Paper Reference(s)

6668/01

Edexcel GCE

Further Pure Mathematics FP2

Advanced

Mock Paper

Time: 1 hour 30 minutes

Materials required for examination	Items included with question papers
Mathematical Formulae	Answer Booklet

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, initials 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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Turn over

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1. (a) Sketch, on the same axes, the graph with equation $y = |3x - 1|$, and the line with equation $y = 4x + 3$.

Show the coordinates of the points at which the graphs meet the x-axis.

(3)

(b) Solve the inequality $|3x - 1| < 4x + 3$.

(3)

(Total 6 marks)

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2. (a) Express $\dfrac{2}{(2r+1)(2r+3)}$ in partial fractions.

(2)

(b) Hence prove that $\displaystyle\sum_{r=1}^{n} \frac{2}{(2r+1)(2r+3)} = \frac{2n}{3(2n+3)}$.

(3)

(Total 5 marks)

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3. (a) Given that $y = \ln(1+5x)$, $|x| < 0.2$, find $\dfrac{d^3y}{dx^3}$.

(4)

(b) Hence obtain the Maclaurin series for $\ln(1+5x)$, $|x| < 0.2$, up to and including the term in x^3.

(3)

(Total 7 marks)

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4. Use the Taylor Series method to find the series solution, ascending up to and including the term in x^3, of the differential equation

$$\frac{d^2y}{dx^2} + y\frac{dy}{dx} + y^2 = 3x + 4,$$

given that —— $= y = 1$ at $x = 0$.

(Total 8 marks)

5.

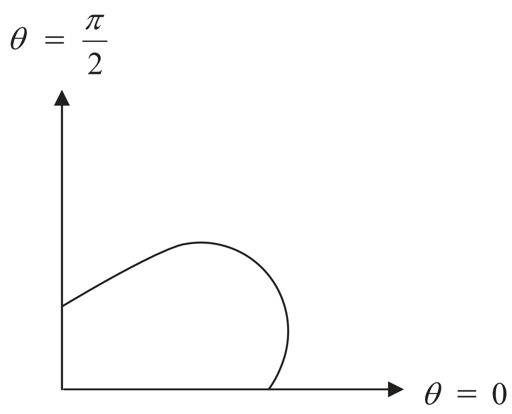

Figure 1

The curve C, shown in Figure 1, has polar equation, $r = 2 + \sin 3\theta$, $0 \leqslant \theta \leqslant \frac{\pi}{2}$

Use integration to calculate the exact value of the area enclosed by C, the line $\theta = 0$ and the line $\theta = \frac{\pi}{2}$.

(Total 7 marks)

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6. (a) Use de Moivre's Theorem to show that

$$\sin 5\theta = 16\sin^5\theta - 20\sin^3\theta + 5\sin\theta .$$

(5)

(b) Hence or otherwise, prove that the only real solutions of the equation

$$\sin 5\theta = 5\sin\theta ,$$

are given by $\theta = n\pi$, where n is an integer.

(4)

(Total 9 marks)

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7. A population P is growing at a rate which is modelled by the differential equation

$$\frac{\mathrm{d}P}{\mathrm{d}t} - 0.1P = 0.05t ,$$

where t years is the time that has elapsed from the start of observations.

It is given that the population is 10 000 at the start of the observations.

(a) Solve the differential equation to obtain an expression for P in terms of t.

(7)

(b) Show that the population doubles between the sixth and seventh year after the observations began.

(2)

(Total 9 marks)

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8. A complex number z satisfies the equation

$$|z - 5 - 12\text{i}| = 3.$$

(a) Describe in geometrical terms with the aid of a sketch, the locus of the point which represents z in the Argand diagram.

(3)

For points on this locus, find

(b) the maximum and minimum values for $|z|$,

(4)

(c) the maximum and minimum values for arg z, giving your answers in radians to 2 decimal places.

(4)

(Total 11 marks)

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9. Resonance in an electrical circuit is modelled by the differential equation

$$\frac{\mathrm{d}^2V}{\mathrm{d}t^2} + 64V = \cos 8t\ ,$$

where V represents the voltage in the circuit and t represents time.

(a) Find the value of   for which   is a particular integral of the differential equation.

(5)

(b) Find the general solution of the differential equation.

(4)

Given that $V = 0$ and $\dfrac{\mathrm{d}V}{\mathrm{d}t} = 0$ when $t = 0$,

(c) find the particular solution of the equation.

(3)

(d) Describe the behaviour of V as t becomes large, according to this model.

(1)

(Total 13 marks)

TOTAL FOR PAPER: 75 MARKS

END