Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International Advanced Level

Centre Number | Candidate Number

Monday 3 June 2019

Afternoon (Time: 1 hour 30 minutes) | Paper Reference **WFM02/01**

Mathematics

International Advanced Subsidiary/Advanced Level
Further Pure Mathematics F2

You must have:
Mathematical Formulae and Statistical Tables (Blue), calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions
- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information
- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 8 questions in this question paper. The total mark for this paper is 75.
- The marks for each question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice
- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

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Answer ALL questions. Write your answers in the spaces provided.

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

$$|x^2 - 6| > x$$

(6)

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Question 1 continued

Q1

(Total 6 marks)

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2. A transformation T from the z-plane to the w-plane is given by

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

The imaginary axis in the z-plane is mapped by T onto the curve C in the w-plane.

Show that C is a circle and find its centre and radius.

(6)

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Question 2 continued

Q2

(Total 6 marks)

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

(1)

(b) Hence, using the method of differences, show that, for $n \in \mathbb{Z}$, $n > 2$

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

(5)

(c) Hence show that, for $n > 1$

$$\sum_{r=n}^{3n} \frac{2}{r^2-1} = \frac{2(an-1)(bn+1)}{3n(cn+1)(n-1)}$$

where a, b and c are integers to be found.

(4)

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Question 3 continued

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Question 3 continued

Question 3 continued

(Total 10 marks)

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Q3

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4.

$$(\cos x)\frac{dy}{dx} + (\sin x)y = 2\cos^3 x \sin x - 3 \qquad 0 \leqslant x < \frac{\pi}{2}$$

(a) Find the general solution of this differential equation. Give your answer in the form $y = f(x)$.

(7)

(b) Find the particular solution of this differential equation for which $y = 3\sqrt{3}$ at $x = \frac{\pi}{3}$

Give your answer in the form $y = f(x)$.

(3)

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Question 4 continued

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Question 4 continued

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Question 4 continued

Q4

(Total 10 marks)

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5. (a) Express the complex number $-8 - 8\text{i}\sqrt{3}$ in the form $r(\cos\theta + \text{i}\sin\theta)$, where $r > 0$ and $-\pi < \theta \leqslant \pi$

(3)

(b) Hence solve the equation $z^4 = -8 - 8\text{i}\sqrt{3}$, giving the roots in the form $z = a + \text{i}b$ where a and b are real.

(5)

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Question 5 continued

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Question 5 continued

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Question 5 continued

Q5

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6. Find the Taylor series expansion about $x = 1$ of $\dfrac{1}{\sqrt{1 + x^2}}$ in ascending powers of $(x - 1)$, up to and including the term in $(x - 1)^2$, simplifying each term.

(8)

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Question 6 continued

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Q6

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7. (a) Show that the substitution $y = vx$ transforms the differential equation

$$x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + (2 - x^2)y = 2x^3 \qquad x > 0 \qquad \text{(I)}$$

into the differential equation

$$\frac{d^2v}{dx^2} - v = 2 \qquad \text{(II)}$$

(5)

(b) By solving differential equation (II), find the general solution of differential equation (I) in the form $y = f(x)$.

(6)

Given that $y = e$ and $\frac{dy}{dx} = e$ at $x = 1$

(c) find the particular solution of differential equation (I).

(4)

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Question 7 continued

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Question 7 continued

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Question 7 continued

Q7

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8.

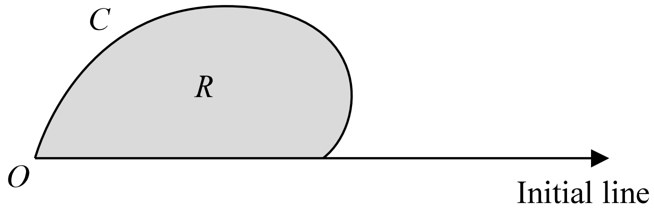

Figure 1

The curve C shown in Figure 1 has polar equation

$$r = \sin\theta + \cos 2\theta \qquad 0 \leqslant \theta \leqslant \frac{\pi}{2}$$

At the point P on C the tangent to C is parallel to the initial line.

Given that O is the pole,

(a) find the length of the line of OP, giving your answer to 3 significant figures.

(6)

The region R, shown shaded in Figure 1, is bounded by the curve C and the initial line.

(b) Use calculus to find the exact area of R.

(6)

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Question 8 continued

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Question 8 continued

Question 8 continued

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Q8

(Total 12 marks)

TOTAL FOR PAPER: 75 MARKS

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