Paper Reference(s)

6665/01

Edexcel GCE

Core Mathematics C3

Advanced Level

Wednesday 20 January 2010 – Afternoon

Time: 1 hour 30 minutes

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

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

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 9 questions in this question 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 not gain full credit.

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1. Express

$$\frac{x+1}{3x^2-3} - \frac{1}{3x+1}$$

as a single fraction in its simplest form.

(4)

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2. $$\mathrm{f}(x) = x^3 + 2x^2 - 3x - 11$$

(*a*) Show that $\mathrm{f}(x) = 0$ can be rearranged as

(2)

$$x = \sqrt{\left(\frac{3x+11}{x+2}\right)}, \quad x \neq -2.$$

The equation $\mathrm{f}(x) = 0$ has one positive root α.

The iterative formula $x_n = \sqrt{\left(\frac{3x_n+11}{x_n+2}\right)}$ is used to find an approximation to α.

(*b*) Taking $x_1 = 0$, find, to 3 decimal places, the values of x_2, x_3 and x_4.

(3)

(*c*) Show that $\alpha = 2.057$ correct to 3 decimal places.

(3)

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3. (*a*) Express $5\cos x - 3\sin x$ in the form $R\cos(x + \alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$.

(4)

(*b*) Hence, or otherwise, solve the equation

$$5\cos x - 3\sin x = 4$$

for $0 \leq x < 2\pi$, giving your answers to 2 decimal places.

(5)

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4. (i) Given that $y = \frac{\ln(x^2+1)}{x}$, find $\frac{\mathrm{d}y}{\mathrm{d}x}$.

(4)

(ii) Given that $x = \tan y$, show that $\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{1}{1+x^2}$.

(5)

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5. Sketch the graph of $y = \ln |x|$, stating the coordinates of any points of intersection with the axes.

(3)

6.

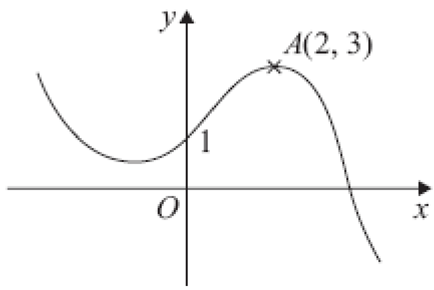

Figure 1

Figure 1 shows a sketch of the graph of $y = \mathrm{f}(x)$.

The graph intersects the y-axis at the point (0, 1) and the point $A(2, 3)$ is the maximum turning point.

Sketch, on separate axes, the graphs of

(i) $y = \mathrm{f}(-x) + 1$,

(ii) $y = \mathrm{f}(x + 2) + 3$,

(iii) $y = 2\mathrm{f}(2x)$.

On each sketch, show the coordinates of the point at which your graph intersects the y-axis and the coordinates of the point to which A is transformed.

(9)

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7. (*a*) By writing $\sec x$ as $\dfrac{1}{\cos x}$, show that $\dfrac{\mathrm{d}(\sec x)}{\mathrm{d}x} = \sec x \tan x$.

(3)

Given that $y = \mathrm{e}^{2x} \sec 3x$,

(*b*) find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$.

(4)

The curve with equation $y = \mathrm{e}^{2x} \sec 3x$, $-\dfrac{\pi}{6} < x < \dfrac{\pi}{6}$, has a minimum turning point at (a, b).

(*c*) Find the values of the constants *a* and *b*, giving your answers to 3 significant figures.

(4)

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8. Solve

$$\operatorname{cosec}^2 2x - \cot 2x = 1$$

for $0 \leq x \leq 180°$.

(7)

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9. (i) Find the exact solutions to the equations

(*a*) $\ln(3x - 7) = 5$,

(3)

(*b*) $3^x \mathrm{e}^{7x+2} = 15$.

(5)

(ii) The functions f and g are defined by

$$\mathrm{f}(x) = \mathrm{e}^{2x} + 3, \qquad x \in \mathbb{R},$$

$$\mathrm{g}(x) = \ln(x - 1), \qquad x \in \mathbb{R}, \quad x > 1.$$

(*a*) Find f^{-1} and state its domain.

(4)

(*b*) Find fg and state its range.

(3)

TOTAL FOR PAPER: 75 MARKS

END