

Paper Reference(s)

**6672**

**Edexcel GCE  
Pure Mathematics P2  
Advanced/Advanced Subsidiary**

**Tuesday 11 June 2002 – Afternoon  
Time: 1 hour 30 minutes**

**Materials required for examination**

Answer Book (AB16)  
Mathematical Formulae (Lilac)  
Graph Paper (ASG2)

**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**

In the boxes on the answer book, write the name of the examining body (Edexcel), your centre number, candidate number, the unit title (Pure Mathematics P2), the paper reference (6672), 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**

A booklet 'Mathematical Formulae and Statistical Tables' is provided.

Full marks may be obtained for answers to ALL questions.

This paper has eight questions. Pages 7 and 8 are blank.

**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.

1. (a) Write down the first four terms of the binomial expansion, in ascending powers of  $x$ , of  $(1 + 3x)^n$ , where  $n > 2$ . (2)

Given that the coefficient of  $x^3$  in this expansion is ten times the coefficient of  $x^2$ ,

- (b) find the value of  $n$ , (2)

- (c) find the coefficient of  $x^4$  in the expansion. (2)
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2. Express  $\frac{3}{x^2 + 2x} + \frac{x - 4}{x^2 - 4}$  as a single fraction in its simplest form. (7)
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3. The speed,  $v \text{ m s}^{-1}$ , of a lorry at time  $t$  seconds is modelled by

$$v = 5(e^{0.1t} - 1) \sin(0.1t), \quad 0 \leq t \leq 30.$$

- (a) Copy and complete the following table, showing the speed of the lorry at 5 second intervals. Use radian measure for  $0.1t$  and give your values of  $v$  to 2 decimal places where appropriate.

$t$	0	5	10	15	20	25
$v$		1.56	7.23	17.36		

(3)

- (b) Verify that, according to this model, the lorry is moving more slowly at  $t = 25$  than at  $t = 24.5$ . (1)

The distance,  $s$  metres, travelled by the lorry during the first 25 seconds is given by

$$s = \int_0^{25} v \, dt.$$

- (c) Estimate  $s$  by using the trapezium rule with all the values from your table. (4)
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4. (a) Write down formulae for  $\sin(A + B)$  and  $\sin(A - B)$ .

Using  $X = A + B$  and  $Y = A - B$ , prove that

$$\sin X + \sin Y = 2 \sin \frac{X + Y}{2} \cos \frac{X - Y}{2} .$$

**(4)**

- (b) Hence, or otherwise, solve, for  $0 \leq \theta < 360$ ,

$$\sin 4\theta^\circ + \sin 2\theta^\circ = 0.$$

**(5)**

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5. (a) Given that  $3 + 2 \log_2 x = \log_2 y$ , show that  $y = 8x^2$ . **(3)**

- (b) Hence, or otherwise, find the roots  $\alpha$  and  $\beta$ , where  $\alpha < \beta$ , of the equation

$$3 + 2 \log_2 x = \log_2 (14x - 3).$$

**(3)**

- (c) Show that  $\log_2 \alpha = -2$ . **(1)**

- (d) Calculate  $\log_2 \beta$ , giving your answer to 3 significant figures. **(3)**
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6.

Figure 1

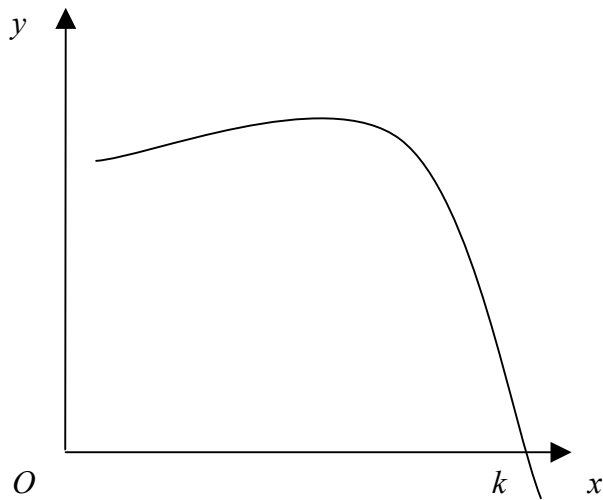


Figure 1 shows a sketch of the curve with equation  $y = f(x)$ , where

$$f(x) = 10 + \ln(3x) - \frac{1}{2}e^x, \quad 0.1 \leq x \leq 3.3.$$

Given that  $f(k) = 0$ ,

(a) show, by calculation, that  $3.1 < k < 3.2$ .

(2)

(b) Find  $f'(x)$ .

(3)

The tangent to the graph at  $x = 1$  intersects the  $y$ -axis at the point  $P$ .

(c) (i) Find an equation of this tangent.

(ii) Find the exact  $y$ -coordinate of  $P$ , giving your answer in the form  $a + \ln b$ .

(5)

7.

Figure 2

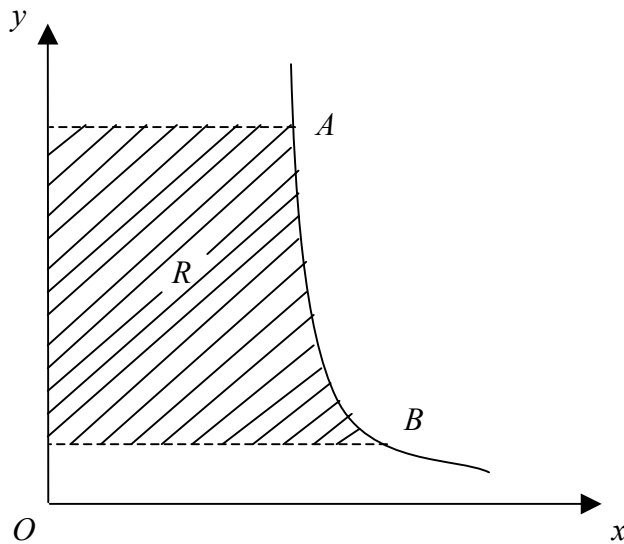


Figure 2 shows a sketch of the curve  $C$  with equation  $y = \frac{4}{x-3}$ ,  $x \neq 3$ .

The points  $A$  and  $B$  on the curve have  $x$ -coordinates 3.25 and 5 respectively.

(a) Write down the  $y$ -coordinates of  $A$  and  $B$ . (1)

(b) Show that an equation of  $C$  is  $\frac{3y+4}{y}$ ,  $y \neq 0$ . (1)

The shaded region  $R$  is bounded by  $C$ , the  $y$ -axis and the lines through  $A$  and  $B$  parallel to the  $x$ -axis. The region  $R$  is rotated through  $360^\circ$  about the  $y$ -axis to form a solid shape  $S$ .

(c) Find the volume of  $S$ , giving your answer in the form  $\pi(a + b \ln c)$ , where  $a$ ,  $b$  and  $c$  are integers. (7)

The solid shape  $S$  is used to model a cooling tower. Given that 1 unit on each axis represents 3 metres,

(d) show that the volume of the tower is approximately  $15\,500 \text{ m}^3$ . (2)

8.  $f(x) = x^2 - 2x - 3, x \in \mathbb{R}, x \geq 1.$

(a) Find the range of  $f$ . (1)

(b) Write down the domain and range of  $f^{-1}$ . (2)

(c) Sketch the graph of  $f^{-1}$ , indicating clearly the coordinates of any point at which the graph intersects the coordinate axes. (4)

Given that  $g(x) = |x - 4|, x \in \mathbb{R},$

(d) find an expression for  $gf(x)$ . (2)

(e) Solve  $gf(x) = 8$ . (5)

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END