Please check the examination deta	ils below before enter	ring your candidate information
Candidate surname		Other names
Pearson Edexcel International Advanced Level	Centre Number	Candidate Number
<b>Time</b> 1 hours 30 minutes	Paper reference	WFM03/01
Mathematics International Advance Further Pure Mathema	•	//Advanced Level
You must have: Mathematical Formulae and Stat	istical Tables (Yel	low), 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 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.
- Good luck with your examination.

Turn over ▶







1.	(a) Using the definitions of hyperbolic functions in terms of exponentials, show that $1 - \tanh^2 x \equiv \mathrm{sech}^2 x$	(3)
	(b) Solve the equation	
	$2 \operatorname{sech}^2 x + 3 \tanh x = 3$	
	giving your answer as an exact logarithm.	(2)
		(3)

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(Total 6 marks)



2. A curve has equation

$$y = \sqrt{9 - x^2} \qquad 0 \leqslant x \leqslant 3$$

(a) Using calculus, show that the length of the curve is  $\frac{3\pi}{2}$ 

**(4)** 

The curve is rotated through  $2\pi$  radians about the *x*-axis.

(b) Using calculus, find the exact area of the surface generated.

**(3)** 

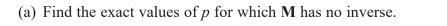
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Question 2 continued	



Question 2 continued		Leave blank
		Q2
(Total 7	marks)	



 $\begin{pmatrix} 3 & 1 & p \\ 1 & 1 & 2 \\ -1 & p & 2 \end{pmatrix}$  where p is a real constant 3.



**(4)** 

Given that M does have an inverse,

(b) find  $\mathbf{M}^{-1}$  in terms of p.

**(5)** 

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Question 3 continued	



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	Q3
(Total 9 marks)	



4. (i)	$f(x) = x \arccos x \qquad -1 \leqslant x \leqslant 1$	
Find the exact va	alue 011 (0.3).	(3)
(ii)	$g(x) = \arctan(e^{2x})$	
Show that		
	$g''(x) = k \operatorname{sech}(2x) \tanh(2x)$	
where k is a con-	stant to be found.	
where k is a cons	stant to be found.	(5)



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	Q4
(Total 8 marks)	
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$$I_n = \int \sec^n x \, \mathrm{d}x \qquad n \geqslant 0$$

(a) Prove that for  $n \ge 2$ 

$$(n-1)I_n = \tan x \sec^{n-2} x + (n-2)I_{n-2}$$
(6)

(b) Hence, showing each step of your working, find the exact value of

$$\int_0^{\frac{\pi}{4}} \sec^6 x \, \mathrm{d}x$$

**(4)** 

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(Total 10 marks)

**6.** The line  $l_1$  has equation

$$\mathbf{r} = \mathbf{i} + \mathbf{j} + \mathbf{k} + \lambda(\mathbf{i} + 3\mathbf{k})$$

and the line  $l_2$  has equation

$$\mathbf{r} = 2\mathbf{i} + s\mathbf{j} + \mu(\mathbf{i} - 2\mathbf{j} + \mathbf{k})$$

where *s* is a constant and  $\lambda$  and  $\mu$  are scalar parameters.

Given that  $l_{\scriptscriptstyle 1}$  and  $l_{\scriptscriptstyle 2}$  both lie in a common plane  $\Pi_{\scriptscriptstyle 1}$ 

(a) show that an equation for  $\Pi_1$  is 3x + y - z = 3

(4)

(b) find the value of s.

**(1)** 

The plane  $\Pi_2$  has equation  $\mathbf{r.(i+j-2k)} = 3$ 

(c) Find an equation for the line of intersection of  $\Pi_1$  and  $\Pi_2$ 

**(4)** 

(d) Find the acute angle between  $\Pi_1$  and  $\Pi_2$  giving your answer in degrees to 3 significant figures.

**(4)** 



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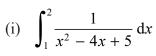
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(Total 13 marks)



7. Using calculus, find the exact values of



**(3)** 

(ii) 
$$\int_{\sqrt{3}}^{3} \frac{\sqrt{x^2 - 3}}{x^2} \, \mathrm{d}x$$

**(5)** 

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Question 7 continued	



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	<b>Q7</b>
(Total 8 marks)	
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**8.** The hyperbola H has equation

$$4x^2 - v^2 = 4$$

(a) Write down the equations of the asymptotes of H.

**(1)** 

(b) Find the coordinates of the foci of H.

**(2)** 

The point  $P(\sec \theta, 2 \tan \theta)$  lies on H.

(c) Using calculus, show that the equation of the tangent to H at the point P is

$$y \tan \theta = 2x \sec \theta - 2$$

**(4)** 

The point V(-1, 0) and the point W(1, 0) both lie on H.

The point  $Q(\sec \theta, -2\tan \theta)$  also lies on H.

Given that P, Q, V and W are distinct points on H and that the lines VP and WQ intersect at the point S,

(d) show that, as  $\theta$  varies, S lies on an ellipse with equation

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

where a and b are integers to be found.

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END	TOTAL FOR PAPER: 75 MARKS
	(Total 14 marks)