Paper Reference(s)

6669/01

Edexcel GCE

Further Pure Mathematics FP3

Advanced

Sample Assessment Material

Time: 1 hour 30 minutes

Materials required for examination	Items included with question papers
Mathematical Formulae	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 formulas stored in them.

Instructions to Candidates

In the boxes on the answer book, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
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 9 questions in this question paper. The total mark for this paper is 75.
There are 4 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. Find the eigenvalues of the matrix $\begin{pmatrix} 7 & 6 \\ 6 & 2 \end{pmatrix}$

(Total 4 marks)

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2. Find the values of x for which

$$9 \cosh x - 6 \sinh x = 7$$

giving your answers as natural logarithms.

(Total 6 marks)

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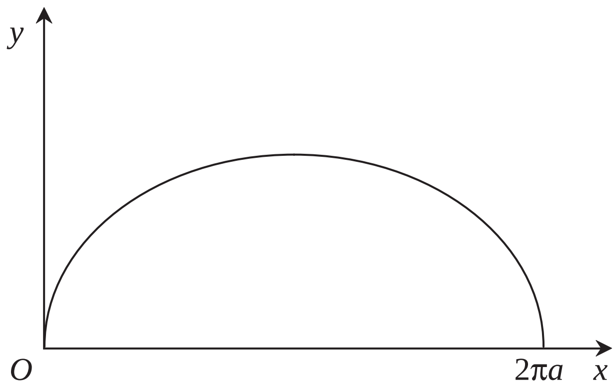
3. **Figure 1**



The parametric equations of the curve C shown in Figure 1 are

$$x = a(t - \sin t), \quad y = a(1 - \cos t), \quad 0 \leq t \leq 2\pi$$

Find, by using integration, the length of C.

(Total 6 marks)

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4. Find $\int \sqrt{(x^2 + 4)}\, \mathrm{d}x$.

(Total 7 marks)

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5. Given that $y = \arcsin x$ prove that

(a) $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{1}{\sqrt{(1 - x^2)}}$

(3)

(b) $(1 - x^2)\dfrac{\mathrm{d}^2 y}{\mathrm{d}x^2} - x\dfrac{\mathrm{d}y}{\mathrm{d}x} = 0$

(4)

(Total 7 marks)

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6. $$I_n = \int_0^{\frac{\pi}{2}} x^n \sin x \, dx$$

(a) Show that for $n \geq 2$

$$I_n = n\left(\frac{\pi}{2}\right)^{n-1} - n(n-1)I_{n-2}$$

(4)

(b) Hence obtain I_3, giving your answers in terms of π.

(4)

(Total 8 marks)

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7. $$\mathbf{A}(x) = \begin{pmatrix} 1 & x & -1 \\ 3 & 0 & 2 \\ 1 & 1 & 0 \end{pmatrix}, \; x \neq \frac{5}{2}$$

(a) Calculate the inverse of $\mathbf{A}(x)$.

$$\mathbf{B} = \begin{pmatrix} 1 & 3 & -1 \\ 3 & 0 & 2 \\ 1 & 1 & 0 \end{pmatrix}$$

(8)

The image of the vector $\begin{pmatrix} p \\ q \\ r \end{pmatrix}$ when transformed by $\mathbf{B}$ is $\begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix}$

(b) Find the values of p, q and r.

(4)

(Total 14 marks)

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8. The points A, B, C, and D have position vectors

$$\mathbf{a} = 2\mathbf{i} + \mathbf{k},\; \mathrm{b} = \mathbf{i} + 3\mathbf{j},\; \mathbf{c} = \mathbf{i} + 3\mathbf{j} + 2\mathbf{k},\; \mathbf{d} = 4\mathbf{j} + \mathbf{k}$$

respectively.

(a) Find $\overrightarrow{AB} \times \overrightarrow{AC}$ and hence find the area of triangle ABC.

(7)

(b) Find the volume of the tetrahedron $ABCD$.

(2)

(c) Find the perpendicular distance of D from the plane containing A, B and C.

(3)

(Total 12 marks)

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9. The hyperbola C has equation $\dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} = 1$

(a) Show that an equation of the normal to C at $P(a \sec \theta, b \tan \theta)$ is

$$by + ax \sin \theta = (a^2 + b^2)\tan \theta$$

(6)

The normal at P cuts the coordinate axes at A and B. The mid-point of AB is M.

(b) Find, in cartesian form, an equation of the locus of M as θ varies.

(7)

(Total 13 marks)

TOTAL FOR PAPER: 75 MARKS

END

