

Paper Reference(s)

**6665**

# **Edexcel GCE**

## **Core Mathematics C3**

### **Advanced Level**

**Thursday 17 January 2008 – Afternoon**

**Time: 1 hour 30 minutes**

**Materials required for examination**

Mathematical Formulae (Green)

**Items included with question papers**

Nil

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.

#### **Instructions to Candidates**

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In the boxes on the answer book, write the name of the examining body (Edexcel), your centre number, candidate number, the unit title (Core Mathematics C3), the paper reference (6665), your surname, other name and signature.

When a calculator is used, the answer should be given to an appropriate degree of accuracy.

#### **Information for Candidates**

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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 on this paper. The total mark for this paper is 75.

#### **Advice to Candidates**

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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.

1. Given that

$$\frac{2x^4 - 3x^2 + x + 1}{(x^2 - 1)} \equiv (ax^2 + bx + c) + \frac{dx + e}{(x^2 - 1)},$$

find the values of the constants  $a, b, c, d$  and  $e$ .

(4)

2. A curve  $C$  has equation

$$y = e^{2x} x \tan x, \quad x \neq (2n+1)\pi/2$$

(a) Show that the turning points on  $C$  occur where  $\tan x = -1$ .

(6)

(b) Find an equation of the tangent to  $C$  at the point where  $x = 0$ .

(2)

3.  $f(x) = \ln(x+2) - x + 1, x > -2, x \in \mathbb{R}$ .

(a) Show that there is a root of  $f(x) = 0$  in the interval  $2 < x < 3$ .

(2)

(b) Use the iterative formula  $x_{n+1} = \ln(x_n + 2) + 1, x_0 = 2.5$   
to calculate the values of  $x_1, x_2$  and  $x_3$  giving your answers to 5 decimal places.

(3)

(c) Show that  $x = 2.505$  is a root of  $f(x) = 0$  correct to 3 decimal places.

(2)

4.

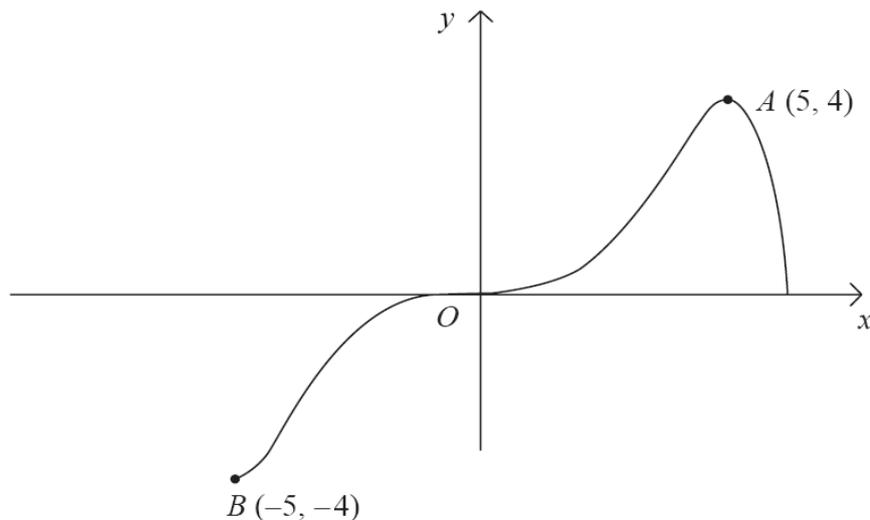


Figure 1

Figure 1 shows a sketch of the curve with equation  $y = f(x)$ .

The curve passes through the origin  $O$  and the points  $A(5, 4)$  and  $B(-5, -4)$ .

In separate diagrams, sketch the graph with equation

(a)  $y = |f(x)|$ ,

(3)

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

(3)

(c)  $y = 2f(x+1)$ .

(4)

On each sketch, show the coordinates of the points corresponding to  $A$  and  $B$ .



5. The radioactive decay of a substance is given by

$$R = 1000e^{-ct}, t \geq 0.$$

where  $R$  is the number of atoms at time  $t$  years and  $c$  is a positive constant.

- (a) Find the number of atoms when the substance started to decay.

(1)

It takes 5730 years for half of the substance to decay.

- (b) Find the value of  $c$  to 3 significant figures.

(4)

- (c) Calculate the number of atoms that will be left when  $t = 22\,920$ .

(2)

- (d) In the space provided on page 13, sketch the graph of  $R$  against  $t$ .

(2)

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6. (a) Use the double angle formulae and the identity

$$\cos(A+B) \equiv \cos A \cos B - \sin A \sin B$$

to obtain an expression for  $\cos 3x$  in terms of powers of  $\cos x$  only.

(4)

- (b) (i) Prove that

$$\frac{\cos x}{1 + \sin x} + \frac{1 + \sin x}{\cos x} \equiv 2 \sec x, \quad x \neq (2n+1)\frac{\pi}{2}.$$

(4)

- (ii) Hence find, for  $0 < x < 2\pi$ , all the solutions of

$$\frac{\cos x}{1 + \sin x} + \frac{1 + \sin x}{\cos x} = 4.$$

(3)

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7. A curve  $C$  has equation

$$y = 3\sin 2x + 4\cos 2x, \quad -\pi \leq x \leq \pi.$$

The point  $A(0, 4)$  lies on  $C$ .

- (a) Find an equation of the normal to the curve  $C$  at  $A$ .

(5)

- (b) Express  $y$  in the form  $R\sin(2x+\alpha)$ , where  $R > 0$  and  $0 < \alpha < \frac{\pi}{2}$ .

Give the value of  $\alpha$  to 3 significant figures.

(4)

- (c) Find the coordinates of the points of intersection of the curve  $C$  with the  $x$ -axis.

Give your answers to 2 decimal places.

(4)

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8. The functions  $f$  and  $g$  are defined by

$$f : x \mapsto 1 - 2x^3, \quad x \in \mathbb{R}$$

$$g : x \mapsto \frac{3}{x} - 4, \quad x > 0, \quad x \in \mathbb{R}$$

- (a) Find the inverse function  $f^{-1}$ .

(2)

- (b) Show that the composite function  $gf$  is

$$gf : x \mapsto \frac{8x^3 - 1}{1 - 2x^3}.$$

(4)

- (c) Solve  $gf(x) = 0$ .

(2)

- (d) Use calculus to find the coordinates of the stationary point on the graph of  $y = gf(x)$ .

(5)

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**TOTAL FOR PAPER: 75 MARKS**

**END**