

Paper Reference(s)

**6668/01**

**Edexcel GCE**

**Further Pure Mathematics FP2**

**Advanced**

**Practice Paper A**

**Time: 1 hour 30 minutes**

**Materials required for examination**

Mathematical Formulae

**Items included with question papers**

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 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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*Turn over*

1. Solve the equation

$$z^5 = i,$$

giving your answers in the form  $\cos \theta + i \sin \theta$ .

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**(Total 5 marks)**

2. (a) By expressing  $\frac{2}{4r^2 - 1}$  in partial fractions, or otherwise, prove that

$$\sum_{r=1}^n \frac{2}{4r^2 - 1} = 1 - \frac{1}{2n+1}.$$

**(3)**

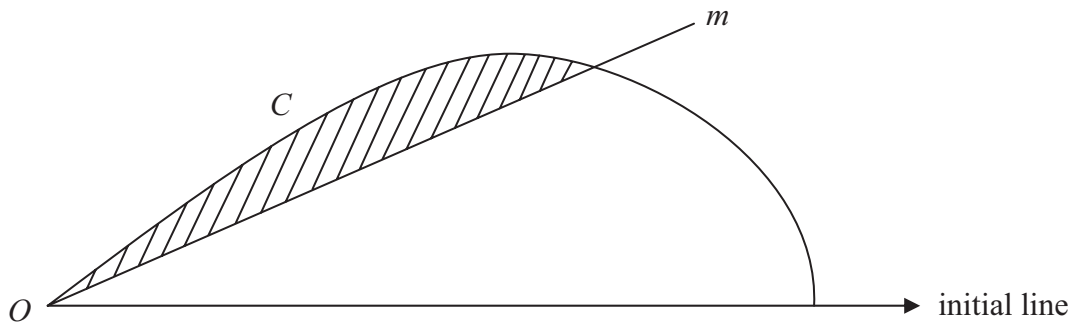
(b) Hence find the exact value of  $\sum_{r=11}^{20} \frac{1}{4r^2 - 1}$ .

**(2)**

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**(Total 5 marks)**

3.



**Figure 1**

Figure 1 shows a curve  $C$  with polar equation  $r = 4a \cos 2\theta$ ,  $0 \leq \theta \leq \frac{\pi}{4}$ , and a line  $m$  with polar equation  $\theta = \frac{\pi}{8}$ . The shaded region, shown in Figure 1, is bounded by  $C$  and  $m$ . Use calculus to show that the area of the shaded region is  $\frac{1}{2} a^2(\pi - 2)$ .

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**(Total 7 marks)**

4. A complex number  $z$  is represented by the point  $P$  in the Argand diagram. Given that

$$|z - 3i| = 3,$$

(a) sketch the locus of  $P$ .

(2)

(b) Find the complex number  $z$  which satisfies both  $|z - 3i| = 3$  and  $\arg(z - 3i) = \frac{3}{4}\pi$ .

(4)

The transformation  $T$  from the  $z$ -plane to the  $w$ -plane is given by

$$w = \frac{2i}{z}.$$

(c) Show that  $T$  maps  $|z - 3i| = 3$  to a line in the  $w$ -plane, and give the cartesian equation of this line.

(5)

**(Total 11 marks)**

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5.

$$(1 + 2x) \frac{dy}{dx} = x + 4y^2.$$

(a) Show that

$$(1 + 2x) \frac{d^2y}{dx^2} = 1 + 2(4y - 1) \frac{dy}{dx}. \quad (1)$$

(2)

(b) Differentiate equation (1) with respect to  $x$  to obtain an equation involving

$$\frac{d^3y}{dx^3}, \frac{d^2y}{dx^2}, \frac{dy}{dx}, x \text{ and } y.$$

(3)

Given that  $y = \frac{1}{2}$  at  $x = 0$ ,

(c) find a series solution for  $y$ , in ascending powers of  $x$ , up to and including the term in  $x^3$ .

(6)

**(Total 11 marks)**

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6. (a) Find the general solution of the differential equation

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 2y = 2e^{-t}. \quad (6)$$

- (b) Find the particular solution that satisfies  $y = 1$  and  $\frac{dy}{dt} = 1$  at  $t = 0$ . (6)

**(Total 12 marks)**

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7. (a) Use algebra to find the exact solutions of the equation

$$|2x^2 + x - 6| = 6 - 3x. \quad (6)$$

- (b) On the same diagram, sketch the curve with equation  $y = |2x^2 + x - 6|$  and the line with equation  $y = 6 - 3x$ . (3)

- (c) Find the set of values of  $x$  for which

$$|2x^2 + x - 6| > 6 - 3x. \quad (3)$$

**(Total 12 marks)**

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8. During an industrial process, the mass of salt,  $S$  kg, dissolved in a liquid  $t$  minutes after the process begins is modelled by the differential equation

$$\frac{dS}{dt} + \frac{2S}{120-t} = \frac{1}{4}, \quad 0 \leq t < 120.$$

Given that  $S = 6$  when  $t = 0$ ,

- (a) find  $S$  in terms of  $t$ , (8)

- (b) calculate the maximum mass of salt that the model predicts will be dissolved in the liquid at any one time during the process. (4)

**(Total 12 marks)**

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**TOTAL FOR PAPER: 75 MARKS**

**END**