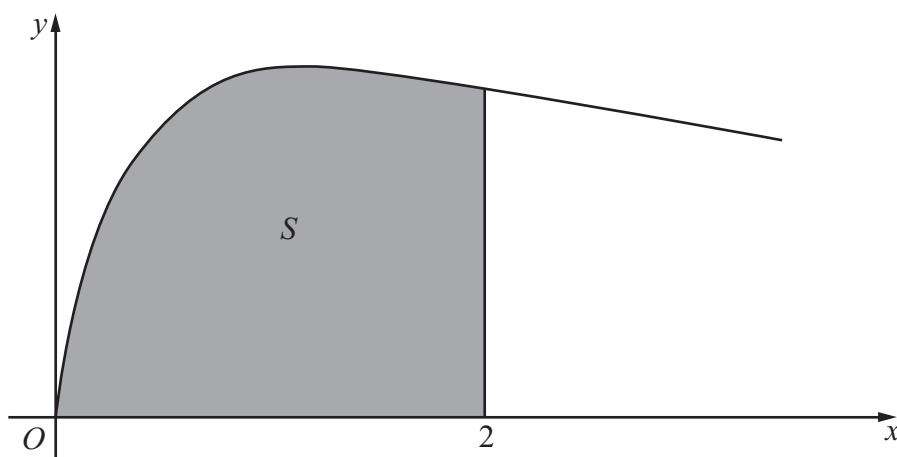6666

Leave
blank

4.

Figure 1

Figure 1 shows the curve with equation

$$y = \sqrt{\left(\frac{2x}{3x^2 + 4} \right)}, \quad x \geqslant 0$$

The finite region S, shown shaded in Figure 1, is bounded by the curve, the x-axis and the line $x = 2$

The region S is rotated 360° about the x-axis.

Use integration to find the exact value of the volume of the solid generated, giving your answer in the form $k \ln a$, where k and a are constants.

(5)

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave blank

Question 4 continued

Q4

(Total 5 marks)

P 4 0 0 8 5 A 0 1 1 2 8

Winter 2012
Past Paper
www.mystudybro.com
This resource was created and owned by Pearson Edexcel
Mathematics C4
6666

5.
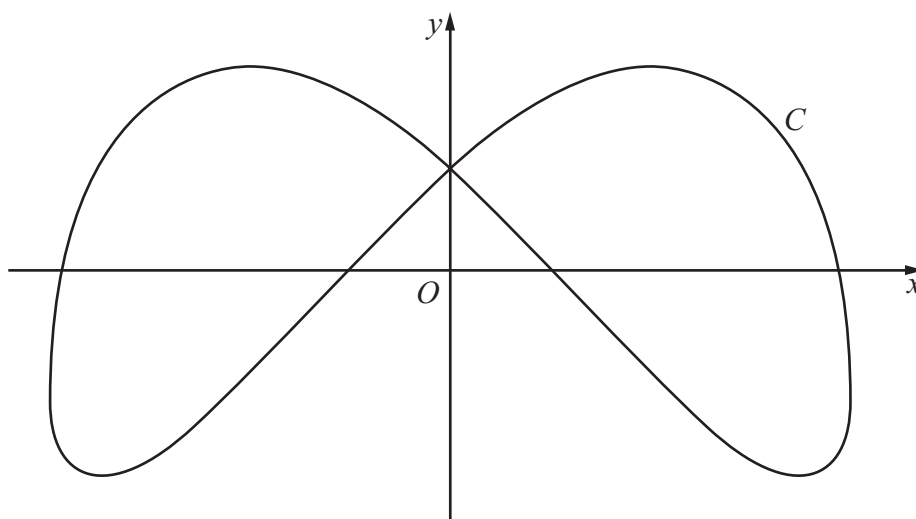
Figure 2

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

$$x = 4\sin\left(t + \frac{\pi}{6}\right), \qquad y = 3\cos 2t, \qquad 0 \leqslant t < 2\pi$$

(a) Find an expression for $\dfrac{dy}{dx}$ in terms of t.

(3)

(b) Find the coordinates of all the points on C where $\dfrac{dy}{dx} = 0$

(5)

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave
blank

Question 5 continued

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave blank

Question 5 continued

P40085A01428

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave blank

Question 5 continued

Q5

(Total 8 marks)

P 4 0 0 8 5 A 0 1 5 2 8

Winter 2012
Past Paper
www.mystudybro.com
This resource was created and owned by Pearson Edexcel
Mathematics C4
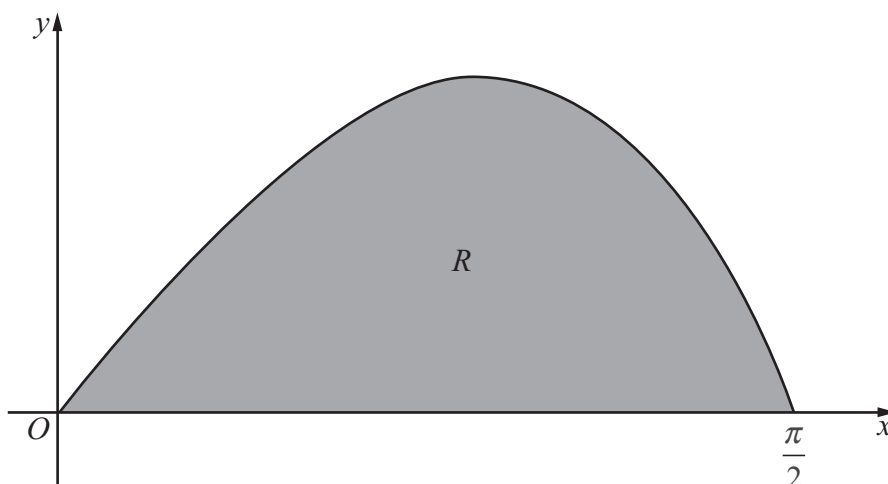6666

Leave
blank

6.

Figure 3

Figure 3 shows a sketch of the curve with equation $y = \dfrac{2\sin 2x}{(1+\cos x)}$, $0 \leqslant x \leqslant \dfrac{\pi}{2}$.

The finite region R, shown shaded in Figure 3, is bounded by the curve and the x-axis.

The table below shows corresponding values of x and y for $y = \dfrac{2\sin 2x}{(1+\cos x)}$.

x	0	$\dfrac{\pi}{8}$	$\dfrac{\pi}{4}$	$\dfrac{3\pi}{8}$	$\dfrac{\pi}{2}$
y	0		1.17157	1.02280	0

(a) Complete the table above giving the missing value of y to 5 decimal places.

(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 4 decimal places.

(3)

(c) Using the substitution $u = 1 + \cos x$, or otherwise, show that

$$\int \frac{2\sin 2x}{(1 + \cos x)}\, dx = 4\ln(1+\cos x) - 4\cos x + k$$

where k is a constant.

(5)

(d) Hence calculate the error of the estimate in part (b), giving your answer to 2 significant figures.

(3)

P 4 0 0 8 5 A 0 1 6 2 8

Winter 2012
Past Paper
www.mystudybro.com
This resource was created and owned by Pearson Edexcel
Mathematics C4
6666

Leave blank

Question 6 continued

P 4 0 0 8 5 A 0 1 7 2 8

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave
blank

Question 6 continued

P 4 0 0 8 5 A 0 1 8 2 8

Winter 2012

Past Paper

www.mystudybro.com

This resource was created and owned by Pearson Edexcel

Mathematics C4

6666

Leave
blank

Question 6 continued

Q6

(Total 12 marks)

Winter 2012
Past Paper
www.mystudybro.com
This resource was created and owned by Pearson Edexcel
Mathematics C4
6666

Leave blank

7. Relative to a fixed origin O, the point A has position vector $(2\mathbf{i} - \mathbf{j} + 5\mathbf{k})$,
the point B has position vector $(5\mathbf{i} + 2\mathbf{j} + 10\mathbf{k})$,
and the point D has position vector $(-\mathbf{i} + \mathbf{j} + 4\mathbf{k})$.

The line l passes through the points A and B.

(a) Find the vector $\overrightarrow{AB}$.

(2)

(b) Find a vector equation for the line l.

(2)

(c) Show that the size of the angle BAD is $109°$, to the nearest degree.

(4)

The points A, B and D, together with a point C, are the vertices of the parallelogram $ABCD$, where $\overrightarrow{AB} = \overrightarrow{DC}$.

(d) Find the position vector of C.

(2)

(e) Find the area of the parallelogram $ABCD$, giving your answer to 3 significant figures.

(3)

(f) Find the shortest distance from the point D to the line l, giving your answer to 3 significant figures.

(2)

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave
blank

Question 7 continued

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave blank

Question 7 continued

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave blank

Question 7 continued

(Total 15 marks)

Q7

P40085A02328

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave blank

8. (a) Express $\dfrac{1}{P(5-P)}$ in partial fractions.

(3)

A team of conservationists is studying the population of meerkats on a nature reserve. The population is modelled by the differential equation

$$\frac{dP}{dt} = \frac{1}{15}P(5 - P), \quad t \geqslant 0$$

where P, in thousands, is the population of meerkats and t is the time measured in years since the study began.

Given that when $t = 0$, $P = 1$,

(b) solve the differential equation, giving your answer in the form,

$$P = \frac{a}{b + c\,e^{-\frac{1}{3}t}}$$

where a, b and c are integers.

(8)

(c) Hence show that the population cannot exceed 5000

(1)

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave
blank

Question 8 continued

Winter 2012
Past Paper
www.mystudybro.com
This resource was created and owned by Pearson Edexcel
Mathematics C4
6666

Leave
blank

Question 8 continued

P 4 0 0 8 5 A 0 2 6 2 8

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave
blank

Question 8 continued

Winter 2012
Past Paper

www.mystudybro.com
This resource was created and owned by Pearson Edexcel

Mathematics C4
6666

Leave
blank

Question 8 continued

Q8

(Total 12 marks)

TOTAL FOR PAPER: 75 MARKS

END