

Paper Reference(s)

**6665/01**

**Edexcel GCE  
Core Mathematics C3  
Advanced Level**

**Thursday 14 June 2007 – Afternoon  
Time: 1 hour 30 minutes**

**Materials required for examination**

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 formulas stored in them.**

**Instructions to Candidates**

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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, initials and signature.

**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.  
There are 8 questions in this question 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. Find the exact solutions to the equations

(a)  $\ln x + \ln 3 = \ln 6$ , (2)

(b)  $e^x + 3e^{-x} = 4$ . (4)

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2. 
$$f(x) = \frac{2x+3}{x+2} - \frac{9+2x}{2x^2+3x-2}, \quad x > \frac{1}{2}.$$

(a) Show that  $f(x) = \frac{4x-6}{2x-1}$ . (7)

(b) Hence, or otherwise, find  $f'(x)$  in its simplest form. (3)

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3. A curve  $C$  has equation  $y = x^2e^x$ .

(a) Find  $\frac{dy}{dx}$ , using the product rule for differentiation. (3)

(b) Hence find the coordinates of the turning points of  $C$ . (3)

(c) Find  $\frac{d^2y}{dx^2}$ . (2)

(d) Determine the nature of each turning point of the curve  $C$ . (2)

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4.  $f(x) = -x^3 + 3x^2 - 1.$

(a) Show that the equation  $f(x) = 0$  can be rewritten as

$$x = \sqrt{\left(\frac{1}{3-x}\right)}.$$

**(2)**

(b) Starting with  $x_1 = 0.6$ , use the iteration

$$x_{n+1} = \sqrt{\left(\frac{1}{3-x_n}\right)}$$

**(2)**

to calculate the values of  $x_2, x_3$  and  $x_4$ , giving all your answers to 4 decimal places.

(c) Show that  $x = 0.653$  is a root of  $f(x) = 0$  correct to 3 decimal places.

**(3)**

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

$$f: \mapsto \ln(2x - 1), \quad x \in \mathbb{R}, \quad x > \frac{1}{2},$$

$$g: \mapsto \frac{2}{x-3}, \quad x \in \mathbb{R}, \quad x \neq 3.$$

(a) Find the exact value of  $fg(4)$ .

**(2)**

(b) Find the inverse function  $f^{-1}(x)$ , stating its domain.

**(4)**

(c) Sketch the graph of  $y = |g(x)|$ . Indicate clearly the equation of the vertical asymptote and the coordinates of the point at which the graph crosses the  $y$ -axis.

**(3)**

(d) Find the exact values of  $x$  for which  $\left|\frac{2}{x-3}\right| = 3$ .

**(3)**

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6. (a) Express  $3 \sin x + 2 \cos x$  in the form  $R \sin(x + \alpha)$  where  $R > 0$  and  $0 < \alpha < \frac{\pi}{2}$ . (4)

(b) Hence find the greatest value of  $(3 \sin x + 2 \cos x)^4$ . (2)

(c) Solve, for  $0 < x < 2\pi$ , the equation

$$3 \sin x + 2 \cos x = 1,$$

giving your answers to 3 decimal places. (5)

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7. (a) Prove that

$$\frac{\sin \theta}{\cos \theta} + \frac{\cos \theta}{\sin \theta} = 2 \operatorname{cosec} 2\theta, \quad \theta \neq 90n^\circ. \quad (4)$$

(b) Sketch the graph of  $y = 2 \operatorname{cosec} 2\theta$  for  $0^\circ < \theta < 360^\circ$ . (2)

(c) Solve, for  $0^\circ < \theta < 360^\circ$ , the equation

$$\frac{\sin \theta}{\cos \theta} + \frac{\cos \theta}{\sin \theta} = 3$$

giving your answers to 1 decimal place. (6)

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8. The amount of a certain type of drug in the bloodstream  $t$  hours after it has been taken is given by the formula

$$x = De^{\frac{1}{8}t},$$

where  $x$  is the amount of the drug in the bloodstream in milligrams and  $D$  is the dose given in milligrams.

A dose of 10 mg of the drug is given.

- (a) Find the amount of the drug in the bloodstream 5 hours after the dose is given.  
Give your answer in mg to 3 decimal places.

(2)

A second dose of 10 mg is given after 5 hours.

- (b) Show that the amount of the drug in the bloodstream 1 hour after the second dose is 13.549 mg to 3 decimal places.

(2)

No more doses of the drug are given. At time  $T$  hours after the second dose is given, the amount of the drug in the bloodstream is 3 mg.

- (c) Find the value of  $T$ .

(3)

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**TOTAL FOR PAPER: 75 MARKS**

**END**