

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

Paper Reference(s)

**6666/01**

# Edexcel GCE

# Core Mathematics C4

## Advanced

Tuesday 22 January 2008 – Afternoon

Time: 1 hour 30 minutes

Examiner's use only

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Team Leader's use only

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### Materials required for examination

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### Mathematical Formulae (Green)

### 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, differentiation and integration, or have retrievable mathematical formulae stored in them.**

### Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature. Check that you have the correct question paper.

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

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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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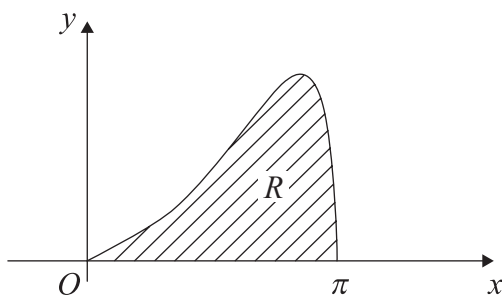
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### Figure 1

(a) Complete the table below with the values of  $y$  corresponding to  $x = \frac{\pi}{4}$  and  $\frac{\pi}{2}$ , giving your answers to 5 decimal places.

$x$	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{3\pi}{4}$	$\pi$
$y$	0			8.87207	0

(2)

- (b) Use the trapezium rule, with all the values in the completed table, to obtain an estimate for the area of the region  $R$ . Give your answer to 4 decimal places.

(4)



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**(Total 6 marks)**

Q1



2. (a) Use the binomial theorem to expand

$$(8-3x)^{\frac{1}{3}}, \quad |x| < \frac{8}{3},$$

in ascending powers of  $x$ , up to and including the term in  $x^3$ , giving each term as a simplified fraction.

(5)

- (b) Use your expansion, with a suitable value of  $x$ , to obtain an approximation to  $\sqrt[3]{(7.7)}$ . Give your answer to 7 decimal places.

(2)

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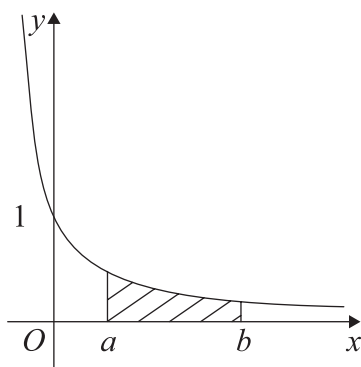
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**(Total 7 marks)**

Q2

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**3.**



### Figure 2

The curve shown in Figure 2 has equation  $y = \frac{1}{(2x+1)}$ . The finite region bounded by the curve, the  $x$ -axis and the lines  $x = a$  and  $x = b$  is shown shaded in Figure 2. This region is rotated through  $360^\circ$  about the  $x$ -axis to generate a solid of revolution.

Find the volume of the solid generated. Express your answer as a single simplified fraction, in terms of  $a$  and  $b$ .

(5)



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**(Total 5 marks)**

Q3



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4. (i) Find  $\int \ln\left(\frac{x}{2}\right) dx$ . (4)

(ii) Find the exact value of  $\int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \sin^2 x \, dx$ . (5)





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**(Total 9 marks)**

Q4

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$$x^3 - 4y^2 = 12xy.$$

- (a) Find the coordinates of the two points on the curve where  $x = -8$ .

(3)

- (b) Find the gradient of the curve at each of these points.

(6)

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**(Total 9 marks)**

Q5



6. The points  $A$  and  $B$  have position vectors  $2\mathbf{i} + 6\mathbf{j} - \mathbf{k}$  and  $3\mathbf{i} + 4\mathbf{j} + \mathbf{k}$  respectively.

The line  $l_1$  passes through the points  $A$  and  $B$ .

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

- (b) Find a vector equation for the line  $l_1$ . (2)

A second line  $l_2$  passes through the origin and is parallel to the vector  $\mathbf{i} + \mathbf{k}$ . The line  $l_1$  meets the line  $l_2$  at the point  $C$ .

- (c) Find the acute angle between  $l_1$  and  $l_2$ . (3)

- (d) Find the position vector of the point  $C$ . (4)



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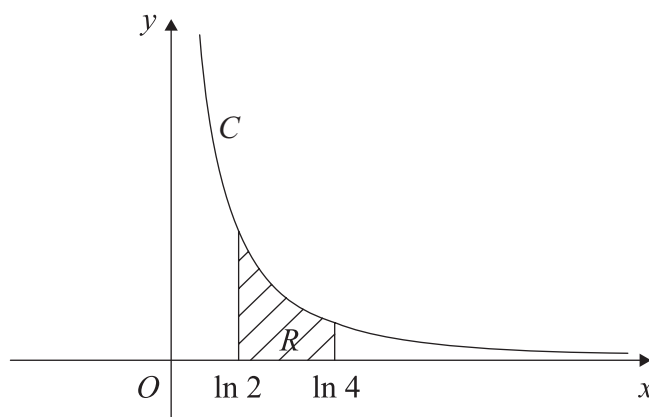
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**(Total 11 marks)**

**Q6**



7.



### Figure 3

The curve  $C$  has parametric equations

$$x = \ln(t + 2), \quad y = \frac{1}{(t + 1)}, \quad t > -1.$$

The finite region  $R$  between the curve  $C$  and the  $x$ -axis, bounded by the lines with equations  $x = \ln 2$  and  $x = \ln 4$ , is shown shaded in Figure 3.

- (a) Show that the area of  $R$  is given by the integral

$$\int_0^2 \frac{1}{(t+1)(t+2)} dt. \quad (4)$$

- (b) Hence find an exact value for this area.

- (c) Find a cartesian equation of the curve  $C$ , in the form  $y = f(x)$ .

- (d) State the domain of values for  $x$  for this curve.







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Question 7 continued

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**(Total 15 marks)**

**Q7**



8. Liquid is pouring into a large vertical circular cylinder at a constant rate of  $1600 \text{ cm}^3 \text{ s}^{-1}$  and is leaking out of a hole in the base, at a rate proportional to the square root of the height of the liquid already in the cylinder. The area of the circular cross section of the cylinder is  $4000 \text{ cm}^2$ .

- $$\frac{dh}{dt} = 0.4 - k\sqrt{h}, \text{ where } k \text{ is a positive constant.} \quad (3)$$

(b) Show that  $k = 0.02$  (1)

- $$\frac{dh}{dt} = 0.4 - 0.02\sqrt{h},$$

$$\int_0^{100} \frac{50}{20 - \sqrt{h}} dh. \quad (2)$$

(d) find the exact value of  $\int_0^{100} \frac{50}{20 - \sqrt{h}} \, dh$ . (6)

- (e) Hence find the time taken to fill the cylinder from empty to a height of 100 cm, giving your answer in minutes and seconds to the nearest second. (1)

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**Q8**

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