Paper Reference(s)

6665

Edexcel GCE

Core Mathematics C3

Advanced Level

Thursday 11 June 2009 – Morning

Time: 1 hour 30 minutes

Materials required for examination	Items included with question papers
Mathematical Formulae (Green)	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 (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

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

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.

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1.

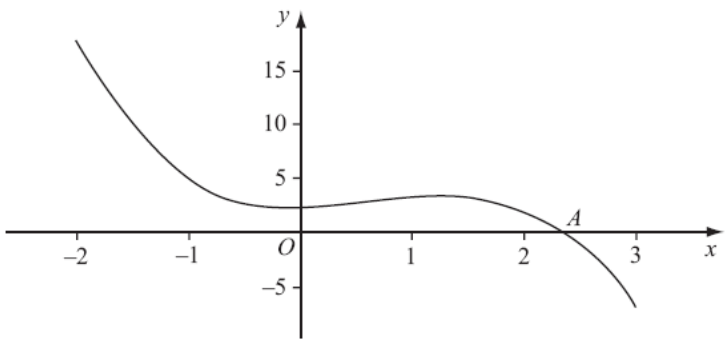

Figure 1

Figure 1 shows part of the curve with equation $y = -x^3 + 2x^2 + 2$, which intersects the x-axis at the point A where $x = \alpha$.
To find an approximation to α, the iterative formula

$$x_{n+1} = \frac{2}{(x_n)^2} + 2$$

is used.

(a) Taking $x_0 = 2.5$, find the values of x_1, x_2, x_3 and x_4.
Give your answers to 3 decimal places where appropriate.

(3)

(b) Show that $\alpha = 2.359$ correct to 3 decimal places.

(3)

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2. (a) Use the identity $\cos^2\theta + \sin^2\theta = 1$ to prove that $\tan^2\theta = \sec^2\theta - 1$.

(2)

(b) Solve, for $0 \leq \theta < 360°$, the equation

$$2\tan^2\theta + 4\sec\theta + \sec^2\theta = 2$$

(6)

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3. Rabbits were introduced onto an island. The number of rabbits, P, t years after they were introduced is modelled by the equation

$$P = 80e^{\frac{1}{5}t}, t \in \Re, t \geq 0$$

(a) Write down the number of rabbits that were introduced to the island.

(1)

(b) Find the number of years it would take for the number of rabbits to first exceed 1000.

(2)

(c) Find $\frac{dP}{dt}$

(2)

(d) Find P when $\frac{dP}{dt} = 50$

(3)

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4. (i) Differentiate with respect to x

(a) $x^2\cos 3x$

(3)

(b) $\dfrac{\ln(x^2+1)}{x^2+1}$

(4)

(ii) A curve C has the equation $y=\sqrt{(4x+1)}$, $x > -0.25$, $y > 0$
The point P on the curve has x-coordinate 2. Find an equation of the tangent to C at P in the form $ax+by+c=0$, where a, b and c are integers.

(6)

5.

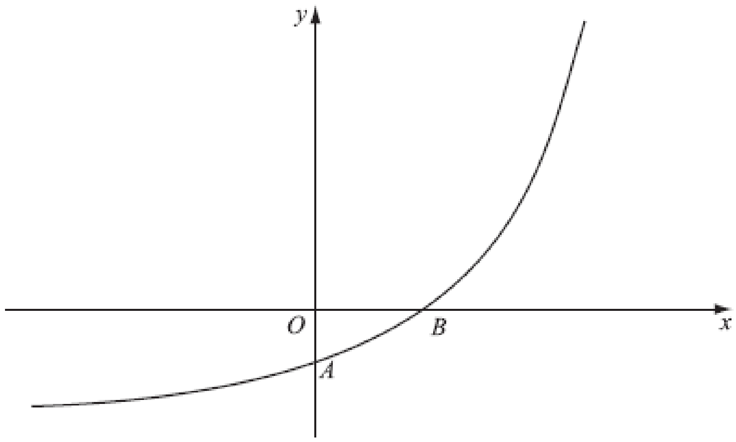

Figure 2

Figure 2 shows a sketch of part of the curve with equation $y = f(x)$
The curve meets the coordinate axes at the points $A(0,1-k)$ and $B(-\frac{1}{2}\ln k, 0)$, where k is a constant and $k > 1$, as shown in Figure 2.
On separate diagrams, sketch the curve with equation

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

(3)

(b) $y = f^{-1}(x)$.

(2)

Show on each sketch the coordinates, in terms of k, of each point at which the curve meets or cuts the axes.
Given that $f(x) = e^{2x} - k$,

(c) state the range of f,

(1)

(d) find $f^{-1}(x)$,

(3)

(e) write down the domain of f^{-1}.

(1)

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6. (a) Use the identity $\cos(A+B)=\cos A\cos B-\sin A\sin B$, to show that

$$\cos 2A = 1 - 2\sin^2 A$$

(2)

The curves C_1 and C_2 have equations

$$C_1 : y = 3\sin 2x$$
$$C_2 : y = 4\sin^2 x - 2\cos 2x$$

(b) Show that the x-coordinates of the points where C_1 and C_2 intersect satisfy the equation

$$4\cos 2x + 3\sin 2x = 2$$

(3)

(c) Express $4\cos 2x + 3\sin 2x$ in the form $R\cos(2x - \alpha)$, where $R > 0$ and $0 < \alpha < 90°$, giving the value of α to 2 decimal places.

(3)

(d) Hence find, for $0 \leq x < 180°$, all the solutions of

$$4\cos 2x + 3\sin 2x = 2$$

giving your answers to 1 decimal place.

(4)

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7. The function f is defined by $f(x) = 1 - \dfrac{2}{(x+4)} + \dfrac{x-8}{(x-2)(x+4)}, x \in \Re, x \neq -4, x \neq 2$

(a) show that $f(x) = \dfrac{x-3}{x-2}$

(5)

The function g is defined by

$$g(x) = \frac{e^x - 3}{e^x - 2}, x \in \Re, x \neq \ln 2$$

(b) Differentiate g(x) to show that $g'(x) = \dfrac{e^x}{(e^x - 2)^2}$

(3)

(c) Find the exact values of x for which $g'(x) = 1$

(4)

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8. (a) Write down $\sin 2x$ in terms of $\sin x$ and $\cos x$.

(1)

(b) Find, for $0 < x < \pi$, all the solutions of the equation

$$\operatorname{cosec} x - 8\cos x = 0$$

giving your answers to 2 decimal places.

(5)

TOTAL FOR PAPER: 75 MARKS

END