Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Further Pure Mathematics F2

Advanced/Advanced Subsidiary

Wednesday 6 June 2018 – Morning
Time: 1 hour 30 minutes

Paper Reference
WFM02/01

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

Total Marks

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 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). Coloured pencils and highlighter pens must not be used.
- **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.
- When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information

- 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.

Turn over ▶

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Pearson

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

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

(5)

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Question 1 continued

Q1

(Total 5 marks)

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

$$\left(x^2 + 1\right)\frac{dy}{dx} + xy - x = 0$$

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

(6)

(b) Find the particular solution for which $y = 2$ when $x = 3$

(2)

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Question 2 continued

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Question 2 continued

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Question 2 continued

Q2

(Total 8 marks)

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3.

$$2\frac{d^2y}{dx^2} + \frac{dy}{dx} - xy = 1$$

(a) Show that

$$\frac{d^4y}{dx^4} = \frac{1}{2}\left(a\frac{dy}{dx} + bx\frac{d^2y}{dx^2} + c\frac{d^3y}{dx^3}\right)$$

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

(4)

Given that $y = 1$ and $\frac{dy}{dx} = 1$ when $x = 2$

(b) find a series solution for y in ascending powers of $(x - 2)$, up to and including the term in $(x - 2)^4$. Write each term in its simplest form.

(4)

(c) Use the solution to part (b) to find an approximate value for y when $x = 2.1$, giving your answer to 3 decimal places.

(2)

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Question 3 continued

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Question 3 continued

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Question 3 continued

Q3

(Total 10 marks)

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

$$|z + \mathrm{i}| = 1$$

(a) sketch the locus of P.

(2)

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

$$w = \frac{3\mathrm{i}z - 2}{z + \mathrm{i}}, \qquad z \neq -\mathrm{i}$$

(b) Given that T maps $|z + \mathrm{i}| = 1$ to a circle C in the w-plane, find a cartesian equation of C.

(7)

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Question 4 continued

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Question 4 continued

Q4

(Total 9 marks)

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

(3)

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

$$\sum_{r=1}^{n} \frac{4r+2}{r(r+1)(r+2)} = \frac{n(an+b)}{2(n+1)(n+2)}$$

where a and b are constants to be found.

(5)

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Question 5 continued

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Question 5 continued

Q5

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

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

into the differential equation

$$\frac{d^2y}{dt^2} - 4\frac{dy}{dt} + 3y = e^{2t} \qquad \text{(II)}$$

(6)

(b) Find the general solution of the differential equation (II), expressing y as a function of t.

(6)

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

(1)

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Question 6 continued

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Question 6 continued

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Q6

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

$$\cos 7\theta \equiv 64\cos^7\theta - 112\cos^5\theta + 56\cos^3\theta - 7\cos\theta$$

(6)

(b) Hence find the four distinct roots of the equation

$$64x^7 - 112x^5 + 56x^3 - 7x + 1 = 0$$

giving your answers to 3 decimal places where necessary.

(5)

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Question 7 continued

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Question 7 continued

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Q7

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8.

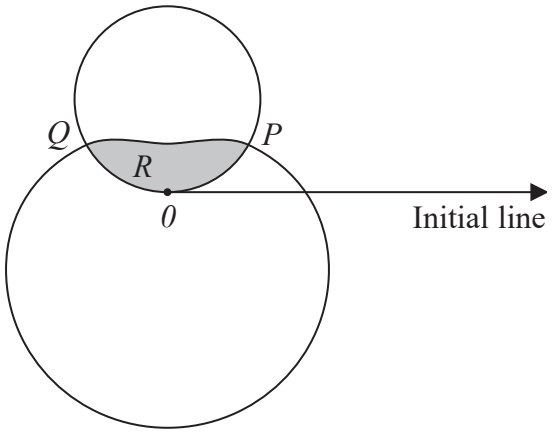

Figure 1

Figure 1 shows a sketch of the curves with polar equations

$$r = 2\sin\theta \qquad 0 \leqslant \theta \leqslant \pi$$
$$r = 1.5 - \sin\theta \qquad 0 \leqslant \theta \leqslant 2\pi$$

The curves intersect at the points P and Q.

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

(3)

The region R, shown shaded in Figure 1, is enclosed by the two curves.

(b) Find the exact area of R, giving your answer in the form $p\pi + q\sqrt{3}$, where p and q are rational numbers to be found.

(8)

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Question 8 continued

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Question 8 continued

Q8

(Total 11 marks)

TOTAL FOR PAPER: 75 MARKS

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