Centre No.					Pape	r Refer	ence			Surname	Initial(s)
Candidate No.			6	6	6	6	/	0	1	Signature	

Paper Reference(s)

### 6666/01

## **Edexcel GCE**

# Core Mathematics C4 Advanced Level

Monday 23 January 2006 – Afternoon

Time: 1 hour 30 minutes

Materials required for examination

Items included with question papers

Nil

Mathematical Formulae (Green)

Candidates may use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and/or integration. Thus candidates may NOT use calculators such as the Texas Instruments TI 89, TI 92, Casio CFX 9970G, Hewlett Packard HP 48G.

Inst	truc	tions	to	Cand	lida	ıtes
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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 20 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 must show sufficient working to make your methods clear to the Examiner. Answers without working may gain no credit.

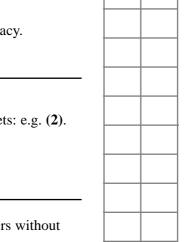
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Examiner's use only

Team Leader's use only

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Turn over

Total



1.	A curve	C is	described	bv	the ec	nnation
1.	A Cui vC		ucscribcu	υy	uic cc	luanon

$$3x^2 + 4y^2 - 2x + 6xy - 5 = 0.$$

Find an equation of the tangent to C at the point (1, -2), giving your answer in the form ax + by + c = 0, where a, b and c are integers.

**(7)** 

2. (a) Given that  $y = \sec x$ , complete the table with the values of y corresponding to  $x = \frac{\pi}{16}, \frac{\pi}{8}$  and  $\frac{\pi}{4}$ .

x	0	$\frac{\pi}{16}$	$\frac{\pi}{8}$	$\frac{3\pi}{16}$	$\frac{\pi}{4}$
y	1			1.20269	

**(2)** 

(b) Use the trapezium rule, with all the values for y in the completed table, to obtain an estimate for  $\int_0^{\frac{\pi}{4}} \sec x \, dx$ . Show all the steps of your working, and give your answer to 4 decimal places.

**(3)** 

The exact value of  $\int_0^{\frac{\pi}{4}} \sec x \, dx$  is  $\ln(1+\sqrt{2})$ .

(c) Calculate the % error in using the estimate you obtained in part (b).

**(2)** 

$\int_1^5 \frac{3x}{\sqrt{(2x-1)}} \mathrm{d}x.$	
	(8)

**(8)** 

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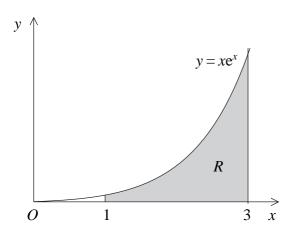


Figure 1

Figure 1 shows the finite shaded region, R, which is bounded by the curve  $y = xe^x$ , the line x = 1, the line x = 3 and the x-axis.

The region *R* is rotated through 360 degrees about the *x*-axis.

Use integration by parts to find an exact value for the **volume** of the solid generated.

5.

$$f(x) = \frac{3x^2 + 16}{(1 - 3x)(2 + x)^2} = \frac{A}{(1 - 3x)} + \frac{B}{(2 + x)} + \frac{C}{(2 + x)^2}, \quad |x| < \frac{1}{3}.$$

(a) Find the values of A and C and show that B = 0.

**(4)** 

(b) Hence, or otherwise, find the series expansion of f(x), in ascending powers of x, up to and including the term in  $x^3$ . Simplify each term.

**(7)** 

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6.	The line <i>l</i>	l <sub>1</sub> has	vector	equation
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$$\mathbf{r} = 8\mathbf{i} + 12\mathbf{j} + 14\mathbf{k} + \lambda(\mathbf{i} + \mathbf{j} - \mathbf{k}),$$

where  $\lambda$  is a parameter.

The point A has coordinates (4, 8, a), where a is a constant. The point B has coordinates (b, 13, 13), where b is a constant. Points A and B lie on the line  $l_1$ .

(a) Find the values of a and b.

**(3)** 

Given that the point O is the origin, and that the point P lies on  $l_1$  such that OP is perpendicular to  $l_1$ ,

(b) find the coordinates of P.

**(5)** 

(c)	Hence find	the	distance	OP,	giving	your	answer	as	a sii	nplified	surd
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**(2)** 

- 7. The volume of a spherical balloon of radius  $r \, \text{cm}$  is  $V \, \text{cm}^3$ , where  $V = \frac{4}{3} \pi r^3$ .
  - (a) Find  $\frac{dV}{dr}$ .

**(1)** 

The volume of the balloon increases with time t seconds according to the formula

$$\frac{\mathrm{d}V}{\mathrm{d}t} = \frac{1000}{(2t+1)^2}, \quad t \geqslant 0.$$

- (b) Using the chain rule, or otherwise, find an expression in terms of r and t for  $\frac{dr}{dt}$ .
- (c) Given that V = 0 when t = 0, solve the differential equation  $\frac{dV}{dt} = \frac{1000}{(2t+1)^2}$ , to obtain V in terms of t.

**(4)** 

- (d) Hence, at time t = 5,
  - (i) find the radius of the balloon, giving your answer to 3 significant figures,

**(3)** 

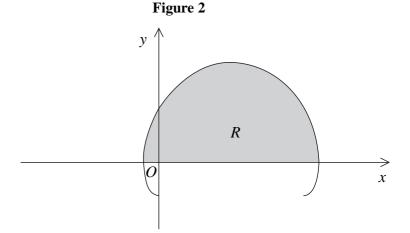
(ii) show that the rate of increase of the radius of the balloon is approximately  $2.90\times 10^{-2}\, cm\, s^{-1}.$ 

**(2)** 

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8.



The curve shown in Figure 2 has parametric equations

$$x = t - 2\sin t$$
,  $y = 1 - 2\cos t$ ,  $0 \leqslant t \leqslant 2\pi$ .

(a) Show that the curve crosses the *x*-axis where  $t = \frac{\pi}{3}$  and  $t = \frac{5\pi}{3}$ .

The finite region R is enclosed by the curve and the x-axis, as shown shaded in Figure 2.

(b) Show that the area of R is given by the integral

$$\int_{\frac{\pi}{3}}^{\frac{5\pi}{3}} (1 - 2\cos t)^2 \mathrm{d}t.$$

**(3)** 

**(2)** 

(c) Use this integral to find the exact value of the shaded area.

**(7)** 

Question 8 continued		blan
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	(Total 12 marks)	
	TOTAL FOR PAPER: 75 MARKS	