Please check the examination det	ails below	before ente	
Candidate surname			Other names
Pearson Edexcel International Advanced Level	Centre	Number	Candidate Number
Sample Assessment Materials fo	or first te	aching Se	eptember 2018
(Time: 1 hour 30 minutes)		Paper Re	eference WFM01/01
Mathematics International Advance Further Pure Mathema		•	y/Advanced Level
You must have: Mathematical Formulae and Sta	tistical T	ables, cal	culator 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 10 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.

		n	rı .	
1.	Use the standard results for	$\sum r$ and for	$\sum r^3$	to show that, for all positive integers n
		r=1	r=1	

$$\sum_{r=1}^{n} r(r^2 - 3) = \frac{n}{4}(n+a)(n+b)(n+c)$$

where a , b and	d c are integers to b	e found.	

(4)

	2			
				۹
		_	٠	6
		λ	ζ	Š
8	í	Ì	ř	ì
8	ĺ	Ì	ľ	j
8	Ľ	4	Ľ	j
3	Ľ	4	Ľ	j
3	ŀ	2	į	
3	ŀ	2	į	
3	ŀ	2	į	
3	ŀ	2	į	
3	ŀ	2	į	
	ŀ	2	į	
3				
3				
3				
3				
3				
3				
3				
3				
3	ŀ			
3				
3				
3				
3				
3				
3				
3				
3				
3				
3				
3				
3				
3				
3				
3				
3				
3				
3				
3				

uestion 1 continued		Lea bla
		Q1
	(Total for Question 1 is 4 marks)	

2.	A parabola P has cartesian equation $y^2 = 28x$. The point S is the focus of the parabola P.
	(a) Write down the coordinates of the point S. (1)
	Points A and B lie on the parabola P . The line AB is parallel to the directrix of P and cuts the x -axis at the midpoint of OS , where O is the origin.
	(b) Find the exact area of triangle ABS. (4)

ĸ.	'n	á		
м		ũ		D
			7	۹
∕ 1	ı.	/1	b	и
M				
K.		г	7	τ
- 24				
×Ι		ш		5
~	e	7	۹	,
\sim		`	á	
×Ι		c	1	Е
×	7	9		
			١	
$^{\sim}$ 4	r	'n		
K.I	۰	۰	ļ	٠
v i	i	×	'n	
		٦	F	
ĸ.	h			ú
- 3	7			
×Ι		_	۵	6
-21		7	٠	7
~.	۰			
			3	
N	۰	9		
ĸ.			7	
. 24	ı	×	۰	۰
Λ.	č	_	2	5
~				
X	۰	Š	ζ	à
ši	l	Š	Ĺ	ì
ğ	ļ	9	į	ì
ă		2		2
ă		2		
Š		2		
ŠĮ		2		
		2		
		2		
		2		
		2		
		2		
		2		
		2		
		2		
				2

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

3.

$$f(x) = x^2 + \frac{3}{x} - 1, \quad x < 0$$

The only real root, α , of the equation f(x) = 0 lies in the interval [-2, -1].

(a) Taking -1.5 as a first approximation to α , apply the Newton-Raphson procedure once to f(x) to find a second approximation to α , giving your answer to 2 decimal places.

(5)

(b) Show that your answer to part (a) gives α correct to 2 decimal places.

(2)

	ì	ė	ģ	٩	۴
Κ	3	7	7	ÿ	ų
			1	Ŀ	
	3		Ī	Z	Ξ
Κ			1		Ξ
Κ	J	8	ζ	2	ā
Κ	J	ξ			E
		×		7	₹
	ì	ř	Ç	ò	ś
	3	b	ę	ņ	
	ļ	Ħ	ŧ	P	ę
Κ	3			F	₹
	Ì	į	ą	þ	É
			_	4	4
	J	F			
	ì	i	í	ì	í
	3	d	ė		5
	ì	Ξ	I	2	Ξ
	J	8	ξ	7	
	Ì	٢	í	è	٩
	1	þ	ŧ	þ	ę
		ŀ	í	è	6
Κ	3	Ŀ		>	_
	Ī	ä	ī	ä	ä
Κ		E	2		2
Κ	ì	ä	í	2	S
Κ	ì	í	É	ĕ	
Κ	ì	ä	í	Ž	ą
Κ	í	í			
		ŀ	í	è	7
Κ	3	Š	í	è	۷
	1				3
Κ	1	2	9	2	
Κ	1	i	i	ø	۲
	1	ŕ	ŧ	þ	ę
		ğ	٤	2	S
Κ	ĺ	ŕ	ľ	7	۹
	3	٩	é	è	
	ì	p	e	7	Ý
	J	ŀ	í	è	4

puestion 3 continued	
	Q
	(Total for Question 3 is 7 marks)

4. Given that

$$\mathbf{A} = \begin{pmatrix} k & 3 \\ -1 & k+2 \end{pmatrix}$$
, where k is a constant

(a) show that det(A) > 0 for all real values of k,

(3)

(b) find A^{-1} in terms of k.

(2)

	ì	ė	ģ	٩	۴
Κ	3	7	7	ÿ	ų
			1	Ŀ	
	3		Ī	Z	Ξ
Κ			1		Ξ
Κ	J	8	ζ	2	ā
Κ	J	ξ			E
		×		7	₹
	ì	ř	Ç	ò	ś
	3	b	ę	ņ	
	ļ	Ħ	ŧ	P	ę
Κ	3			F	₹
	Ì	į	ą	þ	É
			_	4	4
	J	F			
	ì	i	í	ì	í
	3	d	ė		5
	ì	Ξ	I	2	Ξ
	J	8	ξ	7	
	Ì	٢	í	è	٩
	1	þ	ŧ	þ	ę
		ŀ	í	è	6
Κ	3	Ŀ		>	_
	Ī	ä	ī	ä	ä
Κ		E	2		2
Κ	ì	ä	í	2	S
Κ	ì	í	É	ĕ	
Κ	ì	ä	í	Ž	ą
Κ	í	í			
		ŀ	í	è	7
Κ	3	Š	í	è	۷
	1				3
Κ	1	2	9	2	
Κ	1	i	i	ø	۲
	1	ŕ	ŧ	þ	ę
		ğ	٤	2	S
Κ	ĺ	ŕ	ľ	7	۹
	3	٩	é	è	
	ì	p	e	7	Ý
	J	ŀ	í	è	4

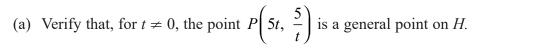
Q4
(Total for Question 4 is 5 marks)

5.	$2z + z^* = \frac{3 + 4i}{7 + i}$	
	Find z, giving your answer in the form $a + bi$, where a and b are real constants. Show all your working.	
		(5)

٩	ä	á	q	į	
4	۹	Þ		2	
×	٥	ì	7		
		9	Ľ		
G	3	ī	2	5	
4		7		۳	۰
A		ü		è	
		S	à	á	
1				Ľ	
		7	3	9	
4	r	'n	ρ	٩	
3			ŗ,	4	
ï	i	ĕ	'n	ĕ	
×		à	6	a	
			г		
1	Ħ	d	b	ė	
٦	L				
		ņ	ø	ņ	
J	۰				
٩	4	4	_	4	
х		3		,	۰
d			2	'n	
ū	Ξ	Ω	2	2	
٩	7	7	3	7	
				j	
	г	Ч	ľ	1	
3	۰	۰	,	۰	۰
	L	2	2	2	
И	r	7	₹	Ź	
ű	ì	'n	ě	Ĺ	
	S	į,	3	Ğ	
	r	7		7	
А	۰	ņ	۰	,	
J	e	è	ě	٤	
9	ú	ó	ĕ	ø	
۹	7	2		si	
Æ	ø	ę	۲	5	
ä	ř				
1		í	è		
4	Ε				
N	ø	pl	ø	b	
J	Ĺ			1	
r	ø	ø	ø	۲	
4	Ħ	ø		2	
ú	ä	ø	е	5	
3	×	۴	ø	۴	
×	d	ρ	ij	ú	
	ľ			1	
ď	ø	q	ø		
	d	ø	۹	ĸ	
И	r			1	
ø		۹	Ħ	н	

Question 5 continued	blank
Question 5 continued	
	05
	Q5
(Total for Question 5 is 5 marks)	

6. The rectangular hyperbola H has equation xy = 25



(1)

The point A on H has parameter $t = \frac{1}{2}$

(b) Show that the normal to H at the point A has equation

$$8y - 2x - 75 = 0$$

(5)

This normal at A meets H again at the point B.

(c) Find the coordinates of B.

(4)

И.	L	à	'n	ø
м	ę	ũ		D
$^{\circ}$	í	à	7	
Ŋ		9		
K.	ä	Ξ	2	Ξ
KJ		d		7
2	5	7	7	7
×	á	è		ρ
×	7	9	d	b
Κį	ř	ς	à	
ĸ	ŧ		7	4
ĸī	i	ĕ	ì	ú
N	i	à	í	è
			ľ	
N		9	ŧ	۹
X.J		Ĺ	ì	ś
Ø	Ķ			
ĸ.	4	2	5	2
×	5	2	ğ	P
×	ı	Ģ	ė	è
S	í	è	é	
K.J	r	g	ř	q
Ø	þ	ø	ķ	d
Ø	ı.	2	2	2
×	ľ	7	7	7
) i	ė	þ	ŧ	ġ
S	à	۹	ú	μ
X.		Н		í
Κį	ù	۵	2	Ś
ΚĠ	í	é	á	
Z.				
И	7	7	ς	
Οı	Ĺ			
S	ľ	9	ŧ	۹
Κ.	a	á	ù	6
X				ŋ
ď	7	þ	ij	е
Ø	ŧ	۴		9
×	á		Ľ	2
S	ľ	5	Č	3
	Ź	٤	2	S
K)	ľ	ζ	7	٦
ď	9	ú	ò	ė
ď.	d	ø	ij	ú
Ø	Ĺ	2	<u>(</u>	1

estion 6 continued	

	Leave
Question 6 continued	

				۵	à
	1		e		Ì
	7	3	9	۹	ij
	٤	į.	à	б.	ā
	ł	Ŀ		Ľ	
	ā	ä		2	
	1	r	n		₹
	٩	e	۰	ę	,
	d	2	à	á	μ
	ĺ		S		Ľ
			7	3	8
				ζ	
	á	r	'n	ρ	
	3	b	ø		q
	ï	i	á	'n	ĕ
	ç		à	6	2
			3	г	
	j	Ħ	d	b	ė
	٦	L			
	4	P	ņ	ø	2
	3	۰			
	9	4	4		4
	٩	ū		а	P
	4			ú	è
	i	ä	L	2	_
	٦	Ē	r	3	₹
	S	L	2	٤.	2
	4		3	Ľ	
	3	7	e	,	ŧ
	1	L	4	_	4
	1	г	7	₹	7
	ä	ì	i	é	è
	1	ä	i.	2	ú
	j		3	Ľ	
	٩	•	,	e	,
	ĕ	۹	þ	ú	è
	ì	d			۴
	3	S			3
	ę	ď	7		
	d				2
	J		Ė	è	ė
	1	Į,	2	S	
	1	ρ	7	₹	۹
	Л	s	4	۷	
	1	2	2	2	
	۰	÷	t		P
	Ý			c	2
	ć	7	5	7	
		×		2	S
	'n	ρ	۲	7	
	4	ĸ	2	۷	
		9		۲	S
	ì	ø	۴	9	
	1	Ĺ	2	2	
	¢	1	7	ď	7

	blank
Question 6 continued	
	Q6
(Total for Question 6 is 10 marks)	

7.

$$\mathbf{P} = \begin{pmatrix} \frac{5}{13} & -\frac{12}{13} \\ \frac{12}{13} & \frac{5}{13} \end{pmatrix}$$

(a) Describe fully the single geometrical transformation U represented by the matrix P.

The transformation V, represented by the 2×2 matrix \mathbf{Q} , is a reflection in the line with equation y = x

(b) Write down the matrix \mathbf{Q} .

(1)

Given that the transformation V followed by the transformation U is the transformation T, which is represented by the matrix \mathbf{R} ,

(c) find the matrix **R**.

(2)

(d) Show that there is a value of k for which the transformation T maps each point on the straight line y = kx onto itself, and state the value of k.

(4)

	bl
Question 7 continued	"

	Leave
	blank
Question 7 continued	
Question / continued	

888
⋖
111
00
⋖
ഗ
-
æ
Z
888
æ
æ
700
25
O
z
0

Question 7 continued		blank
		Q 7
(Tot	eal for Question 7 is 10 marks)	
	- /	

8.

$$f(z) = z^4 + 6z^3 + 76z^2 + az + b$$

where a and b are real constants.

Given that -3 + 8i is a complex root of the equation f(z) = 0

(a) write down another complex root of this equation.

(1)

(b) Hence, or otherwise, find the other roots of the equation f(z) = 0

(6)

(c) Show on a single Argand diagram all four roots of the equation f(z) = 0

(2)

g				
Ì				
		1		
d				
ă			j	
∕1				
ġ				
		í		
S				
	Ė			
		ì	ς	è
	ľ	ì	í	ì
	ľ	ì	Ĺ	ì
	į	į	Ľ	į
	į		į	į
			Ĺ	ì
	į		É	ì
	ŀ	þ	è	f
	ŀ	þ	è	f
	ŀ	þ		f
Š	ŀ	þ	è	f
Š	ŀ	þ	è	f
	ŀ	þ	è	f
Š	ŀ	þ	è	f
Š	ŀ	þ	è	f
Š	ŀ	þ	è	f
Š				
				f

nestion 8 continued	

	Leave blank
Question 8 continued	

	X					
k	š	ė	è	í	Ř	
Ś	Ç	7	ì	9		
	J	Ļ	1	Ę	J	
	ľ	Ē	3	É	9	
Ś	g	3	Ī	3	ä	
	ļ	9	ş	į	Ļ	
Ś	J	Ļ	ė	ŗ	ą	
	ş		5	Z		
	Š			Ę	2	
ķ	ĭ	k	2	5	2	
	ļ	F				
	ė			į	þ	
Ŕ	4	3	Ì	9	Š	
	Č	8	5	2	5	
	ł	Ľ	1	Ļ	1	
Ŕ	1	ķ	2	Š	2	
Ś	ã	į		ì	έ	
	i	ř	۹	ė	þ	
Ŗ	ŝ		Ī	5	3	
Ś	Ĵ	ė	į	į		
	Ą	ė	7	۹	5	
	1	ŀ	è	Š	2	
Ś	Taranta and the	à	á	è	í	
	Ą	ķ	ì	á	j	۰
Ŗ	4	3	Ì	į	į	
	ď		5	7	3	
	ž	ä	þ	q	ś	
	3	į	è	ś	d	
Ś	ì	f	Š	7		
	ł		7	Š	7	

		Leave blank
Question 8 continued		
		Q8
	(Total for Question 8 is 9 marks)	
	(Lotal for Ancedon o 19) marks)	

9. The quadratic equation

$$2x^2 + 4x - 3 = 0$$

has roots α and β .

Without solving the quadratic equation,

- (a) find the exact value of
 - (i) $\alpha^2 + \beta^2$
 - (ii) $\alpha^3 + \beta^3$

(5)

(b) Find a quadratic equation which has roots $(\alpha^2 + \beta)$ and $(\beta^2 + \alpha)$, giving your answer in the form $ax^2 + bx + c = 0$, where a, b and c are integers.

(4)

	٦	ú	á	1	ρ
	4	5	ij		2
	ć		5	2	7
	J		3	Ŀ	
	3	÷	۰	٠	•
	٧	ρ	۹	ú	ø
	J	Ŀ	ч		'n
	3			2	G
	ï		ø		г
	¢	7	9	ц	b
	ì	¥	C	à	6
	٩	L		r.	
		3	5		9
	3	•	ŧ	Ŧ	٠
	ì		۹	Þ	ø
			3	L	
	ð		٠	•	٠
	1	Ŀ	_	4	
	1		7	5	7
	ş	Ė	۹		
	ì	d	ë	2	
	٩	e	۰	٠	,
	٩	ü	i	ė	è
	ì	ы	G	ò	į
	1	Ŀ		Ŀ	
	ĕ				
	J		ij	è	Ė
	3				
	٩	e	۰		,
	d	ρ	٩	ø	ø
	J	Ŀ	ä		i
	5		Ī		
		3	2		
	A	۹		S	3
	i	ä	ú	ř	ę
	٦				
	1			<u>_</u>	
	ā	r	9	,	3
	ı	S	á	à	j
	7	r			
	Ą	b	è	6	ø
	ė	6	Ξ	Z	2
	7		ī	3	е
	١				ú
		ž	è	ě	S
	1	۲	۲	7	
	٩	b	ŝ	'n	ø
		2		ď	3
	4	Р	ς	7	٩
	1	b	í	É	

estion 9 continued	

estion 9 continued		

K	ì	ė	ė		P
Κ	2	3	₹	9	Ę
Κ		Ŀ		Ŀ	
	Ĵ	ä	Ξ	Ž	Ξ
		E			S
		8		è	á
	Į	Ę	Ę		
	ŧ		'n	P	٩
	į	9	2	2	9
	ŝ		3	Ī	
	ĝ			E	>
		ī	7	Ī	7
		ŀ	7	ŧ	Þ
	ζ	0		(
	٩				P
	4	ē	É		è
	0	Ė	Ħ	ġ	P
	í	i	ž	S	ì
		Ŀ	ă	L	J
		Ļ	2	Ĺ	2
	9				7
	٩		ī	S	Z
		C			Z
K	î	ī	Ξ	2	3
	ì	i	Ē	ē	ę
Κ	ì	ĕ	ã		ę
	1				
		ŀ	ę	ŧ	é
	į	à	á	è	6
	J	Ŀ			
	į	í	i	í	
	ğ	á	ė		S
	å	1	Ź	ŕ	5
	ġ	ä	þ	Ġ	š
	4	Ĺ	2	2	
	Ś	ì			Ş
		ľ			
	ß	d	4	d	=

		Lea
uestion 9 continued		
		Q9
	(Total for Question 9 is 9 marks)	

(6)

10. (i) A sequence of positive numbers is defined by

$$u_1 = 5$$

 $u_{n+1} = 3u_n + 2, \quad n \ge 1$

Prove by induction that, for $n \in \mathbb{Z}^+$,

$$u_n = 2 \times (3)^n - 1$$
 (5)

(ii) Prove by induction that, for $n \in \mathbb{Z}^+$,

$$\sum_{r=1}^{n} \frac{4r}{3^r} = 3 - \frac{(3+2n)}{3^n}$$

Κ	G	è	é	۹	۴
K	Š	2	Š	7	۹
	J	ķ	9	ķ	9
	ì	ė	h	í	þ
	d	7	ë	3	2
K	j	Ė	ć		ľ
				2	ζ
	4	ľ	ì	f	۹
	i	ì	ž	6	3
2	ğ	ļ		É	è
Κ	Ĝ	è	d	ŀ	ŕ
	J	ŀ	í	è	Ś
	Š	7			
	į	5		į	P
2	4	2	t	9	ŧ
K	Ĵ	7	ζ	2	
	J	t	j	Ĺ	1
	i	ī	Σ	ζ	2
	d	ţ	7	5	Z
K	ľ		Ī	3	Z
	J	ŀ	9	į	í
	į		ż	į	á
	4	S		Š	à
K	ľ				
	J	ŀ		è	Í
	i	è	P	ę	۹
	M	9	è	ģ	ę
Κ	ľ	2	į	7	ę
	1	į	ž	7	5
	'n	â	þ	q	
	A	ķ	è	ś	d
Κ	ũ	í	ė	9	٩

uestion 10 continued	

	Leave blank
Question 10 continued	Oldin

	٦	ú	á	1	ρ
	4	5	ij		2
	ć		5	2	7
	J		3	Ŀ	
	3	÷	۰	٠	•
	٧	ρ	۹	ú	ø
	J	Ŀ	ч		'n
	3			2	G
	ï		ø		г
	¢	7	9	ц	b
	ì	¥	C	à	6
	٩	L		r.	
		3	5		9
	3	•	ŧ	,	٠
	ì		۹	Þ	ø
			3	L	
	ð		٠	•	٠
	1	Ŀ	_	4	
	1		7	5	7
	ş	Ė	۹		
	ì	d	ë	2	
	٩	e	۰	٠	,
	٩	ü	i	ė	è
	ì	ы	G	ò	į
	1	Ŀ		Ŀ	
	ĕ				
	J		ij	è	Ė
	3				
	٩	e	۰		,
	d	ρ	٩	ø	ø
	J	Ŀ	ä		i
	5		Ī		
		3	2		
	A	۹		S	3
	i	ä	ú	ř	ę
	٦				
	1			<u>_</u>	
	ā	r	9	,	3
	ı	S	á	à	j
	7	r			
	Ą	b	è	6	ø
	ė	2	Ξ	Z	2
	7		ī	3	е
	١				ú
		ž	è	ě	S
	1	۲	۲	7	
	٩	b	ŝ	'n	ø
		2		ď	3
	4	Р	ς	7	٩
	1	b	í	É	

estion 10 continued	