Paper Reference (complete below)								
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Centre No.					
Candidate No.					

Surname	Initial(s)
Signature	

Paper Reference(s)

6663

Edexcel GCE

Core Mathematics C3

Advanced Subsidiary

Set A: Practice Paper 5

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

Materials required for examination
Mathematical Formulae

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature. You must write your answer for each question in the space following the question. If you need more space to complete your answer to any question, use additional answer sheets.

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 nine questions.

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.

Turn over

1. Use the derivatives of $\sin x$ and $\cos x$ to prove that the derivative of $\tan x$ is $\sec^2 x$. **(4)**

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2. The function f is given by $f : x \mapsto 2 + \dfrac{3}{x+2}$, $x \in \mathbb{R}$, $x \neq -2$.

(*a*) Express $2 + \dfrac{3}{x+2}$ as a single fraction. **(1)**

(*b*) Find an expression for $f^{-1}(x)$. **(3)**

(*c*) Write down the domain of f^{-1}. **(1)**

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3. (*a*) Express as a fraction in its simplest form

$$\frac{2}{x-3} + \frac{13}{x^2 + 4x - 21}.$$

(3)

(*b*) Hence solve

$$\frac{2}{x-3} + \frac{13}{x^2 + 4x - 21} = 1.$$

(3)

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4. (*a*) Simplify $\dfrac{x^2 + 4x + 3}{x^2 + x}$.

(2)

(*b*) Find the value of x for which $\log_2 (x^2 + 4x + 3) - \log_2 (x^2 + x) = 4$.

(4)

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5. (i) Prove, by counter-example, that the statement

"$\sec(A + B) \equiv \sec A + \sec B$, for all A and B"

is false

(2)

(ii) Prove that

$$\tan\theta + \cot\theta \equiv 2\,\mathrm{cosec}\,2\theta, \quad \theta \neq \frac{n\pi}{2}, n \in \mathbb{Z}.$$

(5)

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6. (*a*) Prove that

$$\frac{1 - \cos 2\theta}{\sin 2\theta} \equiv \tan\theta, \qquad \theta \neq \frac{n\pi}{2}, \quad n \in \mathbb{Z}.$$

(3)

(*b*) Solve, giving exact answers in terms of π,

$$2(1 - \cos 2\theta) = \tan\theta, \qquad 0 < \theta < \pi.$$

(6)

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7. Given that $y = \log_a x$, $x > 0$, where a is a positive constant,

(*a*) (i) express x in terms of a and y,

(1)

(ii) deduce that $\ln x = y \ln a$.

(1)

(*b*) Show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{1}{x \ln a}$.

(2)

The curve C has equation $y = \log_{10} x$, $x > 0$. The point A on C has x-coordinate 10. Using the result in part (*b*),

(*c*) find an equation for the tangent to C at A.

(4)

The tangent to C at A crosses the x-axis at the point B.

(*d*) Find the exact x-coordinate of B.

(2)

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8. The curve with equation $y = \ln 3x$ crosses the x-axis at the point $P\ (p, 0)$.

(*a*) Sketch the graph of $y = \ln 3x$, showing the exact value of p.

(2)

The normal to the curve at the point Q, with x-coordinate q, passes through the origin.

(*b*) Show that $x = q$ is a solution of the equation $x^2 + \ln 3x = 0$.

(4)

(*c*) Show that the equation in part (*b*) can be rearranged in the form $x = \frac{1}{3}e^{-x^2}$.

(2)

(*d*) Use the iteration formula $x_{n+1} = \frac{1}{3}e^{-x_n^2}$, with $x_0 = \frac{1}{3}$, to find x_1, x_2, x_3 and x_4. Hence write down, to 3 decimal places, an approximation for q.

(3)

9. **Figure 3**

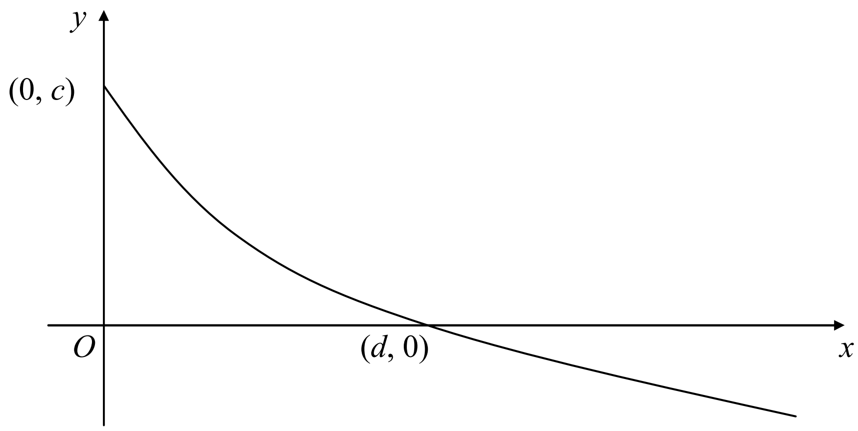

Figure 3 shows a sketch of the curve with equation $y = \mathrm{f}(x)$, $x \geq 0$. The curve meets the coordinate axes at the points $(0, c)$ and $(d, 0)$.

In separate diagrams sketch the curve with equation

(*a*) $y = \mathrm{f}^{-1}(x)$,

(2)

(*b*) $y = 3\mathrm{f}(2x)$.

(3)

Indicate clearly on each sketch the coordinates, in terms of *c* or *d*, of any point where the curve meets the coordinate axes.

Given that f is defined by

$$\mathrm{f} : x \mapsto 3(2^{-x}) - 1,\ x \in \mathbb{R},\ x \geq 0,$$

(*c*) state

(i) the value of *c*,

(ii) the range of f.

(3)

(*d*) Find the value of *d*, giving your answer to 3 decimal places.

(3)

The function g is defined by

$$\mathrm{g} : x \mapsto \log_2 x,\ x \in \mathbb{R},\ x \geq 1.$$

(*e*) Find $\mathrm{fg}(x)$, giving your answer in its simplest form.

(3)

END