

Centre No.						Paper Reference	Surname	Initial(s)
Candidate No.						6 6 6 9 / 0 1	Signature	

Paper Reference(s)

6669/01

Edexcel GCE

Further Pure Mathematics FP3

Advanced/Advanced Subsidiary

Tuesday 23 June 2009 – Morning

Time: 1 hour 30 minutes

Examiner’s use only

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Team Leader’s use only

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

Materials required for examination

Mathematical Formulae (Orange)

Items included with question papers

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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1. Solve the equation

$$7\operatorname{sech} x - \tanh x = 5$$

Give your answers in the form $\ln a$ where a is a rational number.

(5)



2.

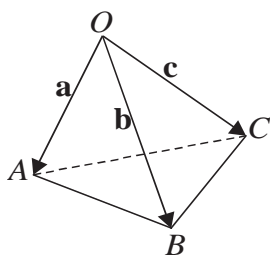


Figure 1

The points A , B and C have position vectors \mathbf{a} , \mathbf{b} and \mathbf{c} respectively, relative to a fixed origin O , as shown in Figure 1.

It is given that

$$\mathbf{a} = \mathbf{i} + \mathbf{j}, \quad \mathbf{b} = 3\mathbf{i} - \mathbf{j} + \mathbf{k} \quad \text{and} \quad \mathbf{c} = 2\mathbf{i} + \mathbf{j} - \mathbf{k}.$$

Calculate

(a) $\mathbf{b} \times \mathbf{c}$, (3)

(b) $\mathbf{a} \cdot (\mathbf{b} \times \mathbf{c})$, (2)

(c) the area of triangle OBC , (2)

(d) the volume of the tetrahedron $OABC$. (1)



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Question 2 continued

Lined area for student response.

Q2

(Total 8 marks)



4. Given that $y = \operatorname{arsinh}(\sqrt{x})$, $x > 0$,

(a) find $\frac{dy}{dx}$, giving your answer as a simplified fraction.

(3)

(b) Hence, or otherwise, find

$$\int_{\frac{1}{4}}^4 \frac{1}{\sqrt{x(x+1)}} dx,$$

giving your answer in the form $\ln\left(\frac{a+b\sqrt{5}}{2}\right)$, where a and b are integers.

(6)



5.

$$I_n = \int_0^5 \frac{x^n}{\sqrt{25-x^2}} dx, \quad n \geq 0$$

(a) Find an expression for $\int \frac{x}{\sqrt{25-x^2}} dx, \quad 0 \leq x \leq 5.$

(2)

(b) Using your answer to part (a), or otherwise, show that

$$I_n = \frac{25(n-1)}{n} I_{n-2} \quad n \geq 2$$

(5)

(c) Find I_4 in the form $k\pi$, where k is a fraction.

(4)



8. A curve, which is part of an ellipse, has parametric equations

$$x = 3 \cos \theta, \quad y = 5 \sin \theta, \quad 0 \leq \theta \leq \frac{\pi}{2}.$$

The curve is rotated through 2π radians about the x -axis.

(a) Show that the area of the surface generated is given by the integral

$$k\pi \int_0^a \sqrt{(16c^2 + 9)} dc, \quad \text{where } c = \cos \theta,$$

and where k and a are constants to be found.

(6)

(b) Using the substitution $c = \frac{3}{4} \sinh u$, or otherwise, evaluate the integral, showing all of your working and giving the final answer to 3 significant figures.

(5)



