Paper Reference(s)

6668/01

Edexcel GCE

Further Pure Mathematics FP2

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 8 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 set of values of x for which

$$\frac{x}{x-3} > \frac{1}{x-2}$$

(Total 7 marks)

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2. (a) Express as a simplified single fraction $\frac{1}{r^2} - \frac{1}{(r+1)^2}$

(2)

(b) Hence prove, by the method of differences, that

$$\sum_{r=1}^{n} \frac{2r+1}{r^2(r+1)^2} = 1 - \frac{1}{(n+1)^2}$$

(3)

(Total 5 marks)

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3. (a) Show that the transformation T

$$w = \frac{z-1}{z+1}$$

maps the circle $|z| = 1$ in the z-plane to the line $|w-1| = |w+\mathrm{i}|$ in the w-plane.

(4)

The transformation T maps the region $|z| \leq 1$ in the z-plane to the region R in the w-plane.

(b) Shade the region R on an Argand diagram.

(2)

(Total 6 marks)

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4. $$\frac{\mathrm{d}^2y}{\mathrm{d}x^2} + y\frac{\mathrm{d}y}{\mathrm{d}x} = x, \quad y = 0, \ \frac{\mathrm{d}y}{\mathrm{d}x} = 2 \text{ at } x = 1$$

Find a series solution of the differential equation in ascending powers of $(x - 1)$ up to and including the term in $(x - 1)^3$.

(Total 7 marks)

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5. (a) Obtain the general solution of the differential equation

$$\frac{\mathrm{d}S}{\mathrm{d}t} - 0.1S = t$$

(6)

(b) The differential equation in part (a) is used to model the assets, £S million, of a bank t years after it was set up. Given that the initial assets of the bank were £200 million, use your answer to part (a) to estimate, to the nearest £ million, the assets of the bank 10 years after it was set up.

(4)

(Total 10 marks)

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6. The curve C has polar equation

$$r^2 = a^2 \cos 2\theta, \quad \frac{-\pi}{4} \leq \theta \leq \frac{\pi}{4}$$

(a) Sketch the curve C.

(2)

(b) Find the polar coordinates of the points where tangents to C are parallel to the initial line.

(6)

(c) Find the area of the region bounded by C.

(4)

(Total 12 marks)

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7. (a) Given that $x = e^t$, show that

(i) $$\frac{dy}{dx} = e^{-t}\frac{dy}{dt}$$

(ii) $$\frac{d^2y}{dx^2} = e^{-2t}\left(\frac{d^2y}{dt^2} - \frac{dy}{dt}\right)$$

(5)

(b) Use you answers to part (a) to show that the substitution $x = e^t$ transforms the differential equation

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

into

$$\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = e^{3t}$$

(3)

(c) Hence find the general solution of

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

(6)

(Total 14 marks)

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8. (a) Given that $z = e^{i\theta}$, show that

$$z^p + \frac{1}{z^p} = 2\cos p\theta,$$

where p is a positive integer.

(2)

(b) Given that

$$\cos^4\theta = A\cos 4\theta + B\cos 2\theta + C,$$

find the values of the constants A, B and C.

(6)

The region R bounded by the curve with equation $y = \cos^2 x$, $-\frac{\pi}{2} \le x \le \frac{\pi}{2}$, and the x-axis is rotated through 2π about the x-axis.

(c) Find the volume of the solid generated.

(6)

(Total 14 marks)

TOTAL FOR PAPER: 75 MARKS

END