Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	7	5	/	0	1	Signature	

Paper Reference(s)

6675/01

Edexcel GCE

Further Pure Mathematics FP2

Advanced/Advanced Subsidiary

Wednesday 3 February 2010 – Morning

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	
Total	

Materials required for examination	Items included with question papers
Mathematical Formulae (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 and integration, or have retrievable mathematical formulae stored in them.

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions.
You must write your answer to each question in the space following the question.
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 in this question paper. The total mark for this paper is 75.
There are 28 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You should show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.

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Turn over

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1. The hyperbola H has equation

$$x^2 - 4y^2 = 4a^2, \quad a > 0$$

(a) Find the eccentricity of H.

(3)

Given that $x = 10$ is an equation of a directrix of H,

(b) find the value of a.

(2)

N 3 6 2 4 6 A 0 2 2 8

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Question 1 continued

(Total 5 marks)

Q1

Leave blank

2. A curve C has intrinsic equation $s = \mathrm{f}(\psi)$. The radius of curvature at any point P on C is $\tan\psi$, where ψ is the angle between the tangent to C at P and the positive x-axis and $0 \leqslant \psi < \frac{\pi}{2}$.

Taking $s = 0$ at $\psi = \frac{\pi}{4}$, find $\mathrm{f}(\psi)$.

(5)

N 3 6 2 4 6 A 0 4 2 8

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Question 2 continued

(Total 5 marks)

Q2

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3. (a) Starting from definitions of $\cosh x$ and $\sinh x$ in terms of exponentials, prove that

$$\sinh 2x = 2\sinh x \cosh x$$

(2)

(b) Hence find the exact values of x for which

$$\sinh 2x = 6\sinh^2 x + 7\sinh x$$

(7)

Leave blank

Question 3 continued

Q3

(Total 9 marks)

Leave blank

4. $$I_n = \int (\ln x)^n \, dx, \quad n \geqslant 0$$

(a) Show that

$$I_n = x(\ln x)^n - nI_{n-1}, \quad n \geqslant 1$$

(4)

(b) Hence find the exact value of $\int_1^e (\ln x)^3 \, dx$.

(6)

N 3 6 2 4 6 A 0 8 2 8

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Question 4 continued

Question 4 continued

Leave blank

Question 4 continued

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(Total 10 marks)

Q4

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5.

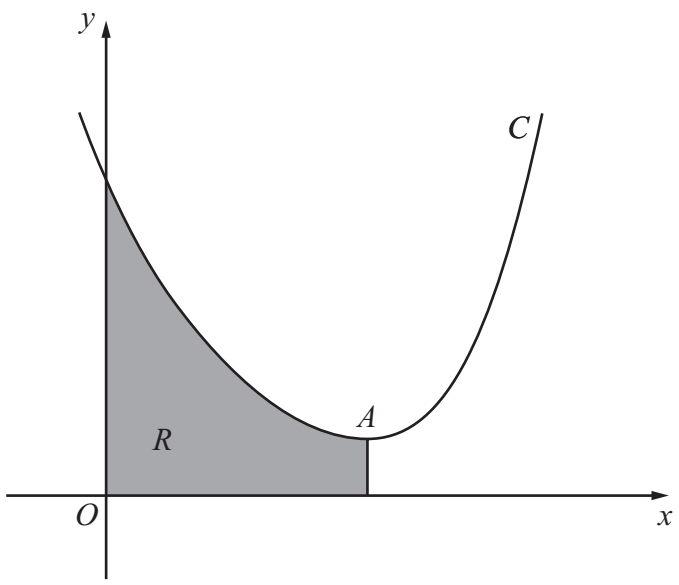

Figure 1

The curve C, with equation $y = \cosh 3x - 4x$, has a minimum point A, as shown in Figure 1.

(a) Use calculus to find the x-coordinate of A. Give your answer in terms of a natural logarithm.

(5)

The region R, shown shaded in Figure 1, is bounded by C, the x-axis, the y-axis and the line through A parallel to the y-axis.

(b) Show that the area of R is $\frac{2}{9}\left[2-(\ln 3)^2\right]$.

(6)

N 3 6 2 4 6 A 0 1 2 2 8

Question 5 continued

Leave blank

Question 5 continued

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N 3 6 2 4 6 A 0 1 4 2 8

Question 5 continued

Leave blank

(Total 11 marks)

Q5

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6. (a) Using the substitution $x = \frac{a}{u}$, or otherwise, find

$$\int \frac{1}{x\sqrt{(a^2 - x^2)}}\,\mathrm{d}x$$

(6)

(b) Hence find

$$\int_3^4 \frac{1}{x\sqrt{(25 - x^2)}}\,\mathrm{d}x$$

giving your answer in the form $a \ln b$, where a and b are rational numbers.

(5)

Question 6 continued

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Question 6 continued

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N 3 6 2 4 6 A 0 1 8 2 8

Question 6 continued

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(Total 11 marks)

Q6

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7. Given that $y = \sin(k \arcsin 2x)$, where k is a constant, show that

(a) $(1-4x^2)\left(\frac{dy}{dx}\right)^2 = 4k^2(1-y^2)$

(5)

(b) $(1-4x^2)\frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 4k^2y = 0$

(5)

N 3 6 2 4 6 A 0 2 0 2 8

Question 7 continued

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Question 7 continued

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Question 7 continued

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Q7

(Total 10 marks)

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8. The parabola C has equation $y^2 = 4ax$, where $a > 0$, and the line l has equation $y = mx + c$. Given that l is a tangent to C,

(a) show that $c = \frac{a}{m}$.

(4)

The point P has coordinates $(4a, 5a)$.

(b) Find equations of the two tangents from P to C.

(5)

The tangents from P to C meet C at the points R and Q.

(c) Find the distance RQ.

(5)

N 3 6 2 4 6 A 0 2 4 2 8

Question 8 continued

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Question 8 continued

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Question 8 continued

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Question 8 continued

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Q8

(Total 14 marks)

TOTAL FOR PAPER: 75 MARKS

END