

Paper Reference(s)

**6665/01**

**Edexcel GCE**

**Core Mathematics C3**

**Advanced Subsidiary**

**Thursday 15 January 2009 – Morning**

**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 or integration, or have retrievable mathematical formulae 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.

The marks for 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.

**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 not gain full credit.

**H31123A**

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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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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.

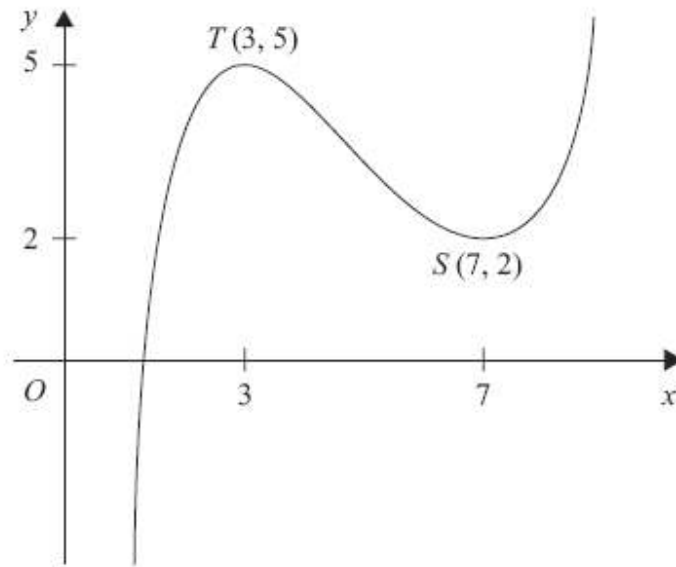
(4)

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

(3)

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

Give your answer in the form  $y = ax + b$ , where  $a$  and  $b$  are constants to be found.

**(6)**

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

$$f : x \mapsto 3x + \ln x, \quad x > 0, \quad x \in \mathbb{R},$$

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

(a) Write down the range of  $g$ . (1)

(b) Show that the composite function  $fg$  is defined by

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

(c) Write down the range of  $fg$ . (1)

(d) Solve the equation  $\frac{d}{dx}[fg(x)] = x(xe^{x^2} + 2)$ . (6)

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

$$\sin 3\theta = 3 \sin \theta - 4 \sin^3 \theta. \quad (4)$$

(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

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

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7.  $f(x) = 3xe^x - 1.$

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

$$x_{n+1} = \frac{1}{3}e^{-x_n}.$$

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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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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**TOTAL FOR PAPER: 75 MARKS**

**END**