

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						<b>6</b>	<b>6</b>	<b>6</b>	<b>5</b>	<b>/</b>	<b>0</b>	<b>1</b>	Signature	

Paper Reference(s)

**6665/01**

# Edexcel GCE

## Core Mathematics C3

### Advanced

Thursday 15 January 2009 – Morning  
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

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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, 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.

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1. (a) Find the value of  $\frac{dy}{dx}$  at the point where  $x = 2$  on the curve with equation

$$y = x^2 \sqrt{5x - 1}.$$

(6)

- (b) Differentiate  $\frac{\sin 2x}{x^2}$  with respect to  $x$ .

(4)

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**(Total 10 marks)**

## Q1



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2.  $f(x) = \frac{2x+2}{x^2-2x-3} - \frac{x+1}{x-3}$

- (a) Express  $f(x)$  as a single fraction in its simplest form.

(4)

- (b) Hence show that  $f'(x) = \frac{2}{(x-3)^2}$

(3)



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**(Total 7 marks)**

Q2

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3.

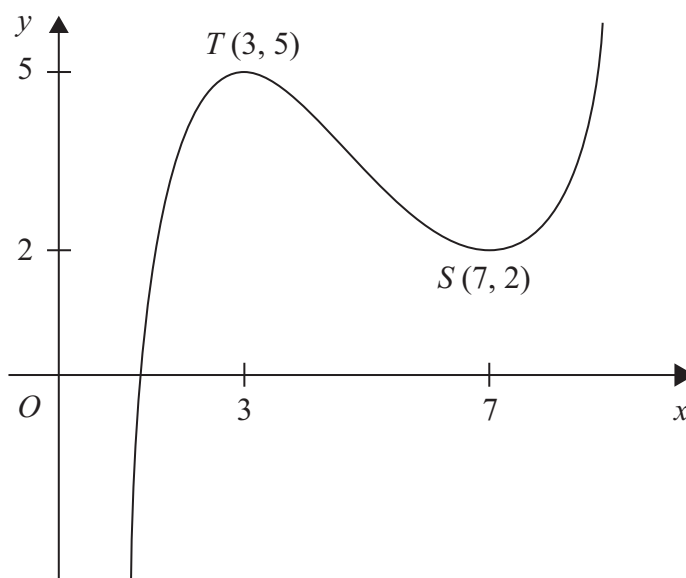
**Figure 1**

Figure 1 shows the graph of  $y = f(x)$ ,  $1 < x < 9$ .

The points  $T(3, 5)$  and  $S(7, 2)$  are turning points on the graph.

Sketch, on separate diagrams, the graphs of

(a)  $y = 2f(x) - 4$ ,

**(3)**

(b)  $y = |f(x)|$ .

**(3)**

Indicate on each diagram the coordinates of any turning points on your sketch.



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Question 3 continued

Q3

(Total 6 marks)



4. Find the equation of the tangent to the curve  $x = \cos(2y + \pi)$  at  $\left(0, \frac{\pi}{4}\right)$ .

(6)

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**(Total 6 marks)**

Q4



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- $$g: x \mapsto e^{x^2}, \quad x \in \mathbb{R}$$

- $$\text{fg} : x \mapsto x^2 + 3e^{x^2}, \quad x \in \mathbb{R} . \quad (2)$$

- (d) Solve the equation  $\frac{d}{dx}[\text{fg}(x)] = x(xe^{x^2} + 2)$ .



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**(Total 10 marks)**

**Q5**



**6.** (a) (i) By writing  $3\theta = (2\theta + \theta)$ , show that

$$\sin 3\theta = 3 \sin \theta - 4 \sin^3 \theta.$$

(4)

(ii) Hence, or otherwise, for  $0 < \theta < \frac{\pi}{3}$ , solve

$$8 \sin^3 \theta - 6 \sin \theta + 1 = 0.$$

Give your answers in terms of  $\pi$ .

(5)

(b) Using  $\sin(\theta - \alpha) = \sin \theta \cos \alpha - \cos \theta \sin \alpha$ , or otherwise, show that

$$\sin 15^\circ = \frac{1}{4}(\sqrt{6} - \sqrt{2}).$$

(4)

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**(Total 13 marks)**

**Q6**



7.

The curve with equation  $y = f(x)$  has a turning point  $P$ .

- (a) Find the exact coordinates of  $P$ .

(5)

The equation  $f(x) = 0$  has a root between  $x = 0.25$  and  $x = 0.3$

- (b) Use the iterative formula

with  $x_0 = 0.25$  to find, to 4 decimal places, the values of  $x_1$ ,  $x_2$  and  $x_3$ .

(3)

- (c) By choosing a suitable interval, show that a root of  $f(x) = 0$  is  $x = 0.2576$  correct to 4 decimal places.

(3)

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**(Total 11 marks)**

**Q7**



8. (a) Express  $3 \cos \theta + 4 \sin \theta$  in the form  $R \cos(\theta - \alpha)$ , where  $R$  and  $\alpha$  are constants,  $R > 0$  and  $0 < \alpha < 90^\circ$ .

(4)

(b) Hence find the maximum value of  $3 \cos \theta + 4 \sin \theta$  and the smallest positive value of  $\theta$  for which this maximum occurs.

(3)

The temperature,  $f(t)$ , of a warehouse is modelled using the equation

$$f(t) = 10 + 3 \cos(15t)^\circ + 4 \sin(15t)^\circ,$$

where  $t$  is the time in hours from midday and  $0 \leq t < 24$ .

(c) Calculate the minimum temperature of the warehouse as given by this model.

(2)

(d) Find the value of  $t$  when this minimum temperature occurs.

(3)

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**Q8**

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