Please check the examination detail	s below before ente	ering your candidate i	nformation
Candidate surname		Other names	
Centre Number Candidat	e Number		
Pearson Edexcel Int	ernation	al Advand	ced Level
Time 1 hour 30 minutes	Paper reference	WFM	02/01
Mathematics			
International Advanced	Subsidiar	v/Advanced	Level
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Further Pure Mathemat	ics F2		
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You must have:			Total Marks
Mathematical Formulae and Statis	stical lables (Ye	llow), calculator	

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 9 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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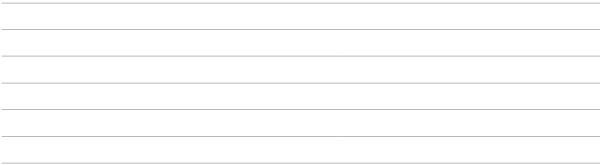


2.	Use algebra to determine the set of values of $x$ for which

 $\frac{x}{2-x} \leqslant \frac{x+3}{x}$ 

 $(Solutions\ relying\ entirely\ on\ graphical\ methods\ are\ not\ acceptable.)$ 

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**(6)** 

3. A transformation maps points from the z-plane, where z = x + iy, to the w-plane, where w = u + iv. The transformation is given by

$$w = \frac{(2+i)z+4}{z-i} \qquad z \neq i$$

The transformation maps the imaginary axis in the z-plane onto the line l in the w-plane.

Determine a Cartesian equation of l, giving your answer in the form au + bv + c = 0 where a, b and c are integers to be found.

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Question 3 continued	Dialik
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4. (a) Determine the general solution of the differential equation

$$(x+1)\frac{\mathrm{d}y}{\mathrm{d}x} - xy = \mathrm{e}^{3x} \qquad x > -1$$

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

**(7)** 

(b) Determine the particular solution of the differential equation for which y = 5 when x = 0 (2)



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- **5.** Given that  $y = \tan^2 x$ 
  - (a) show that

$$\frac{\mathrm{d}^3 y}{\mathrm{d}x^3} = 8\tan x \sec^2 x \left( p \sec^2 x + q \right)$$

where p and q are integers to be determined.

(b) Hence determine the Taylor series expansion about  $\frac{\pi}{3}$  of  $\tan^2 x$  in ascending powers of

 $\left(x - \frac{\pi}{3}\right)$  up to and including the term in  $\left(x - \frac{\pi}{3}\right)^3$ , giving each coefficient in simplest form.





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**6.** The complex number z on an Argand diagram is represented by the point P where

$$|z+1-13i| = 3|z-7-5i|$$

Given that the locus of *P* is a circle,

(a) determine the centre and radius of this circle.

**(5)** 

The complex number w, on the same Argand diagram, is represented by the point Q, where

$$\arg\left(w - 8 - 6\mathrm{i}\right) = -\frac{3\pi}{4}$$

Given that the locus of P intersects the locus of Q at the point R,

(b)	determine	the	complex	number	represent	ing	R
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7. (a) Show that the transformation  $x = t^2$  transforms the differential equation

$$4x\frac{d^2y}{dx^2} + 2(1 + 2\sqrt{x})\frac{dy}{dx} - 15y = 15x$$
 (I)

into the differential equation

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 15y = 15t^2$$
 (II)

(b) Solve differential equation (II) to determine y in terms of t.

(5)

**(5)** 

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

**(1)** 




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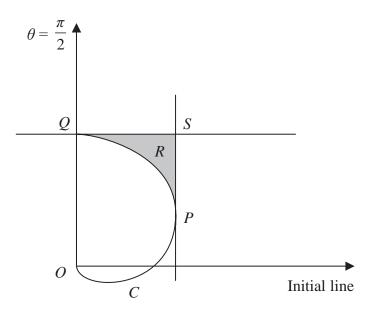


Figure 1

The curve C shown in Figure 1 has polar equation

The point *P* lies on *C* such that the tangent to *C* at *P* is perpendicular to the initial line.

(a) Use calculus to determine the polar coordinates of P.

**(5)** 

The tangent to C at the point Q where  $\theta = \frac{\pi}{2}$  is parallel to the initial line.

The tangent to C at Q meets the tangent to C at P at the point S, as shown in Figure 1.

The finite region R, shown shaded in Figure 1, is bounded by the line segments QS, SP and the curve C.

(b) Use algebraic integration to show that the area of R is

$$\frac{1}{32}(a\sqrt{3} + b\pi)$$

where a and b are integers to be determined.

**(6)** 

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**9.** (a) Show that

$$n^5 - (n-1)^5 \equiv 5n^4 - 10n^3 + 10n^2 - 5n + 1$$

**(2)** 

(b) Hence, using the method of differences, show that for all integer values of n,

$$\sum_{r=1}^{n} r^4 = \frac{1}{30} n(n+1)(2n+1)(an^2 + bn + c)$$

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

**(7)** 


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