Candidate surname			Other names
Pearson Edexcel International Idvanced Level	Centre	Number	Candidate Number
Sample Assessment Materials fo	or first te	aching Se	eptember 2018
(Time: 1 hour 30 minutes)		Paper Re	eference <b>WFM02/01</b>
Mathamatica			
Mathematics International Advance Further Pure Mathema		•	y/Advanced Level

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 ▶







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

1.	Using	algebra,	find	the	set	of	values	of $x$	for	which
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$$\frac{x}{x+2} < \frac{2}{x+5}$$

$\lambda + 2 = \lambda + 3$	
	(7

Question 1 continued		Leave
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		Q1
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	(Total for Question 1 is 7 marks)	

2. (a) Express  $\frac{1}{(r+6)(r+8)}$  in partial fractions.

(1)

(b) Hence show that

$$\sum_{r=1}^{n} \frac{2}{(r+6)(r+8)} = \frac{n(an+b)}{56(n+7)(n+8)}$$

	where $a$	and and	b	are	integers	to	be	found	d.
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Question 2 continued	

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Question 2 continued		
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	(Total for Question 2 is 5 marks)	

3. (a) Show that the substitution  $z = y^{-2}$  transforms the differential equation

$$\frac{\mathrm{d}y}{\mathrm{d}x} + 2xy = x\mathrm{e}^{-x^2}y^3 \quad (\mathrm{I})$$

into the differential equation

$$\frac{\mathrm{d}z}{\mathrm{d}x} - 4xz = -2x\mathrm{e}^{-x^2} \quad \text{(II)}$$

(b) Solve differential equation (II) to find z as a function of x.

**(5)** 

(c) Hence find the general solution of differential equation (I), giving your answer in the form  $y^2 = f(x)$ .

**(1)** 

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(Total for Question 3 is 10 marks)		Q3
(Total for Question 3 is 10 marks)		
	(Total for Question 3 is 10 marks)	

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

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

The line in the z-plane with equation y = 2x is mapped by T onto the curve C in the w-plane.

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

**(7)** 

The region y < 2x in the z-plane is mapped by T onto the region R in the w-plane.

(b) Sketch circle C on an Argand diagram and shade and label region R.

(2)

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Question 4 continued	

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	(Total for Question 4 is 9 marks)	
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- Given that  $y = \cot x$ ,
  - (a) show that

$$\frac{\mathrm{d}^2 y}{\mathrm{d}x^2} = 2\cot x + 2\cot^3 x \tag{3}$$

(b) Hence show that

$$\frac{\mathrm{d}^3 y}{\mathrm{d}x^3} = p \cot^4 x + q \cot^2 x + r$$

where p, q and r are integers to be found.

**(3)** 

(c) Find the Taylor series expansion of cot x in ascending powers of  $\left(x - \frac{\pi}{3}\right)$  up to and including the term in  $\left(x - \frac{\pi}{3}\right)^3$ .

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	(Total for Question 5 is 9 marks)	

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

$$\frac{\mathrm{d}^2 y}{\mathrm{d}x^2} - 2\frac{\mathrm{d}y}{\mathrm{d}x} - 3y = 2\sin x \quad \text{(I)}$$

(8)

Given that y = 0 and  $\frac{dy}{dx} = 1$  when x = 0

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

**(5)** 

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(Total for	Question 6 is 13 marks)

7.

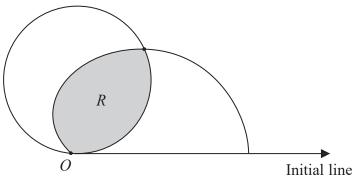


Figure 1

Figure 1 shows the two curves given by the polar equations

$$r = \sqrt{3} \sin \theta$$
,  $0 \leqslant \theta \leqslant \pi$ 

$$r = 1 + \cos \theta$$
,  $0 \le \theta \le \pi$ 

(a) Verify that the curves intersect at the point P with polar coordinates  $\left(\frac{3}{2}, \frac{\pi}{3}\right)$ .

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

(b) Use calculus to find the exact area of R, giving your answer in the form  $a(\pi - \sqrt{3})$ , where a is a constant to be found.

**(6)** 

estion 7 continued	

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	(Total for Question 7 is 8 marks)	

**8.** (a) Show that

$$\left(z + \frac{1}{z}\right)^3 \left(z - \frac{1}{z}\right)^3 = z^6 - \frac{1}{z^6} - k\left(z^2 - \frac{1}{z^2}\right)$$

where k is a constant to be found.

**(3)** 

Given that  $z = \cos \theta + i \sin \theta$ , where  $\theta$  is real,

(b) show that

(i) 
$$z^n + \frac{1}{z^n} = 2\cos n\theta$$

(ii) 
$$z^n - \frac{1}{z^n} = 2i\sin n\theta$$

(3)

(c) Hence show that

$$\cos^3\theta \sin^3\theta = \frac{1}{32} (3\sin 2\theta - \sin 6\theta)$$
 (4)

(d) Find the exact value of

$$\int_0^{\frac{\pi}{8}} \cos^3 \theta \sin^3 \theta \, \mathrm{d}\theta \tag{4}$$

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Question 8 continued	

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Question 8 continued	