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INTERNATIONAL A LEVEL MATHEMATICS • FURTHER PURE 2 (WFM02)

Further Pure 2 Practice Paper 1

Edexcel IAL Further Pure Mathematics 2

AIMING FOR B

Written in the style of the Pearson Edexcel International Advanced Level paper (WFM02/01) • Calculator allowed

A full 75-mark paper of multi-step exam questions covering every Further Pure 2 chapter, with a separate mark scheme

Time	Total	You must have
1 hour 30 minutes	**75 marks**	**Mathematical Formulae and Statistical Tables, calculator**

Instructions

- Use black ink or ball-point pen. Pencil may be used for diagrams and sketches.
- Answer **all** questions, in the spaces provided.
- Show enough working to make your method clear. Answers without working may not gain full credit.
- Give inexact answers to **three significant figures** unless the question says otherwise.

Information

- There are 9 questions in this paper. The total mark is 75.
- The marks for each question are shown in brackets.

Advice

- Sit the paper in one go, in 1 hour 30 minutes, with the mark scheme closed.
- Read each question carefully and try every question. Check your answers if you have time.
- Then mark it line by line with the mark scheme and fill in your score.

Track your score

Q	Topic	Marks	Score
1	An inequality with two fractions	6	
2	Partial fractions and the method of differences	7	
3	Fifth roots of a complex number	7	
4	A first-order differential equation	8	
5	A Maclaurin series and an estimate	8	
6	Loci in the Argand diagram	8	
7	A second-order differential equation	9	
8	Tangents to a polar curve and an area	10	
9	de Moivre's theorem and an integral	12	
	Total	**75**	

Rough grade guide (out of 75): A* **69** • A **64** • B **57** • C **49**

Based on recent WFM02 grade boundaries. Real boundaries change every series, so treat this as a guide, not a grade.

Mark scheme | Exam questions by topic | More practice papers

Name ..... Date .....

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1. In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

Use algebra to find the set of values of x for which

$$\frac{x}{x-2} < \frac{2x}{x+1}$$

(6)

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(Total for Question 1 is 6 marks)

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2. **(a)** Express $\dfrac{4}{(r+1)(r+3)}$ in partial fractions.

(2)

(b) Hence, using the method of differences, show that, for all positive integers n,

$$\sum_{r=1}^{n} \frac{4}{(r+1)(r+3)} = \frac{n(5n+13)}{3(n+2)(n+3)}$$

(5)

(Total for Question 2 is 7 marks)

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3.

$$w = 16 + 16\sqrt{3}\,\mathrm{i}$$

(a) Express w in the form $re^{i\theta}$, where $r > 0$ and $-\pi < \theta \leqslant \pi$

(2)

(b) Solve the equation $z^5 = w$, giving your answers in the form $re^{i\theta}$, where $r > 0$ and $-\pi < \theta \leqslant \pi$

(4)

(c) Show the points representing your answers to part (b) on a single Argand diagram.

(1)

(Total for Question 3 is 7 marks)

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4. **(a)** Find the general solution of the differential equation

$$\cos x \frac{\mathrm{d}y}{\mathrm{d}x} + y \sin x = \cos^3 x, \qquad 0 \leqslant x < \frac{\pi}{2}$$

giving your answer in the form $y = \mathrm{f}(x)$

(6)

Given that $y = 2$ when $x = 0$

(b) find the exact value of y when $x = \frac{\pi}{3}$

(2)

(Total for Question 4 is 8 marks)

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5.

$$f(x) = e^{\sin x}$$

(a) Show that $f''(x) = \left(\cos^2 x - \sin x\right) e^{\sin x}$

(3)

(b) Hence find the Maclaurin series expansion of $f(x)$, in ascending powers of x, up to and including the term in x^3

(3)

(c) Use your answer to part (b) to find an estimate for $\int_0^{0.2} e^{\sin x}\,dx$, giving your answer to 4 decimal places.

(2)

(Total for Question 5 is 8 marks)

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6. **(a)** On the same Argand diagram, sketch the locus of points representing complex numbers z satisfying

$$|z-3-4i| = 2 \qquad \text{and} \qquad \arg(z-1) = \frac{\pi}{4}$$

(3)

(b) Find the complex numbers z that satisfy both $|z-3-4i| = 2$ and $\arg(z-1) = \frac{\pi}{4}$

(3)

(c) Find the greatest value of $|z|$ for points on the locus $|z-3-4i| = 2$

(2)

(Total for Question 6 is 8 marks)

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7.

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 5y = 10\cos x$$

(a) Given that $y = \lambda\cos x + \mu\sin x$ is a particular integral of the differential equation, find the value of λ and the value of μ

(4)

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

(2)

(c) Find the particular solution for which $y = 0$ and $\frac{dy}{dx} = 0$ when $x = 0$

(3)

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Question 7 continued

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(Total for Question 7 is 9 marks)

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8.

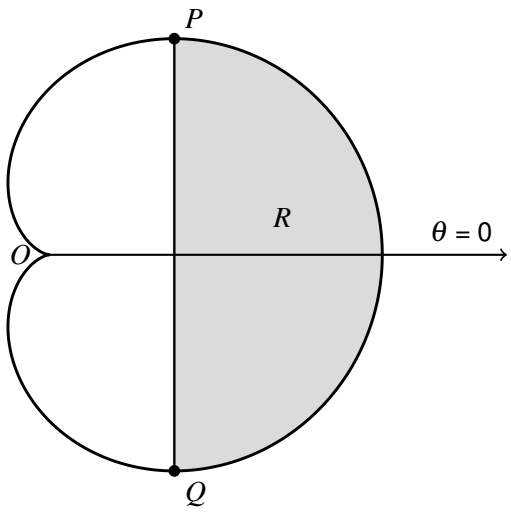

Figure 1

Figure 1 shows the curve C with polar equation

$$r = 4(1 + \cos\theta), \qquad -\pi < \theta \leqslant \pi$$

At the points P and Q on C the tangent to C is parallel to the initial line.

(a) Find the polar coordinates of P and the polar coordinates of Q

(5)

The finite region R, shown shaded in Figure 1, is bounded by C and the straight line PQ

(b) Use calculus to find the exact area of R, giving your answer in the form $a\pi + b\sqrt{3}$, where a and b are integers.

(5)

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Question 8 continued

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(Total for Question 8 is 10 marks)

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9. In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

(a) Use de Moivre's theorem to show that

$$\cos^5\theta = \frac{1}{16}(\cos 5\theta + 5\cos 3\theta + 10\cos\theta)$$

(6)

(b) Hence find the exact value of

$$\int_0^{\frac{\pi}{3}} \cos^5\theta \, \mathrm{d}\theta$$

(4)

(c) Hence solve, for $0 \leqslant \theta \leqslant \pi$, the equation

$$\cos 5\theta + 5\cos 3\theta + 10\cos\theta = 0$$

(2)

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Question 9 continued

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(Total for Question 9 is 12 marks)

TOTAL FOR PAPER IS 75 MARKS

END

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