

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel**  
International  
Advanced Level

Centre Number

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Candidate Number

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**Friday 15 May 2020**

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.

Turn over ►

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Question 1 continued

Handwriting practice area with horizontal lines.

(Total 7 marks)

Q1



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2. (a) Write  $\frac{3r+1}{r(r-1)(r+1)}$  in partial fractions.

(2)

(b) Hence find

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

giving your answer in the form

$$\frac{an^2 + bn + c}{2n(n+1)}$$

where  $a$ ,  $b$  and  $c$  are integers to be determined.

(5)

(c) Hence determine the exact value of

$$\sum_{r=15}^{20} \frac{3r+1}{r(r-1)(r+1)}$$

(2)

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**Question 2 continued**

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**Question 2 continued**

Lined writing area for the answer to Question 2.

Q2

**(Total 9 marks)**

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3. Use algebra to obtain the set of values of  $x$  for which

$$\left| \frac{x^2 + 3x + 10}{x + 2} \right| < 7 - x$$

(9)

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**Question 3 continued**

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**(Total 9 marks)**

Q3



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4. (a) Express the complex number  $18\sqrt{3} - 18i$  in the form

$$r(\cos \theta + i \sin \theta) \quad -\pi < \theta \leq \pi \qquad (3)$$

(b) Solve the equation

$$z^4 = 18\sqrt{3} - 18i$$

giving your answers in the form  $re^{i\theta}$  where  $-\pi < \theta \leq \pi$  (5)

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### Question 4 continued

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**Question 4 continued**

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Q4

**(Total 8 marks)**



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

$$w = \frac{z - 3i}{z + 2i} \quad z \neq -2i$$

The circle with equation  $|z| = 1$  in the  $z$ -plane is mapped by  $T$  onto the circle  $C$  in the  $w$ -plane.

Determine

- (i) the centre of  $C$ ,
- (ii) the radius of  $C$ .

(7)

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Question 5 continued

Lined writing area for the question response.

Q5

(Total 7 marks)



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6. Obtain the general solution of the equation

$$x^2 \frac{dy}{dx} + (x \cot x + 2)xy = 4 \sin x \quad 0 < x < \pi$$

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

(8)

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7.

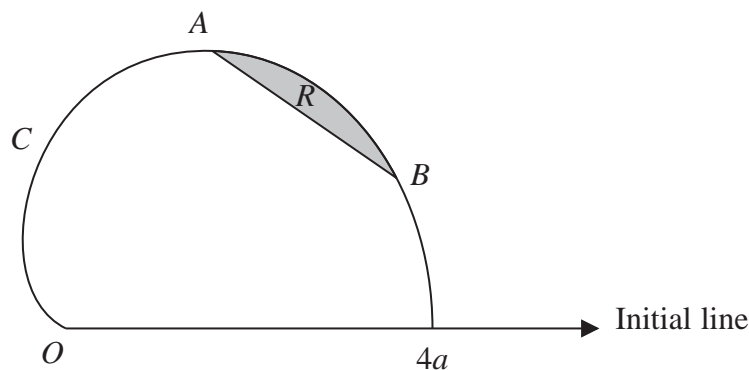


Figure 1

The curve  $C$ , shown in Figure 1, has polar equation

$$r = 2a(1 + \cos \theta) \quad 0 \leq \theta \leq \pi$$

where  $a$  is a positive constant.

The tangent to  $C$  at the point  $A$  is parallel to the initial line.

(a) Determine the polar coordinates of  $A$ .

(6)

The point  $B$  on the curve has polar coordinates  $\left(a(2 + \sqrt{3}), \frac{\pi}{6}\right)$

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

(b) Use calculus to determine the exact area of the shaded region  $R$ .

Give your answer in the form

$$\frac{a^2}{4}(d\pi - e + f\sqrt{3})$$

where  $d$ ,  $e$  and  $f$  are integers.

(7)

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### Question 7 continued

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### Question 7 continued

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(Total 13 marks)

Q7

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8. (a) Show that the transformation  $x = e^u$  transforms the differential equation

$$x^2 \frac{d^2 y}{dx^2} + 3x \frac{dy}{dx} - 8y = 4 \ln x \quad x > 0 \quad (\text{I})$$

into the differential equation

$$\frac{d^2 y}{du^2} + 2 \frac{dy}{du} - 8y = 4u \quad (\text{II})$$

(6)

- (b) Determine the general solution of differential equation (II), expressing  $y$  as a function of  $u$ .

(7)

- (c) Hence obtain the general solution of differential equation (I).

(1)

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Question 8 continued

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**Question 8 continued**

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**Question 8 continued**

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Question 8 continued

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Q8

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(Total 14 marks)

TOTAL FOR PAPER: 75 MARKS

END

